B.Tech. (Information Technology)

2022 Regulations, Curriculum & Syllabi

Stay Ahead

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University – Chennai • Approved by AICTE • Accredited by NAAC with "A+" Grade

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. Apply technical, analytical, and creative thinking skills to understand and meet the needs of industry, academia, and research.

II. Excel in leadership, team spirit, and entrepreneurship skills to provide effective, user-friendly, and innovative solutions to real-world problems.

III. Practice work ethics with social and environmental responsibility to address the complex engineering and societally relevant problems.

IV. Pursue lifelong learning for professional development, use cutting-edge technologies, and involve in applied research to design optimal solutions.

PROGRAMME OUTCOMES (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

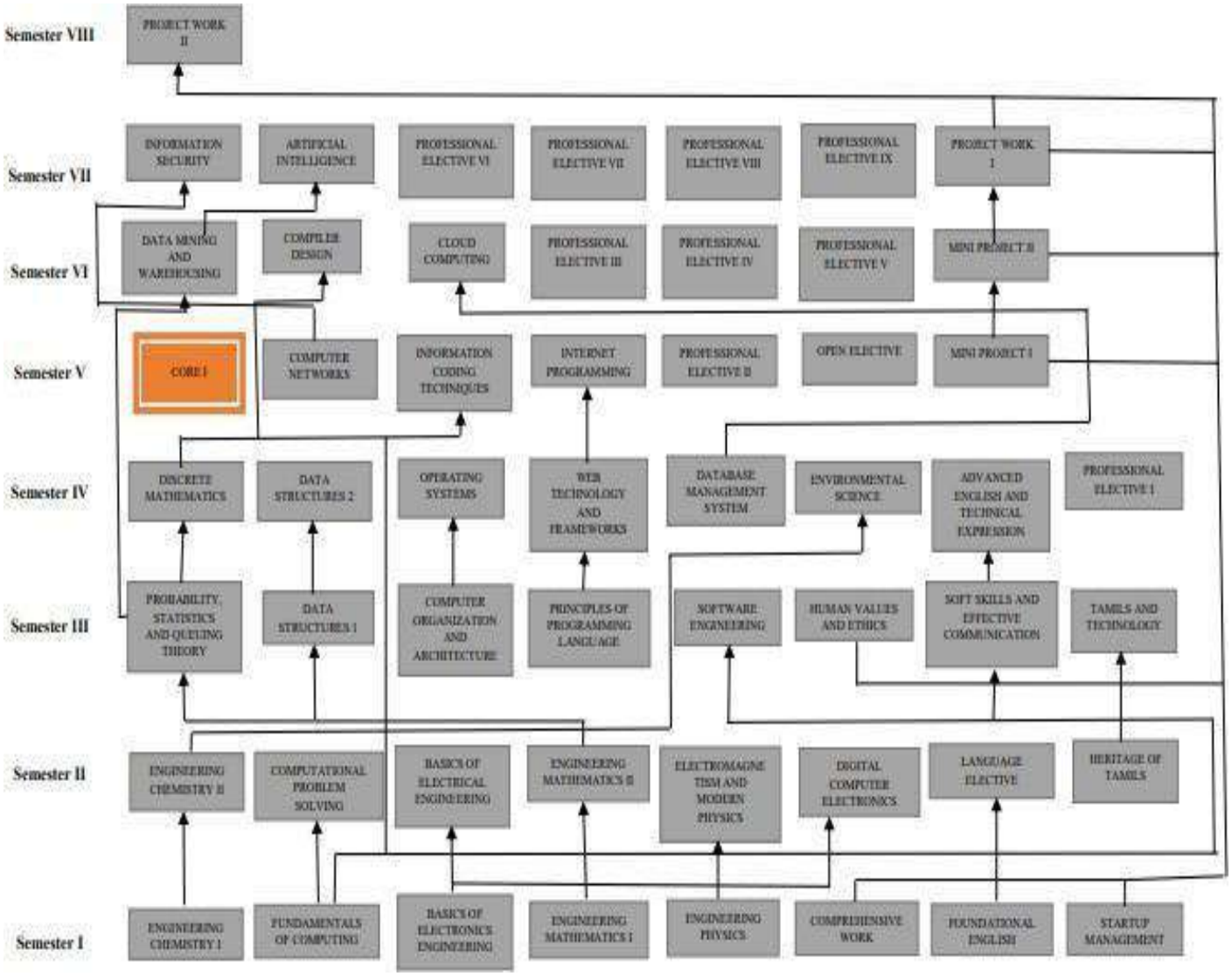
PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

MAPPING OF PEOs AND POs

PEO(s)	Programme Outcomes(s)											
	(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**	**(l)**
I	X	X	X	X	X	X				X		
II		X	X	X		X		X		X	X	X
III			X		X	X	X		X		X	X
IV	X	X			X	X		X		X		X

Connectivity Chart



CANDIDATES ADMITTED DURING ACADEMIC YEAR: 2022 - 2023

DEPARTMENT OF INFORMATION TECHNOLOGY

Minimum Credits to be Earned: 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
22PH102	ENGINEERING PHYSICS	2	0	2	3	4	50	50	100	BS
22CH103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
22GE001	FUNDAMENTALS OF COMPUTING	3	0	0	3	3	40	60	100	ES
22HS001	FOUNDATIONAL ENGLISH	1	0	2	2	3	100	0	100	HSS
22GE004	BASICS OF ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
22HS002	STARTUP MANAGEMENT	1	0	2	2	3	100	0	100	EEC
22IT108	COMPREHENSIVE WORK	0	0	2	1	2	100	0	100	EEC
Total		**14**	**1**	**12**	**21**	**27**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
22PH202	ELECTROMAGNETISM AND MODERN PHYSICS	2	0	2	3	4	50	50	100	BS
22CH203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
22GE002	COMPUTATIONAL PROBLEM SOLVING	3	0	0	3	3	40	60	100	ES
22GE003	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES
22IT206	DIGITAL COMPUTER ELECTRONICS	3	0	2	4	5	50	50	100	ES
	LANGUAGE ELECTIVE	1	0	2	2	3	100	0	100	HSS
*22HS003	தமிழர் மரபு HERITAGE OF TAMILS	1	0	0	1	1	100	0	100	HSS
Total		**17**	**1**	**10**	**23**	**28**	-	-	-	-

* The lateral entry students have to complete this course during IV semester.

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT301	PROBABILITY, STATISTICS AND QUEUING THEORY	3	1	0	4	4	40	60	100	ES
22IT302	DATA STRUCTURES I	3	0	2	4	5	50	50	100	ES
22IT303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3	3	40	60	100	PC
22IT304	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	2	4	5	50	50	100	PC
22IT305	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
22HS004	HUMAN VALUES AND ETHICS	2	0	0	2	2	100	0	100	HSS
22HS005	SOFT SKILLS AND EFFECTIVE COMMUNICATION	0	0	2	1	2	100	0	100	HSS
22HS006	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY	1	0	0	1	1	100	0	100	HSS
Total		**18**	**1**	**6**	**22**	**25**	-	-	-	-
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT401	DISCRETE MATHEMATICS	3	1	0	4	4	40	60	100	ES
22IT402	DATA STRUCTURES II	3	0	2	4	5	50	50	100	PC
22IT403	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
22IT404	WEB TECHNOLOGY AND FRAMEWORKS	2	0	2	3	4	50	50	100	PC
22IT405	DATABASE MANAGEMENT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I				3		-	-	100	PE
22HS007	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
22HS008	ADVANCED ENGLISH AND TECHNICAL EXPRESSION	0	0	2	1	2	100	0	100	EEC
Total		-	-	-	**23**	-				-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours / Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT501	PRINCIPLES OF COMMUNICATION	3	0	0	3	3	40	60	100	PC
22IT502	COMPUTER NETWORKS	3	0	2	4	5	50	50	100	PC
22IT503	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
22IT504	INTERNET OF THINGS	2	0	2	3	4	50	50	100	PC
	PROFESSIONAL ELECTIVE II	-	-	-	3	-	-	-	100	PE
	OPEN ELECTIVE	-	-	-	3	-	-	-	100	OE
22IT507	MINI PROJECT I	0	0	2	1	2	60	40	100	EEC
Total		-	-	-	**21**	-	-	-	-	-
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							C IA	**SEE**	**Total**	
22IT601	DATA MINING AND WAREHOUSING	3	0	2	4	5	50	50	100	PC
22IT602	PRINCIPLES OF COMPILER DESIGN	3	1	0	4	4	40	60	100	PC
22IT603	CLOUD COMPUTING	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE III	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IV	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE V	-	-	-	3	-	-	-	100	PE
22IT607	MINI PROJECT II	0	0	2	1	2	60	40	100	EEC
Total		-	-	-	**22**	-	-	-	-	-

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT701	CRYPTOGRAPHY AND INFORMATION SECURITY	3	0	0	3	3	40	60	100	PC
22IT702	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE VI	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VIII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IX	-	-	-	3	-	-	-	100	PE
22IT707	PROJECT WORK I	0	0	4	2	4	60	40	100	EEC
Total		-	-	-	**21**	-	-	-	-	-
VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT801	PROJECT WORK II	0	0	20	10	20	60	40	100	EEC
Total		**0**	**0**	**20**	**10**	**20**	-	-	-	**-**

ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
LANGUAGE ELECTIVES										
22HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
22HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
22HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
22HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
22HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
DISCIPLINE ELECTIVES										
VERTICAL 1 - DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
22IT007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IT010	APP DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT012	DevOps	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
22IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE

22IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
22IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	4	50	50	100	PE
22IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
22IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
22IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
22IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
22IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
22IT023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
22IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
22IT025	MULTIMEDIA AND ANIMATION	2	0	2	3	4	50	50	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT026	AUGMENTED REALITY AND VIRTUAL REALITY	2	0	2	3	4	50	50	100	PE
22IT027	GAME DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT028	VIDEO CREATION AND EDITING	2	0	2	3	4	50	50	100	PE
22IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
22IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
22IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	3	50	50	100	PE
22IT033	IoT ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT034	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE

VERTICAL VII- DIVERSIFIED COURSES										
22IT035	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE
22IT036	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT037	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT038	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
22IT039	HUMAN COMPUTER INTERACTION	3	0	0	3	3	40	60	100	PE
22IT040	E-COMMERCE	3	0	0	3	3	40	60	100	PE
22IT041	C# and .NET	3	0	0	3	3	40	60	100	PE
22IT042	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	3	40	60	100	PE
HONOUR VERTICAL- DATA SCIENCE										
22ITH01	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22ITH02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22ITH03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22ITH04	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22ITH05	NATURAL LANGUAGE PROCESSING	2	0	2	3	3	50	50	100	PE
22ITH06	COMPUTER VISION	2	0	2	3	3	50	50	100	PE
MINOR VERTICAL - SOFTWARE APPLICATION DEVELOPMENT										
22ITM43	PROBLEM SOLVING USING C	2	0	2	3	3	50	50	100	PE
22ITM44	DATA STRUCTURES USING C++	2	0	2	3	3	50	50	100	PE
22ITM45	DATABASE PROGRAMMING USING SQL	2	0	2	3	3	50	50	100	PE
22ITM46	RPA AUTOMATION TECHNIQUES	2	0	2	3	3	50	50	100	PE
22ITM47	FRONT END DESIGN USING HTML, CSS	2	0	2	3	3	50	50	100	PE
22ITM48	DATA ANALYSIS USING PYTHON	2	0	2	3	3	50	50	100	PE
22ITM49	SOFTWARE ENGINEERING METHODOLOGIES	2	0	2	3	3	50	50	100	PE
OPEN ELECTIVES										
22OIT01	DATA STRUCTURES	3	0	0	3	3	40	60	100	OE
22OIT02	C++ PROGRAMMING	2	0	0	2	3	50	60	100	OE
22OIT03	PROGRAMMING USING JAVA	2	0	0	2	3	50	60	100	OE

22OIT04	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	2	0	0	2	3	50	50	100	OE
22OCE01	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OEC02	MICROCONTROLLER PROGRAMMING	3	0	0	3	3	40	60	100	OE
22OEI01	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	3	40	60	100	OE
22OEI02	SENSOR TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OEI03	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OEI04	OPTOELECTRONICS AND LASER INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OME01	DIGITAL MANUFACTURING	3	0	0	3	3	40	60	100	OE
22OME02	INDUSTRIAL PROCESS ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME03	MAINTENANCE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME04	SAFETY ENGINEERING	3	0	0	3	3	40	60	100	OE
22OBT01	BIOFUELS	3	0	0	3	3	40	60	100	OE
22OFD01	TRADITIONAL FOODS	3	0	0	3	3	40	60	100	OE
22OFD02	FOOD LAWS AND REGULATIONS	3	0	0	3	3	40	60	100	OE
22OFD03	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	3	0	0	3	3	40	60	100	OE
22OFD04	CEREAL, PULSES AND OIL SEED TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OFT01	FASHION CRAFTSMANSHIP	3	0	0	3	3	40	60	100	OE
22OFT02	INTERIOR DESIGN IN FASHION	3	0	0	3	3	40	60	100	OE
22OFT03	SURFACE ORNAMENTATION	3	0	0	3	3	40	60	100	OE
22OPH01	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH02	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	OE
22OPH03	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH04	BIOPHOTONICS	3	0	0	3	3	40	60	100	OE
22OPH05	PHYSICS OF SOFT MATTER	3	0	0	3	3	40	60	100	OE
22OCH01	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	OE
22OCH02	POLYMER SCIENCE	3	0	0	3	3	40	60	100	OE
22OCH03	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	OE
22OGE01	PRINCIPLES OF MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OGE02	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	40	60	100	OE
22OGE03	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	40	60	100	OE
22OGE04	NATION BUILDING, LEADERSHIP AND SOCIAL RESPONSIBILITY	3	0	0	3	3	40	60	100	OE
22OBM01	OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES	3	0	0	3	3	40	60	100	OE
22OBM02	AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT	3	0	0	3	3	40	60	100	OE

22OBM03	HOSPITAL AUTOMATION	3	0	0	3	3	40	60	100	OE
22OAG01	RAIN WATER HARVESTING TECHNIQUES	3	0	0	3	3	40	60	100	OE
22OEE01	VALUE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OEE02	ELECTRICAL SAFETY	3	0	0	3	3	40	60	100	OE
22OCB01	INTERNATIONAL BUSINESS MANAGEMENT	3	0	0	3	3	40	60	100	OE

ONE CREDIT COURSES										
22IT0XA	SWIFT FOR IOS DEVELOPMENT	1	0	0	1	-	100	0	100	EEC
22IT0XB	CONTAINERS AUTOMATION	1	0	0	1	-	100	0	100	EEC
22IT0XC	AWS LOAD BALANCING TECHNIQUE	1	0	0	1	-	100	0	100	EEC
22IT0XD	ETHICAL HACKING ESSENTIAL: WEB PENTESTING	1	0	0	1	-	100	0	100	EEC
22IT0XE	GENERATIVE AI WITH LARGE LANGUAGE MODELS	1	0	0	1	-	100	0	100	EEC
22IT0XF	DEEP LEARNING USING COMPUTER VISION	1	0	0	1	-	100	0	100	EEC
22IT0XG	FEATURE ENGINEERING FOR NLP	1	0	0	1	-	100	0	100	EEC
22IT0XH	TABLEAU	1	0	0	1	-	100	0	100	EEC
22IT0XI	WEB DEVELOPMENT USING CMS: A COMPARATIVE STUDY	1	0	0	1	-	100	0	100	EEC
22IT0XJ	DATA VISUALIZATION AND REPORTING USING POWERBI	1	0	0	1	-	100	0	100	EEC
22IT0XK	CLOUD MULTI-TENANCY AND SECURITY	1	0	0	1	-	100	0	100	EEC
22IT0XL	CLOUD INFRASTRUCTURE MODERNIZATION	1	0	0	1	-	100	0	100	EEC
22IT0XM	CYBER RISK MITIGATION	1	0	0	1	-	100	0	100	EEC
22IT0XN	BUILDING APIS WITH DJANGO FRAMEWORK	1	0	0	1	-	100	0	100	EEC
22IT0XO	REAL TIME INTERNET OF ROBOTICS THINGS (RIoT)	1	0	0	1	-	100	0	100	EEC
22IT0XP	WEB PENTESTING	1	0	0	1	-	100	0	100	EEC

CANDIDATES ADMITTED DURING ACADEMIC YEAR: 2023 - 2024

DEPARTMENT OF INFORMATION TECHNOLOGY
Minimum Credits to be Earned : 163

I SEMESTER

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							CIA	SEE	Total	
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22PH102	ENGINEERING PHYSICS	2	0	2	3	4	50	50	100	BS
22CH103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
22GE001	FUNDAMENTALS OF COMPUTING	3	0	0	3	3	40	60	100	ES
22HS001	FOUNDATIONAL ENGLISH	1	0	2	2	3	100	0	100	HSS
22GE004	BASICS OF ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
22HS002	STARTUP MANAGEMENT	1	0	2	2	3	100	0	100	EEC
*22HS003	தமிழர் மரபு HERITAGE OF TAMILS	1	0	0	1	1	100	0	100	HSS
Total		**15**	**1**	**10**	**21**	**26**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
22PH202	ELECTROMAGNETISM AND MODERN PHYSICS	2	0	2	3	4	50	50	100	BS
22CH203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
22GE002	COMPUTATIONAL PROBLEM SOLVING	3	0	0	3	3	40	60	100	ES
22GE003	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES
22IT206	DIGITAL COMPUTER ELECTRONICS	3	0	2	4	5	50	50	100	ES
	LANGUAGE ELECTIVE	1	0	2	2	3	100	0	100	HSS
*22HS006	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY	1	0	0	1	1	100	0	100	HSS
Total		**17**	**1**	**10**	**23**	**28**	-	-	-	-

* The lateral entry students have to complete these courses during III and IV semester.

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT301	PROBABILITY, STATISTICS AND QUEUING THEORY	3	1	0	4	4	40	60	100	ES
22IT302	DATA STRUCTURES I	3	0	2	4	5	50	50	100	ES
22IT303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	1	0	4	4	40	60	100	PC
22IT304	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	2	4	5	50	50	100	PC
22IT305	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
22HS004	HUMAN VALUES AND ETHICS	2	0	0	2	2	40	60	100	HSS
22HS005	SOFT SKILLS AND EFFECTIVE COMMUNICATION	0	0	2	1	2	60	40	100	HSS
Total		**17**	**2**	**6**	**22**	**25**	-	-	-	-
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT401	DISCRETE MATHEMATICS	3	1	0	4	4	40	60	100	ES
22IT402	DATA STRUCTURES II	3	0	2	4	5	50	50	100	PC
22IT403	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
22IT404	WEB TECHNOLOGY AND FRAMEWORKS	2	0	2	3	4	50	50	100	PC
22IT405	DATABASE MANAGEMENT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	-	-	-	3	-	-	-	100	PE
22HS007	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
22HS008	ADVANCED ENGLISH AND TECHNICAL EXPRESSION	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**23**	**-**	-	-	-	-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT501	PRINCIPLES OF COMMUNICATION	3	0	0	3	3	40	60	100	PC
22IT502	COMPUTER NETWORKS	3	0	2	4	5	50	50	100	PC
22IT503	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
22IT504	INTERNET OF THINGS	2	0	2	3	4	50	50	100	PC
	PROFESSIONAL ELECTIVE II	-	-	-	3	-	-	-	100	PE
	OPEN ELECTIVE	-	-	-	3	-	-	-	100	OE
22IT507	MINI PROJECT I	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	**-**	**-**	**-**	**-**

VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT601	DATA MINING AND WAREHOUSING	3	0	2	4	5	50	50	100	PC
22IT602	PRINCIPLES OF COMPILER DESIGN	3	1	0	4	4	40	60	100	PC
22IT603	CLOUD COMPUTING	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE III	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IV	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE V	-	-	-	3	-	-	-	100	PE
22IT607	MINI PROJECT II	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**22**	**-**	**-**	**-**	**-**	**-**

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours / Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT701	CRYPTOGRAPHY AND INFORMATION SECURITY	3	0	0	3	3	40	60	100	PC
22IT702	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE VI	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VIII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IX	-	-	-	3	-	-	-	100	PE
22IT707	PROJECT WORK I	0	0	4	2	4	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	-	-	-	-

VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours / Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT801	PROJECT WORK II	0	0	20	10	20	60	40	100	EEC
Total		**0**	**0**	**20**	**10**	**20**	-	-	-	**-**

ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
LANGUAGE ELECTIVES										
22HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
22HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
22HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
22HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
22HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
DISCIPLINE ELECTIVES										
VERTICAL 1 - DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
22IT007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IT010	APP DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT012	DevOps	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
22IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE

22IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
22IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	4	50	50	100	PE
22IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
22IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
22IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
22IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
22IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
22IT023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
22IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
22IT025	MULTIMEDIA AND ANIMATION	2	0	2	3	4	50	50	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT026	AUGMENTED REALITY AND VIRTUAL REALITY	2	0	2	3	4	50	50	100	PE
22IT027	GAME DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT028	VIDEO CREATION AND EDITING	2	0	2	3	4	50	50	100	PE
22IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
22IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
22IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT033	IoT ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT034	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE

VERTICAL VII- DIVERSIFIED COURSES										
22IT035	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE
22IT036	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT037	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT038	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
22IT039	HUMAN COMPUTER INTERACTION	3	0	0	3	3	40	60	100	PE
22IT040	E-COMMERCE	3	0	0	3	3	40	60	100	PE
22IT041	C# AND .NET	3	0	0	3	3	40	60	100	PE
22IT042	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	3	40	60	100	PE
HONOUR VERTICAL-DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
MINOR VERTICAL - SOFTWARE APPLICATION DEVELOPMENT										
22ITM43	PROBLEM SOLVING USING C	2	0	2	3	3	50	50	100	PE
22ITM44	DATA STRUCTURES USING C++	2	0	2	3	3	50	50	100	PE
22ITM45	DATABASE PROGRAMMING USING SQL	2	0	2	3	3	50	50	100	PE
22ITM46	RPA AUTOMATION TECHNIQUES	2	0	2	3	3	50	50	100	PE
22ITM47	FRONT END DESIGN USING HTML, CSS	2	0	2	3	3	50	50	100	PE
22ITM48	DATA ANALYSIS USING PYTHON	2	0	2	3	3	50	50	100	PE
22ITM49	SOFTWARE ENGINEERING METHODOLOGIES	2	0	2	3	3	50	50	100	PE
OPEN ELECTIVES										
22OIT01	DATA STRUCTURES	3	0	0	3	3	40	60	100	OE
22OIT02	C++ PROGRAMMING	2	0	0	2	3	50	60	100	OE
22OIT03	PROGRAMMING USING JAVA	2	0	0	2	3	50	60	100	OE
22OIT04	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	2	0	0	2	3	50	50	100	OE
22OCE01	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OEC02	MICROCONTROLLER PROGRAMMING	3	0	0	3	3	40	60	100	OE

22OEI01	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	3	40	60	100	OE
22OEI02	SENSOR TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OEI03	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OEI04	OPTOELECTRONICS AND LASER INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
		3	0	0	3	3	40	60	100	OE
22OME01	DIGITAL MANUFACTURING	3	0	0	3	3	40	60	100	OE
22OME02	INDUSTRIAL PROCESS ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME03	MAINTENANCE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME04	SAFETY ENGINEERING	3	0	0	3	3	40	60	100	OE
22OBT01	BIOFUELS	3	0	0	3	3	40	60	100	OE
22OFD01	TRADITIONAL FOODS	3	0	0	3	3	40	60	100	OE
22OFD02	FOOD LAWS AND REGULATIONS	3	0	0	3	3	40	60	100	OE
22OFD03	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	3	0	0	3	3	40	60	100	OE
22OFD04	CEREAL, PULSES AND OIL SEED TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OFT01	FASHION CRAFTSMANSHIP	3	0	0	3	3	40	60	100	OE
22OFT02	INTERIOR DESIGN IN FASHION	3	0	0	3	3	40	60	100	OE
22OFT03	SURFACE ORNAMENTATION	3	0	0	3	3	40	60	100	OE
22OPH01	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH02	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	OE
22OPH03	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH04	BIOPHOTONICS	3	0	0	3	3	40	60	100	OE
22OPH05	PHYSICS OF SOFT MATTER	3	0	0	3	3	40	60	100	OE
22OCH01	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	OE
22OCH02	POLYMER SCIENCE	3	0	0	3	3	40	60	100	OE
22OCH03	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	OE
22OGE01	PRINCIPLES OF MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OGE02	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	40	60	100	OE
22OGE03	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	40	60	100	OE
22OGE04	NATION BUILDING, LEADERSHIP AND SOCIAL RESPONSIBILITY	3	0	0	3	3	40	60	100	OE
22OBM01	OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES	3	0	0	3	3	40	60	100	OE
22OBM02	AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT	3	0	0	3	3	40	60	100	OE

22OBM03	HOSPITAL AUTOMATION	3	0	0	3	3	40	60	100	OE
22OAG01	RAIN WATER HARVESTING TECHNIQUES	3	0	0	3	3	40	60	100	OE
22OEE01	VALUE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OEE02	ELECTRICAL SAFETY	3	0	0	3	3	40	60	100	OE
22OCB01	INTERNATIONAL BUSINESS MANAGEMENT	3	0	0	3	3	40	60	100	OE
ONE CREDIT COURSES										
22IT0XA	SWIFT FOR IOS DEVELOPMENT	1	0	0	1	-	100	0	100	EEC
22IT0XB	CONTAINERS AUTOMATION	1	0	0	1	-	100	0	100	EEC
22IT0XC	AWS LOAD BALANCING TECHNIQUE	1	0	0	1	-	100	0	100	EEC
22IT0XD	ETHICAL HACKING ESSENTIAL: WEB PENTESTING	1	0	0	1	-	100	0	100	EEC
22IT0XE	GENERATIVE AI WITH LARGE LANGUAGE MODELS	1	0	0	1	-	100	0	100	EEC
22IT0XF	DEEP LEARNING USING COMPUTER VISION	1	0	0	1	-	100	0	100	EEC
22IT0XG	FEATURE ENGINEERING FOR NLP	1	0	0	1	-	100	0	100	EEC
22IT0XH	TABLEAU	1	0	0	1	-	100	0	100	EEC
22IT0XI	WEB DEVELOPMENT USING CMS: A COMPARATIVE STUDY	1	0	0	1	-	100	0	100	EEC
22IT0XJ	DATA VISUALIZATION AND REPORTING USING POWERBI	1	0	0	1	-	100	0	100	EEC
22IT0XK	CLOUD MULTI-TENANCY AND SECURITY	1	0	0	1	-	100	0	100	EEC
22IT0XL	CLOUD INFRASTRUCTURE MODERNIZATION	1	0	0	1	-	100	0	100	EEC
22IT0XM	CYBER RISK MITIGATION	1	0	0	1	-	100	0	100	EEC
22IT0XN	BUILDING APIs WITH DJANGO FRAMEWORK	1	0	0	1	-	100	0	100	EEC
22IT0XO	REAL TIME INTERNET OF ROBOTICS THINGS (RIoT)	1	0	0	1	-	100	0	100	EEC
22IT0XP	WEB PENTESTING	1	0	0	1	-	100	0	100	EEC

B.Tech. (Information Technology)

2022 Regulations, Curriculum & Syllabi

Stay Ahead

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. Apply technical, analytical, and creative thinking skills to understand and meet the needs of industry, academia, and research.

II. Excel in leadership, team spirit, and entrepreneurship skills to provide effective, user-friendly, and innovative solutions to real-world problems.

III. Practice work ethics with social and environmental responsibility to address the complex engineering and societally relevant problems.

IV. Pursue lifelong learning for professional development, use cutting-edge technologies, and involve in applied research to design optimal solutions.

PROGRAMME OUTCOMES (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

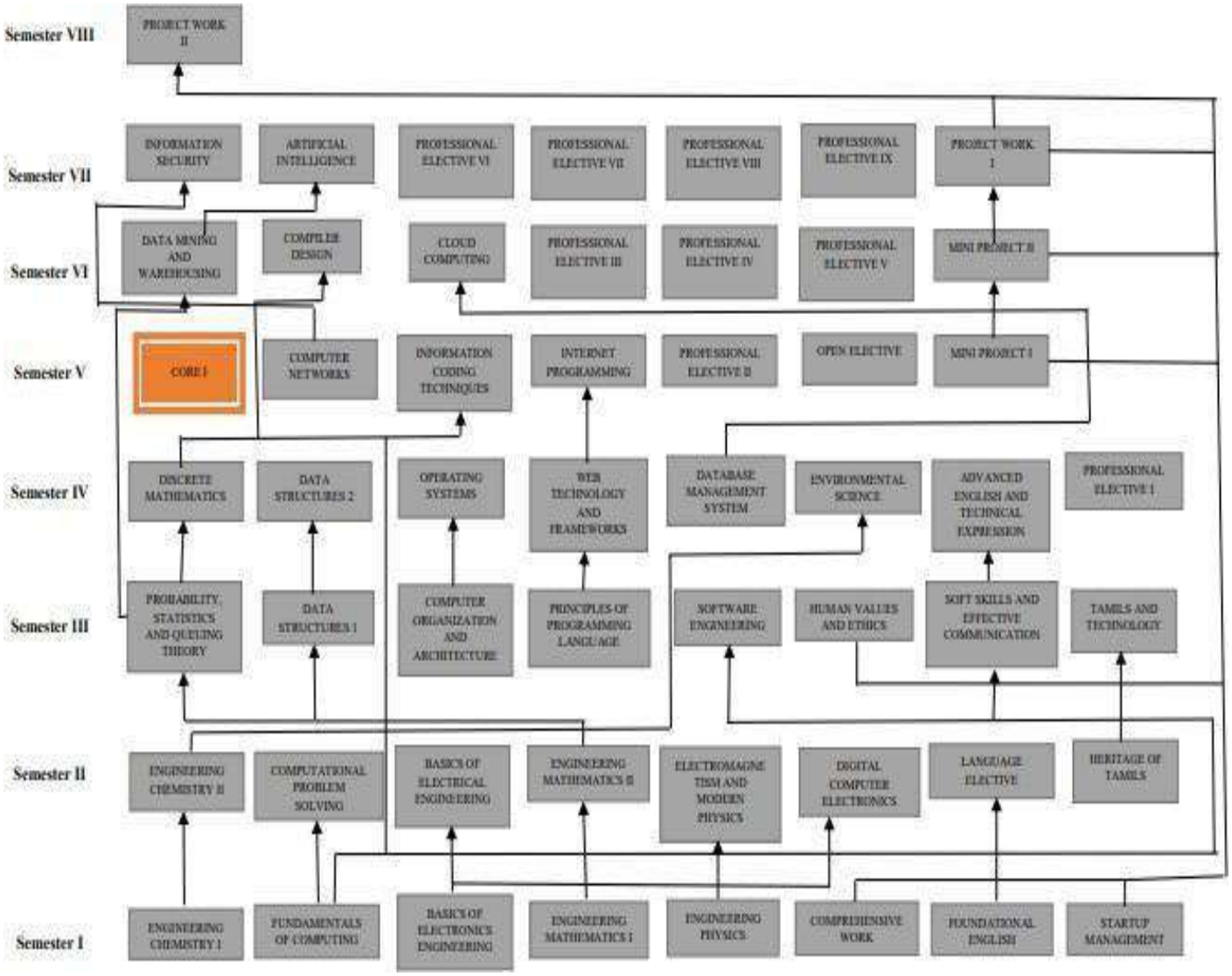
PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

MAPPING OF PEOs AND POs

PEO(s)	Programme Outcomes(s)											
	(a)	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**	**(h)**	**(i)**	**(j)**	**(k)**	**(l)**
I	X	X	X	X	X	X				X		
II		X	X	X		X		X		X	X	X
III			X		X	X	X		X		X	X
IV	X	X			X	X		X		X		X

Connectivity Chart



CANDIDATES ADMITTED DURING ACADEMIC YEAR :2024 - 2028

DEPARTMENT OF INFORMATION TECHNOLOGY
Minimum Credits to be Earned : 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
22PH102	ENGINEERING PHYSICS	2	0	2	3	4	50	50	100	BS
22CH103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
22GE001	FUNDAMENTALS OF COMPUTING	3	0	0	3	3	40	60	100	ES
22HS001	FOUNDATIONAL ENGLISH	1	0	2	2	3	50	50	100	HSS
22GE004	BASICS OF ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
22HS002	STARTUP MANAGEMENT	1	0	2	2	3	50	50	100	EEC
*22HS003	தமிழர் மரபு HERITAGE OF TAMILS	1	0	0	1	1	40	60	100	HSS
Total		**15**	**1**	**10**	**21**	**26**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
22PH202	ELECTROMAGNETISM AND MODERN PHYSICS	2	0	2	3	4	50	50	100	BS
22CH203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
22GE002	COMPUTATIONAL PROBLEM SOLVING	3	0	0	3	3	40	60	100	ES
22GE003	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES
22IT206	DIGITAL COMPUTER ELECTRONICS	3	0	2	4	5	50	50	100	ES
	LANGUAGE ELECTIVE	1	0	2	2	3	50	50	100	HSS
*22HS006	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY	1	0	0	1	1	40	60	100	HSS
22HS009	CO-CURRICULAR OR EXTRACURRICULAR ACTIVITIES	0	0	2	-	2	100	-	100	HSS
Total		**17**	**1**	**12**	**23**	**30**	-	-	-	-

* The lateral entry students have to complete these courses during III and IV semester.

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT301	PROBABILITY, STATISTICS AND QUEUING THEORY	3	1	0	4	4	40	60	100	ES
22IT302	DATA STRUCTURES I	3	0	2	4	5	50	50	100	ES
22IT303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	1	0	4	4	40	60	100	PC
22IT304	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	2	4	5	50	50	100	PC
22IT305	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
22HS004	HUMAN VALUES AND ETHICS	2	0	0	2	2	40	60	100	HSS
22HS005	SOFT SKILLS AND EFFECTIVE COMMUNICATION	0	0	2	1	2	60	40	100	HSS
Total		**17**	**2**	**6**	**22**	**25**	-	-	-	-
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT401	DISCRETE MATHEMATICS	3	1	0	4	4	40	60	100	ES
22IT402	DATA STRUCTURES II	3	0	2	4	5	50	50	100	PC
22IT403	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
22IT404	WEB TECHNOLOGY AND FRAMEWORKS	2	0	2	3	4	50	50	100	PC
22IT405	DATABASE MANAGEMENT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	-	-	-	3	-	-	-	100	PE
22HS007	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
22HS008	ADVANCED ENGLISH AND TECHNICAL EXPRESSION	0	0	2	1	2	60	40	100	EEC
22HS010	SOCIALLY RELEVANT PROJECTS	0	0	2	-	2	100	-	100	HSS
Total		**-**	**-**	**-**	**23**	**-**	-	-	-	-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT501	PRINCIPLES OF COMMUNICATION	3	0	0	3	3	40	60	100	PC
22IT502	COMPUTER NETWORKS	3	0	2	4	5	50	50	100	PC
22IT503	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
22IT504	INTERNET OF THINGS	2	0	2	3	4	50	50	100	PC
	PROFESSIONAL ELECTIVE II	-	-	-	3	-	-	-	100	PE
	OPEN ELECTIVE	-	-	-	3	-	-	-	100	OE
22IT507	MINI PROJECT I	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	**-**	**-**	**-**	**-**
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT601	DATA MINING AND WAREHOUSING	3	0	2	4	5	50	50	100	PC
22IT602	PRINCIPLES OF COMPILER DESIGN	3	1	0	4	4	40	60	100	PC
22IT603	CLOUD COMPUTING	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE III	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IV	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE V	-	-	-	3	-	-	-	100	PE
22IT607	MINI PROJECT II	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**22**	**-**	**-**	**-**	**-**	**-**

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT701	CRYPTOGRAPHY AND INFORMATION SECURITY	3	0	0	3	3	40	60	100	PC
22IT702	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE VI	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VIII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IX	-	-	-	3	-	-	-	100	PE
22IT707	PROJECT WORK I	0	0	4	2	4	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	-	-	-	**-**

VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT801	Project Work II	0	0	20	10	20	60	40	100	EEC
Total		**0**	**0**	**20**	**10**	**20**	-	-	-	**-**

ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
LANGUAGE ELECTIVES										
22HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
22HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
22HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
22HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
22HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
DISCIPLINE ELECTIVES										
VERTICAL 1 - DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
22IT007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IT010	APP DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT012	DevOps	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
22IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE

22IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
22IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	4	50	50	100	PE
22IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
22IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
22IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
22IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
22IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
22IT023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
22IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
22IT025	MULTIMEDIA AND ANIMATION	2	0	2	3	4	50	50	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT026	AUGMENTED REALITY AND VIRTUAL REALITY	2	0	2	3	4	50	50	100	PE
22IT027	GAME DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT028	VIDEO CREATION AND EDITING	2	0	2	3	4	50	50	100	PE
22IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
22IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
22IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT033	IoT ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT034	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE

VERTICAL VII- DIVERSIFIED COURSES										
22IT035	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE
22IT036	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT037	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT038	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
22IT039	HUMAN COMPUTER INTERACTION	3	0	0	3	3	40	60	100	PE
22IT040	E-COMMERCE	3	0	0	3	3	40	60	100	PE
22IT041	C# and .NET	3	0	0	3	3	40	60	100	PE
22IT042	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	3	40	60	100	PE
MINOR VERTICAL - SOFTWARE APPLICATION DEVELOPMENT										
22ITM43	PROBLEM SOLVING USING C	2	0	2	3	3	50	50	100	PE
22ITM44	DATA STRUCTURES USING C++	2	0	2	3	3	50	50	100	PE
22ITM45	DATABASE PROGRAMMING USING SQL	2	0	2	3	3	50	50	100	PE
22ITM46	RPA AUTOMATION TECHNIQUES	2	0	2	3	3	50	50	100	PE
22ITM47	FRONT END DESIGN USING HTML, CSS	2	0	2	3	3	50	50	100	PE
22ITM48	DATA ANALYSIS USING PYTHON	2	0	2	3	3	50	50	100	PE
22ITM49	SOFTWARE ENGINEERING METHODOLOGIES	2	0	2	3	3	50	50	100	PE
OPEN ELECTIVES										
22OIT01	DATA STRUCTURES	3	0	0	3	3	40	60	100	OE
22OIT02	C++ PROGRAMMING	2	0	0	2	3	50	60	100	OE
22OIT03	PROGRAMMING USING JAVA	2	0	0	2	3	50	60	100	OE
22OIT04	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	2	0	0	2	3	50	50	100	OE
22OCE01	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OEC02	MICROCONTROLLER PROGRAMMING	3	0	0	3	3	40	60	100	OE
22OEI01	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	3	40	60	100	OE
22OEI02	SENSOR TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OEI03	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OEI04	OPTOELECTRONICS AND LASER INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OME01	DIGITAL MANUFACTURING	3	0	0	3	3	40	60	100	OE

22OME02	INDUSTRIAL PROCESS ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME03	MAINTENANCE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME04	SAFETY ENGINEERING	3	0	0	3	3	40	60	100	OE
22OBT01	BIOFUELS	3	0	0	3	3	40	60	100	OE
22OFD01	TRADITIONAL FOODS	3	0	0	3	3	40	60	100	OE
22OFD02	FOOD LAWS AND REGULATIONS	3	0	0	3	3	40	60	100	OE
22OFD03	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	3	0	0	3	3	40	60	100	OE
22OFD04	CEREAL, PULSES AND OIL SEED TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OFT01	FASHION CRAFTSMANSHIP	3	0	0	3	3	40	60	100	OE
22OFT02	INTERIOR DESIGN IN FASHION	3	0	0	3	3	40	60	100	OE
22OFT03	SURFACE ORNAMENTATION	3	0	0	3	3	40	60	100	OE
22OPH01	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH02	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	OE
22OPH03	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH04	BIO-PHOTONICS	3	0	0	3	3	40	60	100	OE
22OPH05	PHYSICS OF SOFT MATTER	3	0	0	3	3	40	60	100	OE
22OCH01	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	OE
22OCH02	POLYMER SCIENCE	3	0	0	3	3	40	60	100	OE
22OCH03	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	OE
22OMA01	GRAPH THEORY AND COMBINATORICS	3	0	0	3	3	40	60	100	OE
22OGE01	PRINCIPLES OF MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OGE02	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	40	60	100	OE
22OGE03	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	40	60	100	OE
22OGE04	NATION BUILDING: LEADERSHIP AND SOCIAL RESPONSIBILITY	3	0	0	3	3	40	60	100	OE
22OBM01	OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES	3	0	0	3	3	40	60	100	OE
22OBM02	AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OBM03	HOSPITAL AUTOMATION	3	0	0	3	3	40	60	100	OE
22OAG01	RAIN WATER HARVESTING TECHNIQUES	3	0	0	3	3	40	60	100	OE
22OEE01	VALUE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OEE02	ELECTRICAL SAFETY	3	0	0	3	3	40	60	100	OE
22OCB01	INTERNATIONAL BUSINESS MANAGEMENT	3	0	0	3	3	40	60	100	OE

ONE CREDIT COURSES										
22IT0XA	SWIFT FOR IOS DEVELOPMENT	1	0	0	1	-	100	0	100	EEC
22IT0XB	CONTAINERS AUTOMATION	1	0	0	1	-	100	0	100	EEC
22IT0XC	AWS LOAD BALANCING TECHNIQUE	1	0	0	1	-	100	0	100	EEC
22IT0XD	ETHICAL HACKING ESSENTIAL: WEB PENTESTING	1	0	0	1	-	100	0	100	EEC
22IT0XE	GENERATIVE AI WITH LARGE LANGUAGE MODELS	1	0	0	1	-	100	0	100	EEC
22IT0XF	DEEP LEARNING USING COMPUTER VISION	1	0	0	1	-	100	0	100	EEC
22IT0XG	FEATURE ENGINEERING FOR NLP	1	0	0	1	-	100	0	100	EEC
22IT0XH	TABLEAU	1	0	0	1	-	100	0	100	EEC
22IT0XI	WEB DEVELOPMENT USING CMS: A COMPARATIVE STUDY	1	0	0	1	-	100	0	100	EEC
22IT0XJ	DATA VISUALIZATION AND REPORTING USING POWERBI	1	0	0	1	-	100	0	100	EEC
22IT0XK	CLOUD MULTI-TENANCY AND SECURITY	1	0	0	1	-	100	0	100	EEC
22IT0XL	CLOUD INFRASTRUCTURE MODERNIZATION	1	0	0	1	-	100	0	100	EEC
22IT0XM	CYBER RISK MITIGATION	1	0	0	1	-	100	0	100	EEC
22IT0XN	BUILDING APIS WITH DJANGO FRAMEWORK	1	0	0	1	-	100	0	100	EEC
22IT0XO	REAL TIME INTERNET OF ROBOTICS THINGS (RIoT)	1	0	0	1	-	100	0	100	EEC
22IT0XP	WEB PENTESTING	1	0	0	1	-	100	0	100	EEC

22MA101 ENGINEERING MATHEMATICS I 3 1 0 4

Course Objectives

- To impart mathematical modeling to describe and explore real-world phenomena and data.
- To provide basic understanding on Linear, quadratic, power and polynomial, exponential, and multi variable models
- Summarize and apply the methodologies involved in framing the real-world problems related to fundamental principles of polynomial equations

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications. PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement the concepts of mathematical modeling based on linear functions in Engineering.
2. Formulate the real-world problems as a quadratic function model
3. Demonstrate the real-world phenomena and data into Power and Polynomial functions
4. Apply the concept of mathematical modeling of exponential functions in Engineering
5. Develop the identification of multivariable functions in the physical dynamical problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												1
2	2	2												
3	2	1												
4	2	2											1	
5	1	2												2

UNIT I **9 Hours**

MATHEMATICS MODELING OF LINEAR FUNCTIONS

The geometry of linear equations - Formation of linear equations: Method of least squares and method of regression - Vector spaces: Basic concepts with examples - Linear combination - Eigen values and vectors

UNIT II **9 Hours**

MATHEMATICAL MODELING OF QUADRATIC FUNCTIONS

General form of a quadratic function - Basic relationships between the equation and graph of a quadratic function - Sum of squares error and the quadratic function of best fit - Quadratic forms: Matrix form - Orhtogonality - Canonical form and its nature

UNIT III **9 Hours**

MATHEMATICAL MODELING OF POWER AND POLYNOMIAL FUNCTIONS

Characteristics of the graphs of power and polynomial functions - Fitting of power and polynomial functions using the method of least squares - Local maxima and local minima of power and polynomial functions - Power series of functions with real variables, Taylors series, radius and interval of convergence- Tests of convergence for series of positive terms - comparison test, ratio test

UNIT IV **9 Hours**

MATHEMATICAL MODELING OF EXPONENTIAL FUNCTIONS

Concept of exponential growth - Graphs of exponential functions - Relationship between the growth factor and exponential growth or decline - Exponential equations have a variable as an exponent and take the form $y= ab^x$ through least square approximation - Calculus of exponential functions - Exponential series - Characteristics

UNIT V **9 Hours**

MATHEMATICAL MODELING OF MULTIVARIABLE FUNCTIONS

Graphing of functions of two variables -Partial derivatives - Total derivatives - Jacobians - Optimization of multivariable functions with constraints - Optimization of multivariable functions without constraints

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2016
2. B. S. Grewal, Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB, Khanna, 2014
3. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons2020
4. Thomas and Finney, Calculus and analytic Geometry, Fourteenth Edition, By Pearson Paperback, 2018

22PH102 ENGINEERING PHYSICS 2 0 2 3

Course Objectives

- Understand the concept and principle of energy possessed by mechanical system
- Exemplify the propagation and exchange of energy
- Identify the properties of materials based on the energy possession

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PSO1.Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Illustrate the concept and principles of energy to understand mechanical systems
2. Exemplify the types of mechanical oscillations based on vibrational energy
3. Infer the concept of propagation of energy as transverse and longitudinal waves
4. Analyze the exchange of energy and work between the systems using thermodynamic principles
5. Apply the concept of energy and entropy to understand the mechanical properties of materials

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1					2			1		
2	3	2	1	2					2			1	1	
3	3	2	2	1					2			1		
4	3	2	2	1					2			1	2	
5	3	2	2	1					2			1		

UNIT I **6 Hours**

CONSERVATION OF ENERGY

Concept of energy - types of energy-conservation of energy. Mechanical energy: - translation - rotation - vibration - Kinetic and potential energies - conservation - work and energy - laws of motion - minimization of potential energy - equilibrium - dissipative systems - friction

UNIT II **5 Hours**

VIBRATIONAL ENERGY

Periodic Motion - Simple Harmonic Motion - Energy of the SHM - Pendulum types - Damped oscillations - forced oscillations - natural frequency - resonance

UNIT III **6 Hours**

PROPAGATION OF ENERGY

Transfer of energy - material medium - Transverse wave - Longitudinal wave - standing wave – interference - Doppler effect. Sound waves and its types - characteristics - human voicere - reflection - refraction-beats

UNIT IV **7 Hours**

EXCHANGE OF ENERGY

Energy in transit - heat - Temperature - measurement - specific heat capacity and water - thermal expansion- Heat transfer processes Thermodynamics: Thermodynamic systems and processes - Laws of thermodynamics - Entropy - entropy on a microscopic scale -maximization of entropy

UNIT V **6 Hours**

ENERGY IN MATERIALS

Elastic energy - Structure and bonding - Stress - strain - Tension and compression - elastic limit - Elastic Modulus - Stress - strain diagram - ductility - brittleness - rubber elasticity and entropy

EXPERIMENT 1 — 5 Hours

Assess the physical parameters of different materials for engineering applications like radius, thickness and diameter to design the electrical wires, bridges and clothes.

EXPERIMENT 2 — 5 Hours

Evaluate the elastic nature of different solid materials for modern industrial applications like shock absorbers of vehicle

EXPERIMENT 3 — 5 Hours

Analyze the photonic behavior of thin materials for advanced optoelectronic applications like adjusting a patient’s head, chest and neck positions as a medical tool.

EXPERIMENT 4 — 5 Hours

Investigate the phonon behavior of poor conductors for thermionic applications like polymer materials and textile materials.

EXPERIMENT 5 — 5 Hours

Assess the elongation of different solid materials for industrial applications like buildings, bridges and vehicles.

EXPERIMENT 6 — 5 Hours

Measure the compressibility of different liquids for modern industrial applications like navigation, medicine and imaging.

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part I: Classical Mechanics and Thermodynamics, Cognella Academic Publishing, 2019.
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

22CH103 ENGINEERING CHEMISTRY I 2 0 2 3

Course Objectives

- Understand the origin of elements from the universe
- Outline the properties of elements in the periodic table
- Analyse the different types of bond formed during chemical reactions and its reaction thermodynamics
- Summarize different states of matter based on atomic arrangement

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand nuclear transmutation reactions that lead to the formation of elements in the universe
2. Illustrate atomic structure of elements in the periodic table and interpret the periodic trends in properties of elements with its anomaly
3. Apply the conditions for the formation of different types of chemical bonds and predict the minimum energy required for a reaction to occur
4. Analyse endothermic and exothermic processes and exchange of energy during chemical reactions
5. Analyse whether the given matter is a solid, liquid, gas, or plasma and interpret the arrangement of atoms

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1											1	
3	2	1												
4	2	1											1	
5	2	1												

UNIT I **6 Hours**

ORIGIN OF ELEMENTS

Hydrogen - Elements and Sun - fusion - hypernova - supernova - dying stars - man-made elements

UNIT II **6 Hours**

ATOMIC STRUCTURE AND PERIODICITY

Atomic Structure - Electronic configuration - Periodic Table - Periodic trends in properties of elements - Anomalous behaviour in periodicity

UNIT III **6 Hours**

CHEMICAL BONDING

Octet rule & its limitations - types of chemical bonds - bond energy - bond cleavage - activation energy of reactions

UNIT IV **6 Hours**

REACTION THERMODYNAMICS

Conservation of energy - Endothermic reactions & exothermic reactions - Exchange of energy involved in chemical reactions

UNIT V **6 Hours**

STATES OF MATTER

Solid - liquid - gas - plasma - arrangement of atoms/ions/molecules in different phase

EXPERIMENT 1 **5 Hours**

Evaluate the recommended dissolved oxygen (DO) content in effluent samples collected from sewage treatment plants in BIT. Ensure the suitability of outlet water for the growth of aquatic animals (fishes).

EXPERIMENT 2 **5 Hours**

Investigate the amount of Iron (Fe) in a mild steel alloy sample using a spectrophotometer.

EXPERIMENT 3 **4 Hours**

Estimate the amount of chromium present in industry effluent samples and bottled beverages.

EXPERIMENT 4 **5 Hours**

Ensure the suitability of drinking water in the RO water supply in BIT based on the presence of chloride ions.

EXPERIMENT 5 **3 Hours**

Assess the acidic nature of effluent water from industries using the conductometric titration method.

EXPERIMENT 6 **4 Hours**

Measure the stain removal efficiency of the prepared soaps from stained clothes.

EXPERIMENT 7 **4 Hours**

Assess the purity of commercially available active pharmaceutical ingredients(aspirin) as per the government-prescribed standards

Total: 60 Hours

Reference(s)

1 Rose Marie Gallagher and Author Paul Ingram, Complete Chemistry Cambridge IGCSE, 2nd Edition, Oxford university press, 2020.
2 Peter Atkins, Julio D Paula and James Keeler, Atkins' Physical Chemistry, 12th Edition, Oxford university press, 2019.
3 Gareth Price, Thermodynamics of chemical processes, 2nd Edition, Oxford university press, 2019.
4 D Tabor, Gases, liquids and solids and other states of matter, 3rd Edition, Oxford University press, 2018.
5 P L Soni, Text book of inorganic chemistry, Chand publishers, New Delhi, 2017.
6 J.D. Lee, Concise inorganic chemistry, 5th edition (Reprint), Blackman Science Ltd, France, Wiley-India, 2016.

22GE001 FUNDAMENTALS OF COMPUTING 3 0 0 3

Course Objectives

- Understand the fundamental digital logics behind computations of computer systems.
- Develop simple assembly language programs with respect to arithmetic operations.
- Understand the program execution process and basics of software development methodologies.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Infer the hidden languages and inner structures of computer hardware and software through codes and combinations.
2. Interpret the organizational and architectural issues of a digital computer with concepts of various data transfer techniques in digital computers and the I/O interfaces.
3. Analyze programming problems and apply assembly instructions to solve simple problems.
4. Infer the fundamentals of operating system and System programs basics.
5. Apply the software development methodologies to various real life scenarios.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1										
2	3	3	3	1									1	
3	2	2	2	1										
4	2	2	2	1										
5	2	2	2	1									2	

UNIT I **8 Hours**

CODES AND COMBINATIONS

Communication using Mores and Braille binary codes - Digitizing letters, numbers and objects using binary codes - Performing simple operations: addition through binary codes.

UNIT II **9 Hours**

COMPUTATION USING COMPUTER

Communication to computing devices through various input sources - Computational operation - its flow, functions and control - communication to output devices - Basic communication protocol.

UNIT III **11 Hours**

ASSEMBLY LANGUAGE PROGRAMMING

Little Man Computing (LMC) Model - Instruction Set - Labels - Calculation -Branching - Input- Output - Loops - Simple programs.

UNIT IV **9 Hours**

OPERATING SYSTEM AND APPLICATION GENERATION

BIOS - Device Drivers - Resources - Scheduler - Applications Generation and Creation - Stages of Compilation - Linkers, Loaders and Libraries.

UNIT V **8 Hours**

SOFTWARE DEVELOPMENT

Phases of application life cycle management - Software Development Methodologies - Web Page development.

Total: 45 Hours

Reference(s)

1. Charles Petzold, "Code: The Hidden Language of Computer Hardware and Software", Microsoft Press books, 2009.
2. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliaz, "Little Man Computer Programming: For The Perplexed From The Ground Up", The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, "Peter Baer Galvin and Greg Gagne, Operating System Concepts", 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, "Software Engineering: A Practitioner"s Approach", McGraw Hill International edition, Seventh edition, 2010

22HS001 FOUNDATIONAL ENGLISH 1 0 2 2

Course Objectives

- Heighten awareness of grammar in oral and written expression
- Improve speaking potential in formal and informal contexts
- Prowess and develop abilities as critical readers and writers in interpreting complex texts.

Programme Outcomes (POs)

PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO12 Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (Cos)

1. Express themselves in a professional manner using error-free language
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3		2	2	
2									2	3		2	2	
3									2	3		2	2	
4									2	3		2	2	
5									2	3		2	2	

UNIT I **15 Hours**

SELF-EXPRESSION

Self-Introduction-Recreating Interview Scenarios (with a focus on verbal communication)-Subject Verb Concord - Tenses - Common Errors in verbal communication Be-verbs Self-Introduction- Recreating interview scenarios-Haptics-Gestures-Proxemics-Facial expressions- Paralinguistic / Vocalic- Body Language- Appearance-Eye Contact-Artefacts Self-Introduction-Powerful openings and closings at the interview-Effective stock phrases - Modified for spontaneity and individuality-Question tags, framing questions including WH- questions- Prepositions-Listening to Ted talks-Listening for specific information

UNIT II **15 Hours**

CREATIVE EXPRESSION

Descriptive Expression-Picture Description and Blog Writing -Vocabulary-One-word substitution-Adjectives-Similes, Metaphors, Imagery & Idioms -Link words - Inclusive language Narrative Expression- Travelogue and Minutes of Meeting -Verbal Analogy-Sequence & Time order words - Jumbled paragraph, sentences, Sequencing-Text & Paragraph Completion-Past tense -Using quotation marks

UNIT III **15 Hours**

FORMAL EXPRESSION

Formal Letters and Emails-Writing: E-mails and Letters of apology, Requisition and Explanation, and Letters to newspapers-Speaking: Tendering verbal apologies, and explanations, persuading a listener/ audience-Hierarchy in Business correspondence- Subject of a mail, Header, Body (Salutation) and Footer of a mail-Conjunctional clause Punctuation-Formal Idioms-Phrases-Articles - Definite & Indefinite-Types of sentences-Modal verbs Precision in comprehension, Summary writing, Selective summary-Reading: Active reading- short paragraphs, excerpts, articles and editorials-Skimming and Scanning Reading comprehension & analysis- Tenses, QP/ PQ approach. Identifying the central themes/ crux-Interpreting tone - formal/informal/semi-formal-Note-taking-Listening: Listening for data, for specific information, for opinion-Active and passive Listening-Transcription-Paraphrasing and summarizing information-Agreeing & disagreeing-Note-taking-Writing: Summary writing, selective summary, paraphrasing, note-making, opinion pieces-Finding synonyms in the context Paraphrasing- Sentence Transformation - simple, compound, complex. Sentence Substitution-Sentence completion- Interpreting paragraphs

Total: 45 Hours

Reference(s)

1 Sasikumar, V, et.al. A Course in Listening & Speaking Foundation Books, 2005.
2 Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3 Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010
4 Reynolds, John. Cambridge IGCSEA, First Language English. 2018th ed., Hodder Education, 2018.
5 Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

22GE004 BASICS OF ELECTRONICS ENGINEERING 2 0 2 3

Course Objectives

- To Understand the concept of energy transmission through mechanical, electrical and electromagnetic form.
- To Analyze the use of PN Junction Diode and BJT for signal conditioning.
- To apply the working principle of PN Junction Diode and BJT for the design of basic Digital Logic.
- To analyze the working and characteristics of Special Purpose Semiconductor Electronic Devices.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Understand the need for electrical and electromagnetic signal transmission.
2 Analyze the working principle and characteristics of PN junction diode.
3 Analyze the working principle and characteristics of Bipolar Junction Transistor.
4 Apply the working principle of PN Junction diode and BJT for designing basic Digital Logic functions.
5 Analyze the energy conversion needs and working principle of Special purpose electronic devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1										
2	3	3	3	2										
3	3	3	3	2									1	
4	3	3	3	2										
5	3	3	3	1									1	

UNIT I **6 Hours**

ENERGY TRANSFER AND SIGNALS

Energy Transmission through Mechanical, Electrical and Electromagnetic means, Signal as Energy Transmission, Complexity in signal transmission (Volume of Information, Distance and Time taken), Limitations of Mechanical Energy Transmission, Electrical and Electromagnetic Signal Transmission, Need for Conversion between Electrical and Mechanical Signals.

UNIT II **8 Hours**

SIGNAL CONDITIONING USING DIODE

Need for Vacuum Tubes in the Evolution of Electronics, Overview of Vacuum Tubes, Diode and Triode, Limitations of Vacuum Tubes. Semiconductor Group in Periodic Table, Overview of Semiconductor Materials, Flow of electrical energy through PN Junction Diode, Signal Clipping, Signal Clamping and Signal Multiplication using PN Junction Diode, Limitations of PN Junction Diode.

UNIT III **6 Hours**

SIGNAL CONDITIONING USING TRANSISTOR

Need for controlling electrical signals, Principle of Bipolar Junction Transistor operation, Signal Switching and Amplification using BJT, Limitations of BJT, Principle of Field Effect Transistor operation.

UNIT IV **6 Hours**

LOGIC SYNTHESIS USING DIODE AND TRANSISTORS

Overview of Logic Gates, PN Junction and BJT as electronic switches, Digital Logic Synthesis using Diode and Transistor: Diode Logic, Resistor Transistor Logic, Diode Transistor Logic, Transistor Logic.

UNIT V **4 Hours**

DEVICES FOR SPECIAL REQUIREMENTS

Voltage Regulation using Zener Diode, Variable Capacitance using Varactor Diode, Electrical Energy to Light Energy conversion using Light Emitting Diode, Light to Energy to Electrical Energy conversion using Solar Cell.

EXPERIMENT 1 **6 Hours**

Design a voltage multiplier to convert the low voltage from the mains power supply to the high voltage to operate the microwave oven.

EXPERIMENT 2 **6 Hours**

Design and construct regulated DC power supply for Mobile phone charger

EXPERIMENT 3 **6 Hours**

Design and construct an audio amplifier circuit for amplifying the volume to play the mobile sound in a huge speaker.

EXPERIMENT 4 **6 Hours**

Design and construct Switching circuit for the Pump to control over flow and drain condition for overhead tank using PN junction diode.

EXPERIMENT 5 **6 Hours**

Design and construct BJT based circuit to implement two-way connection for staircase light application.

Total: 60 Hours

Reference(s)

1. Thomas L. Floyd ,Electronic Devices: Electron Flow Version, Ninth Edition, Prentice Hall, 2012.
2. J Millman, C. Halkias & Satyabrata JIT, Electronic Devices and Circuits, Tata McGraw-Hill, 2007.
3. L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education 2006.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 2003.
5. Adel S. Sedra & Kenneth C. Smith, Micro Electronic Circuits Theory and Applications, Sixth Edition, Oxford University Press, 2013.
6. Behzad Razavi, Microelectronics, Wiley India Pvt. Ltd.; 2nd edition (2018)

22HS002 STARTUP MANAGEMENT **1 0 2 2**

Course Objectives

- Promote entrepreneurial spirit and motivate to build startups
- Provide insights on markets and the dynamics of buyer behaviour
- Train to develop prototypes and refine them to a viable market offering
- Support in developing marketing strategies and financial outlay
- Enable to scale up the porotypes to commercial market offering

Programme Outcomes (POs)

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Generate valid and feasible business ideas
2. Create Business Model Canvas and formulate positioning statement
3. Invent prototypes that fulfills an unmet market need
4. Formulate business strategies and create pitch decks
5. Choose appropriate strategies for commercialization

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1							1	2	1		1			
2							2	2	1	1	2		1	
3							3	3	1	2	2			
4							1	3	1	2	2			
5							2	3	2	2	2		1	

UNIT I **3 Hours**

BUSINESS MODELS AND IDEATION

Startups: Introduction, Types of Business Modes for Startups. Ideation: Sources of Ideas, Assessing Ideas, Validating Ideas, Tools for validating ideas, Role of Innovation and Design Thinking

UNIT II **3 Hours**

UNDERSTANDING CUSTOMERS

Buyer Decision Process, Buyer Behaviour, Building Buyer Personas, Segmenting, Targeting and Positioning, Value Proposition (Business Model Canvas), Information Sourcing on Markets, Customer Validation

UNIT III **3 Hours**

DEVELOPING PROTOTYPES

Prototyping: Methods-Paper and Digital, Customer Involvement in Prototyping, Product Design Sprints, Refining Prototypes

UNIT IV **3 Hours**

BUSINESS STRATEGIES AND PITCHING

Design of Marketing Strategies and Campaigns, Go-To-Market Strategy, Financial KPIs Financial Planning and Budgeting, Assessing Funding Alternatives, Pitching, Preparing Pitch Decks

UNIT V **3 Hours**

COMMERCIALIZATION

Implementation: Prototype to Commercialization, Test Markets, Institutional Support, Registration Process, IP Laws and Protection, Legal Requirements, Type of Ownership, Building and Managing Teams, Defining role of investors

EXPERIMENT 1 **1 Hour**

Analysis of various business sectors

EXPERIMENT 2 **2 Hours**

Developing a Design Thinking Output Chart

EXPERIMENT 3 **1 Hour**

Creating Buyer Personas

EXPERIMENT 4 **3 Hours**

Undertake Market Study to understand market needs and assess market potential

EXPERIMENT 5 **2 Hours**

Preparation of Business Model Canvas

EXPERIMENT 6 **15 Hours**

Developing Prototypes

EXPERIMENT 7 **2 Hours**

Organizing Product Design Sprints

EXPERIMENT 8 **2 Hours**

Preparation of Business Plans

EXPERIMENT 9 **2 Hours**

Preparation of Pitch Decks

Total: 15+30=45 Hours

Reference(s)

1. Rashmi Bansal, Connect the Dots, Westland and Tranquebar Press, 2012
2. Pavan Soni, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Penguin Random House India, 2020
3. Ronnie Screwvala, Dream with Your Eyes Open: An Entrepreneurial Journey, Rupa Publications, 2015
4. Stephen Carter, The Seed Tree: Money Management and Wealth Building Lessons for Teens, Seed Tree Group, 2021
5. Kotler Philip, Marketing Management, Pearson Education India, 15th Edition
6. Elizabeth Verkey and Jithin Saji Isaac, Intellectual Property, Eastern Book Company, 2nd Edition, 2021

22HS003 HERITAGE OF TAMILS 1 0 0 1

Course Objectives

- Describe the linguistic diversity in India, highlighting Dravidian languages and their features.
- Summarize the evolution of art, highlighting key transitions from rock art to modern sculptures.
- Examine the role of sports and games in promoting cultural values and community bonding.
- Discuss the education and literacy systems during the Sangam Age and their impact.
- Outline the importance of inscriptions, manuscripts, and the print history of Tamil books in preserving knowledge and culture.

Programme Outcomes (POs)

PO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the concept of language families in India, with a focus on Dravidian languages.
2. Trace the evolution of art from ancient rock art to modern sculptures in Tamil heritage.
3. Identify and differentiate various forms of folk and martial arts in Tamil heritage.
4. Understand the concepts of Flora and Fauna in Tamil culture and literature.
5. Evaluate the contributions of Tamils to the Indian Freedom Struggle.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				2
2									2	3				2
3									2	3				2
4									2	3				2
5									2	3				2

UNIT I **3 Hours**

LANGUAGE AND LITERATURE

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II **3 Hours**

HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III **3 Hours**

FOLK AND MARTIAL ARTS

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV **3 Hours**

THINAI CONCEPT OF TAMILS

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V **3 Hours**

CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total: 15 Hours

Reference(s)

1. Dr.K.K.Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
2. Dr.S.Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies.
5. Keeladi, Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu.
7. Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
8. R Balakrishnan, Journey of Civilization Indus to Vaigai, RMRL.

22HS003 **தமிழர் மரபு** **1 0 0 1**

பாடத்திட்டத்தின் நோக்கம்

- இந்திய மொழிக்குடும்பத்துள் திராவிட மொழிகள் தனித்து இயங்கும் தன்மையை அதன் சிறப்புகள் வழி அறிதல்.
- தொன்றுதொட்டு தமிழர், கலையில் அடைந்த வளர்ச்சியை இயம்புதல்.
- சங்ககால தமிழரின் கற்றல் திறத்தை இலக்கியங்கள் வழி ஆராய்தல்.

கற்றலின் விளைவு

1 இந்திய மொழிக்குடும்பத்துள் திராவிட மொழிகள் தனித்து இயங்கும் தன்மையை அதன் சிறப்புகள் வழி அறிதல்.
2 தொன்றுதொட்டு தமிழர், கலையில் அடைந்த வளர்ச்சியை இயம்புதல்.
3 சங்ககால தமிழரின் கற்றல் திறத்தை இலக்கியங்கள் வழி ஆராய்தல்.
4 தமிழ் மொழியின் சிறப்புகளை அதன் படைப்பிலக்கியங்கள் மூலம் அறிந்து கொள்ளுதல்.
5 கற்காலம் தொடங்கி, இக்காலம் வரை சிற்பக்கலை அடைந்த வளர்ச்சியை கண்டுகொள்ளல் .
6 தமிழர் தம் வாழ்வில் எங்கனம் இயற்கையை வணங்கி போற்றினர் என்பதை திணை கோட்பாட்டின் வழி தெளிதல்.
7 இந்திய விடுதலை போரில் தமிழர் ஆற்றிய பங்கினை தெரிந்து கொள்ளுதல்.

அலகு I மொழி மற்றும் இலக்கியம்: **3**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22MA201 ENGINEERING MATHEMATICS II 3 1 0 4

Course Objectives

- To impart and analyze the concepts of differential equations to describe in real-world phenomena
- To provide basic understanding on differential equation models and vector field models
- Summarize and apply the methodologies involved in framing the real-world problems related to fundamental principles of complex functions

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Interpret the concept of differential equations through mathematical modeling and analyze its applications in engineering
2. Formulate the real-world problems as second order linear differential equations and give solutions for the same
3. Demonstrate the real-world phenomena with magnitude and direction in the form of vector functions
4. Apply the concept of vector fields and line integrals through mathematical modeling in engineering
5. Determine complex functions and apply them to formulate problems arising in engineering

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	2	2											1	
3	2	2												
4	2	1												2
5	1	2												

UNIT I **9 Hours**

FIRST ORDER LINEAR DIFFERENTIAL EQUATIONS

Formation of differential equations- Solutions of first order linear ODE: Leibnitzs and method of separation of variables- Cooling/Heating of an object - A falling object- Modeling of electric circuits: RL and RC circuits - Modeling of population dynamics: Exponential growth and decay - Logistic growth model

UNIT II **9 Hours**

SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS

Methods of solving second order linear ordinary differential equations -Models for linear oscillators: Simple harmonic motion - Mechanical vibrations with and without damping - Electric circuit system: RLC circuits

UNIT III **9 Hours**

VECTOR DIFFERENTIAL CALCULUS

Vector and scalar functions - Fields - Derivative of vector function and geometrical interpretation- Velocity and acceleration - Gradient and its properties- Tangent and normal vectors - Directional derivative- Divergence of a vector field - Curl of a vector field - Projectile motion

UNIT IV **9 Hours**

VECTOR INTEGRAL CALCULUS

Line integrals of vector point functions - Surface integral of vector point functions - Applications of line and surface integrals - Greens theorem in a plane - Stokes theorem - Gauss divergence theorem

UNIT V **9 Hours**

COMPLEX FUNCTIONS

Basic concepts of Complex numbers Geometrical representation of complex number - Analytic functions and its properties - Construction of Analytic functions: Fluid flow Electric flow - Mapping of complex functions

Tutorial: 15 Hours
Total: 60 Hours

Reference(s):

1. Richard E. Williamson, Introduction to Differential Equations and Dynamical Systems, McGraw Hill Companies. Inc, 1997
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass Thomas Calculus, 13/e, Pearson Publishers, 2013
4. Erwin Kreyszig, Advanced Engineering Mathematics Wiley, 10th editi5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017on ,2015
5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017

22PH202 ELECTROMAGNETISM AND MODERN PHYSICS

2 0 2 3

Course Objectives

- Understand the principles and mechanisms of electricity and magnetism
- Infer the classification of electromagnetic waves
- Analyze the theory of relativity and energy bands

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the principles and mechanism of electrostatics and current
2. Illustrate the principles and mechanism of magneto statics
3. Classify electromagnetic waves and infer the characteristics of visible light
4. Outline the importance of theory of relativity and analyze the wave nature of particles
5. Exemplify the electrical properties of semiconductor based on the band theory

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1					2			1	1	
2	3	2	1	2					2			1		
3	3	2	2	1					2			1		
4	3	2	2	1					2			1		
5	3	2	2	1					2			1	1	

UNIT I **6 Hours**

ELECTRICITY

Electric monopoles - Electric field- Electric flux - Electric potential - electrical energy- capacitor- conductors and insulators-Electric dipole and polarization - electric current -voltage sources- resistance

UNIT II **6 Hours**

MAGNETISM

Sources of magnetism- monopoles-magnetic field and force-magnetic field and current distribution-magnetic dipole-magnetic potential energy-inductor- electric and magnetic field comparison

UNIT III **6 Hours**

ELECTROMAGNETIC WAVES AND LIGHT

Electromagnetism: basic laws-electromagnetic energy-radiation. Electromagnetic waves: origin, nature and spectrum-visible light Principle of least time- geometrical optics-Human eye - Diffraction - Interference - polarization-LASER

UNIT IV **6 Hours**

MODERN PHYSICS

Special theory of relativity - simultaneity and time dilation - length contraction - relativistic mass variation. Matter waves - de-Broglie hypothesis - wave nature of particles.

UNIT V **6 Hours**

ENERGY BANDS IN SOLIDS

Band theory of solids - classification of materials - semiconductors - direct and indirect semiconductor - fermi energy -Intrinsic and extrinsic semiconductor - carrier concentration - electrical conductivity

EXPERIMENT 1 **5 Hours**

Analysis of I-V characteristics of a solar cell for domestic applications

EXPERIMENT 2 **5 Hours**

Investigate the photonic behavior of laser source for photo copier device

EXPERIMENT 3 **5 Hours**

Implement the principle of stimulated emission of laser for grain size distribution in sediment samples

EXPERIMENT 4 **5 Hours**

Assess the variation of refractive index of glass and water for optical communication

EXPERIMENT 5 **5 Hours**

Evaluate the band gap energy of semiconducting materials for display device applications

EXPERIMENT 6 **5 Hours**

Determine the carrier concentration of charge carriers in semiconductors for automotive applications

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part II: Electricity and Magnetism, Cognella Academic Publishing, 2019
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

22CH203 ENGINEERING CHEMISTRY II 2 0 2 3

Course Objectives

- Understand the concept of electrochemistry for determination of electrode potential, pH and applications as energy storage devices
- Outline the chemistry of metal corrosion and analyze the methods of corrosion control
- Understand how catalyst increases the reaction rate
- Summarize the variation in properties and reactivity of isotopes

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO7 Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications

Course Outcomes (COs)

1. Apply the electrochemical principles to determine the electrode potential of a metal
2. Analyze the construction, cell reactions and working of energy storage devices
3. Analyze the specific operating conditions under which corrosion occurs and suggest a method to control corrosion
4. Illustrate reaction mechanisms and assess the role of catalyst in a chemical reaction
5. Analyze various types of nuclear transmutation including decay reactions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1											1	
2	2	1												
3	2	1					1							
4	2	1												
5	2	1											1	

UNIT I **6 Hours**

ELECTROCHEMISTRY

Origin of potential - electromotive force - electrical double layer - transport of charge within the cell - cell description - prediction of cell potentials

UNIT II **6 Hours**

ENERGY STORING DEVICES

Relation between electrical energy and energy content of a cell - reversible and irreversible cell - charging and discharging reactions in a reversible cell - current challenges in energy storage technologies

UNIT III **6 Hours**

METAL CORROSION AND ITS PREVENTION

Oxidation of metals: Electrochemical origin of corrosion - electromigration - electron transfer in the presence and absence of moisture - galvanic series. Strategies for corrosion control: Galvanic anode and impressed current.

UNIT IV **6 Hours**

CATALYSIS

Energy profile diagram for a chemical reaction - activation energy - role of catalyst - homogeneous and heterogeneous catalysis - types

UNIT V **6 Hours**

NUCLEAR REACTIONS

Radioactive and stable isotopes - variation in properties between isotopes - radioactive decay (alpha, beta and gamma) - half-life period - nuclear reactions - radiocarbondating

EXPERIMENT 1 **4 Hours**

Measure industrial effluent water pH and assess water quality against allowed standards

EXPERIMENT 2 **4 Hours**

Iron (Fe2+) in Bhavani River water: Potentiometric Analysis & Pollution Assessment (CPCB Standards).

EXPERIMENT 3 **4 Hours**

Construct a Zn-Cu electrochemical cell and validate the output by connecting the LED light.

EXPERIMENT 4 **5 Hours**

Evaluate the corrosion percentage in concrete TMT bars

EXPERIMENT 5 **4 Hours**

Determination of the percentage of corrosion inhibition in plain-carbon steel using natural inhibitors using natural inhibitors

EXPERIMENT 6 **4 Hours**

Electroplating of copper metal on iron vessels for domestic application.

EXPERIMENT 7 **5 Hours**

Determination of acid-catalyzed hydrolysis kinetics in locally sourced fruit extracts

Total: 60 Hours

Reference(s)

1. U. Hanefeld, L. Lefferts, Catalysis: An Integrated Textbook for Students, 2nd Edition, Wiley- VCH, 2017.
2. S. Vairam, Engineering Chemistry, 1st Edition, John Wiley & Sons, 2014.
3. Jain and Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2013.
4. P.H. Rieger, Electrochemistry, Second Edition (Reprint), Springer, Netherland, 2012.
5. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th Edition (revised), New Age International Publishers, 2011.
6. E. McCafferty, Introduction to Corrosion Science, 1st Edition, Springer, 2010.

22GE002 COMPUTATIONAL PROBLEM SOLVING 3 0 0 3

Course Objectives

- Analyze the algorithm design techniques and development principles in solving the real-life problems.
- Illustrate the different ways of organizing and storing the data in computing systems.
- Understand the basic network configuration and setup connections among different device systems.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze a problem and formulate algorithms, pseudocodes and flowcharts.
2. Develop algorithmic solutions to simple computational problems and explore algorithmic approaches to problem solving.
3. Design and apply appropriate data structures for solving computing problems.
4. Compare the various storage devices used in a computer system.
5. Analyze the requirements for a given organizational structure and establish the connection between two or more computers to form a network.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2									3	
2	3	3	3	3									3	
3	2	2	2	3									3	
4	2	2	2	2										3
5	2	2	2	2									1	2

UNIT I **6 Hours**

VISUAL PROCESS MODELING

Scenario decomposition - logical sequencing - drawing flowchart - preparing visual process model.

UNIT II **12 Hours**

ALGORITHMIC DESIGN THINKING

Analysis - Verification - Brute force - Divide and conquer - Greedy - Backtracking.

UNIT III **12 Hours**

DATA ORGANIZATION

Elementary Data Organization - Abstract Data Types - Fundamentals of Linear and Non Linear Data Structures.

UNIT IV **7 Hours**

DATA STORAGE

Flat File and Relational database- Data Read & Write in Local Storage, Server Storage and Cloud storage - Database Query Methods.

UNIT V **8 Hours**

NETWORKING ESSENTIALS

Networking Components and Services - IP Addressing - Configuring and Managing the Campus Network - Network Security - Firewalls.

Total: 45 Hours

Reference(s)

1. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2011.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,2016.
4. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill, 2015.
5. Behrouz A.Forouzan, "Data Communication and Networking", 5th Edition, Tata McGraw-Hill, 2014.

22GE003 BASICS OF ELECTRICAL ENGINEERING 2 0 2 3

Course Objectives

- To understand the basic concepts of electrical charge and its properties
- To interpret the formation of electric field due to electric charges
- To illustrate the concept of magnetic fields due to revolving electron
- To illustrate the force on moving charges in electric and magnetic field
- To understand the energy transfer in electro mechanical conversion

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

P04: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Interpret the behavior of electric charges in different medium using coulombs law.
2. Analyse the electric field due to different charge distributions.
3. Analyse the magnetic field intensity due to long conductor, solenoid, toroid and magnetic dipoles.
4. Analyze the force on conductors due to the moving charges.
5. Interpret the energy conversion concepts in electromagnetic fields.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		1									1	
2	3	2		1										
3	1	1	3											1
4	2	1		3									1	
5	3	2		1										

UNIT I **5 Hours**

ELECTRIC CHARGE

Properties of charge, additivity of charges, quantization of charge, conservation of charge, Forces between multiple charges, Electric charge in conductors, Drift of Electrons, Charges in Clouds.

UNIT II **7 Hours**

ELECTRIC FIELD

Electric field due to system of charges, Significance of Electric field line. Electric Dipole and its significance, Continuous charge distribution, Field in infinite long uniform straight conductors, field in uniform charged uniform infinite plane sheet, field due to uniform thin spherical sheet.

UNIT III **7 Hours**

MAGNETIC FIELDS

Concept of magnetic field, magnetic fields in infinitely long straight wire, straight and toroidal solenoids, Magnetic dipole moment of a revolving electron, Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to axis, Induced Electric field due to changing Magnetic Field.

UNIT IV **6 Hours**

FORCE ON CHARGES

Force on a moving charge in uniform magnetic and electric fields, Force on a current carrying conductor in a uniform magnetic field, Force between two parallel current carrying conductors.

UNIT V **5 Hours**

ELECTRO MECHANICAL ENERGY CONVERSION

Energy transfer in electromagnetic fields, Energy storage in magnetic field, Electromagnetic induction, induced emf, Eddy currents. Self and mutual inductance Linear Momentum and Angular Momentum carried by Electromagnetic Fields.

EXPERIMENT 1 **7 Hours**

Analysis the behavior of a Fixed Resistor in an Electric Heater

EXPERIMENT 2 **7 Hours**

Construct an Electrical Wiring layout for a basic Household Applications

EXPERIMENT 3 **8 Hours**

Analysis the self and Mutual Induction in a Domestic Fan

EXPERIMENT 4 **8 Hours**

Design A Transistor-Based Electronic Switch

Total: 60 Hours

Reference(s)

1. Mathew N. O. Sadiku, Principles of Electromagnetics, 6th Edition, Oxford University 2020
2. William H. Hayt and John A. Buck, Engineering Electromagnetics, McGraw Hill 2020
3. Kraus and Fleisch, Electromagnetics with Applications, McGraw Hill International Editions, 2017
4. S.P.Ghosh, Lipika Datta, Electromagnetic Field Theory, First Edition, McGraw Hill Education(India) Private Limited 2017

22IT206 DIGITAL COMPUTER ELECTRONICS 3 0 2 4

Course Objectives

- Understand the operation of Arithmetic Logic unit in Microprocessors
- Interpret Data retrieval from Memory by Microprocessors
- Analyze the role of Control Unit in Microprocessors
- Analyze Instruction execution in Microprocessors

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes

1. Analyze the Design of Arithmetic and Logic Unit in Microprocessors
2. Analyze the Data Storage and Retrieval from Random Access Memory
3. Analyze the working mechanism of Control Unit in Microprocessors
4. Analyze the execution of Arithmetic and Logical Instructions
5. Analyze the execution of Jump and Memory related Instructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2											
2	2	2	2											
3	2	2	2											
4	2	2											1	
5	2	2											1	

UNIT I **9 Hours**

BINARY SYSTEM AND DESIGN OF ALU

Conversion of Decimal, Hexadecimal, Octal and Binary Numbers - Representation of Negative Numbers in Binary - Design of Binary Arithmetic Logic Modules - Magnitude Comparator - Encoder - Decoder - Multiplexer - Demultiplexer - Design of Arithmetic and Logic Unit (ALU)

UNIT 2 **9 Hours**

SYNCHRONOUS CIRCUIT AND DESIGN OF RAM

Latches and Flip Flops - Clock - Registers - Counters - Shift Registers - Storage and Retrieval of Binary Numbers from Registers - Design of Random Access Memory (RAM) - Encoding and Decoding of Memory address locations

UNIT 3 **9 Hours**

DESIGN OF CONTROL UNIT

Design of Control Unit - Mechanism of Instruction Read, Data Read, Instruction Decode, Instruction Execute and Data Write

UNIT 4 **9 Hours**

BASIC INSTRUCTION EXECUTION

Arithmetic Instructions - Increments, Decrements and Rotate Instructions - Logic Instructions - Arithmetic and Logic instructions

UNIT 5 **9 Hours**

ADVANCED INSTRUCTION EXECUTION

Memory Reference instructions - Register Instructions - Jump and Call Instructions - Concept of Flag - Extended Register Instructions - Indirect Instructions - Stack instructions

EXPERIMENT 1 **5 Hours**

Buzzer Alarm System: Logic Circuit for Intruder Detection

EXPERIMENT 2 **5 Hours**

Binary Calculator: Design and Simulation of a Basic Arithmetic Unit.

EXPERIMENT 3 **5 Hours**

Binary Comparator: Designing a Circuit to Compare Binary Numbers

EXPERIMENT 4 **5 Hours**

Digital Lock System: With the combination of Flip-Flops and Logic Gates.

EXPERIMENT 5 **5 Hours**

Digital Alarm Clock: Timekeeping with Counters and Decoders

EXPERIMENT 6 **5 Hours**

Elevator Control System: Implementing Logic for Floor Selection

Total: 75 Hours

Reference(s)

1. Digital Logic & Computer Design , Morris Mano Pearson Education India, 2019
2. Digital Computer Electronics, Albert Paul Malvino and Jerald A Brown (3rd Edition), McGraw Hill Education India, 2001
3. Digital Design and Computer Architecture, David Money Harris and Sarah L Harris, Elsavier, 2007
4. But How do it Know? The Basic Principles of Computers for Everyone, John C Schott, John C Scott Publishers, 2009
5. Code: The Hidden Language of Computer Hardware and Software (2nd Edition), Petzold Charles, Microsoft Press , 2022
6. Digital Computer Fundamentals (6th Edition), Thomas C Bartee, Tata Mcgraw Hill Education, 2011

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22HS006 TAMILS AND TECHNOLOGY

Course Objectives

- Analyze graffiti on potteries as a form of historical and cultural documentation during the Sangam Age.
- Investigate the building materials and the historical context of Hero stones during the Sangam Age by Analyzing the details of stage constructions in Silappathikaram and their cultural significance.
- Examine ancient knowledge of oceans and its impact on Tamil society.

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the significance of the weaving industry during the Sangam Age and its cultural importance.
2. Understand the significance of dams, tanks, ponds, and sluices in the agricultural and irrigation practices of the Chola Period.
3. Explore the architectural designs and structural construction methods used in household materials during the Sangam Age.
4. Explore the art of shipbuilding in ancient Tamil culture and its role in maritime trade and transportation.
5. Trace the development of scientific terminology and vocabulary in Tamil language.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	2			1	
2									2	2				
3									2	2			1	
4									2	3			1	
5									2	3				

UNIT I **3 Hours**

WEAVING AND CERAMIC TECHNOLOGY

Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

UNIT II **3 Hours**

DESIGN AND CONSTRUCTION TECHNOLOGY

Designing and Structural construction House and designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period

UNIT III **3 Hours**

MANUFACTURING TECHNOLOGY

Art of Ship Building-Metallurgical studies-Iron industry-Iron smelting,steel-Copper and gold-Coins as source of history-Minting of Coins-Beads making-industries Stone beads -Glass beads-Terracotta beads-Shell beads-bone beats-Archeological evidences-Gem stone types described in Silappathikaram.

UNIT IV **3 Hours**

AGRICULTURE AND IRRIGATION TECHNOLOGY

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry- Wells designed for cattle use- Agriculture and Agro Processing-Knowledge of Sea-Fisheries- Pearl-Conche diving-Ancient Knowledge of Ocean-Knowledge Specific Society.

UNIT V **3 Hours**

SCIENTIFIC TAMIL

Development of Scientific Tamil-Tamil computing-Digitalization of Tamil Books-Development of Tamil Software-Tamil Virtual Academy-Tamil Digital Library-Online Tamil Dictionaries-Sorkuvai Project.

Total: 15 Hours

Reference(s)

1. Dr. K. K. Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL
2. Dr. S. Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr. S. V. Subatamanian , Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr. M. Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies
5. Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr. K. K. Pillay, Studies in the History of India with Special Reference to Tamil Nadu.

பாடத்திட்டத்தின் நோக்கம்

- சங்க காலத்தில் வரலாறு மற்றும் கலாச்சார ஆவணங்களின் ஒரு வடிவமாக, மட்பாண்டங்கள் மீதான கிராஃபிட்டியை பகுப்பாய்வு செய்தல்.
- சிலப்பதிகாரத்தில் கட்டப்பட்ட மேடை கட்டுமானங்களின் விவரங்களையும் அவற்றின் கலாச்சார முக்கியத்துவத்தையும் பகுப்பாய்வு செய்வதன் மூலம், சங்க காலத்தில் மாவீரர் கற்களின் கட்டுமானப் பொருட்கள் மற்றும் வரலாற்று சூழலை ஆராய்தல்.
- சமுத்திரங்கள் பற்றிய பண்டைய அறிவையும், தமிழ் சமூகத்தில் அதன் தாக்கத்தையும் ஆராய்வது ஆகியவை இப்பாடத்திட்டத்தின் நோக்கம் ஆகும்.

கற்றலின் விளைவு

1 சங்க காலத்தில் நெசவுத் தொழிலின் முக்கியத்துவத்தையும் அதன் கலாச்சார முக்கியத்துவத்தையும் புரிந்து கொள்ளல்.
2 சோழர் கால விவசாய மற்றும் நீர்ப்பாசன நடைமுறைகளில் அணைகள், குளங்கள் மற்றும் மதகுகளின் முக்கியத்துவத்தைப் புரிந்து கொள்ளல்.
3 சங்க காலத்தில் வீட்டுப் பொருட்களில் பயன்படுத்தப்பட்ட கட்டடக்கலை வடிவமைப்புகள் மற்றும் கட்டமைப்பு கட்டுமான முறைகளை ஆராய்தல்.
4 பண்டைய தமிழ் கலாச்சாரத்தில், கப்பல் கட்டும் கலை, கடல் வர்த்தகம் மற்றும் போக்குவரத்தில் அதன் பங்கை ஆராய்தல்.
5 தமிழ் மொழியில் அறிவியல் சொற்களஞ்சியம் மற்றும் சொல்லகராதியின் வளர்ச்சியைக் கண்டறிதல்.

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: **3**

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: **3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22IT301 PROBABILITY, STATISTICS AND QUEUING THEORY 3 1 0 4

Course Objectives

- Understand the basic concepts of probability and the distributions with characteristics and also two-dimensional random variables
- Summarize and apply the methodologies of the statistics and queuing theory.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learningalgorithms and analytical tools to enable information retrieval and decision making in scientific and business applications

Course Outcomes (COs)

1. Demonstrate and apply the basic probability axioms and concepts in the core areas.
2. Apply the concepts of probability distributions in an appropriate place of computers and Engineering.
3. Implement basic statistical inference techniques engineering problems.
4. Design an experiment using ANOVA technique and summarize the measurements for statistical quality control.
5. Identify and apply the queuing methodologies to optimize the result of the waiting line.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2											1	
2	1	2											1	
3	1	2											1	
4	1	2												2
5	1	2												2

UNIT I **9 Hours**

PROBABILITY AND RANDOM VARIABLE

Axioms of probability-Conditional probability-Total probability-Bayes theorem-Random variable-Probability mass function-Probability density functions-Properties-Moments - Moment generating functions and their properties.

UNIT II **9 Hours**

STANDARD DISTRIBUTIONS

Discrete distributions: Binomial - Poisson - Negative Binomial - Continuous distributions: Uniform - Exponential - Gamma - Normal distributions and their properties.

UNIT III **9 Hours**

TESTING OF HYPOTHESIS

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on normal distribution for single mean and difference of means -Small sample tests: t-test for mean -F- test - Chi-square test for Goodness of fit and Independence of attributes.

UNIT IV **9 Hours**

DESIGN OF EXPERIMENTS AND CONTROL CHART

One way and two way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design - Control charts for measurements (X and R charts) - Control charts for attributes (p, c and np charts).

UNIT V **9 Hours**

QUEUING THEORY

Pure Birth and Death Process -Characteristics of Queuing models- Kendalls notation- Single and multi server Markovian queuing models- M/M/1 and M/M/C (Finite and infinite capacity)- Pollaczek-Khinchine formula.

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, PHL Publisher, 1996.
2. Kishore S Trivedi, Probability and Statistics with Reliability Queuing and Computer Science Applications, John Wiley and Sons, Second Edition, 2012.
3. Arnold O Allen, Probability Statistics and Queuing Theory with Computer Applications, New Age International, 2003.
4. Jay L Devore, Probability and Statistics for Engineering and The Sciences, Thomson Learning, Seventh Edition, 2002.
5. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists

22IT302 DATA STRUCTURES I 3 0 2 4

Course Objectives

- Implement array and hash data structure for real world applications.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the performance of various data structures using asymptotic notations.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement the array data structure and its types for searching and sorting operations.
2. Outline the algorithm efficiency with different asymptotic notations for optimizing the code.
3. Implement the linear node-based data structure for real world applications.
4. Evaluate the performance of Hash over arrays and list in memory access.
5. Analyze the tree traversal algorithms for various non-linear data structures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	1
2	2	2	2	2	2						2	2	1	
3	2	3	3	2	2						2	2	2	1
4	3	3	3	3	2						3	3	3	
5	3	2	3	3	3						3	3	2	2

UNIT I **10 Hours**

FOUNDATIONAL DATA STRUCTURES

Algorithms and Data Structures - Data Structures hierarchy -Types of Data- Singular Data and Plural Data - Position indexing : Array - Sets - Ordered Arrays - Searching over Arrays and Ordered Arrays.

UNIT II **7 Hours**

ALGORITHM EFFICIENCY

Algorithm efficiency using Asymptotic Notations - Optimizing code with and without Big O Notation - Optimizing for optimistic scenarios - Trade- offs between Time and Space.

UNIT III **10 Hours**

ADT AND NODE BASED DATA STRUCTURES

ADT : Stacks - Queues - Recursion - Recursive Algorithms for Speed - Node Based Data Structures : Linked list - Need of Linked List - Arrays vs Linked List - Types of Linked List and its operations - Skip Lists.

UNIT IV **8 Hours**

FAST LOOKUP WITH HASH

Hash Table - Hash functions - Internal implementation of Hash - Iteration over Hash - Hash operations - Hash of Hash - Array of Hash - Hash of Array.

UNIT V **10 Hours**

TREES

Tree - Binary Tree - Binary Search Tree - Tree traversal - AVL Tree - Red Black Tree - B Tree - B+ Tree - Heap.

8 Hours

EXPERIMENT 1

Implement a python program for the supermarket application using Stack and Queue for basket storage and checkout respectively.

4 Hours

EXPERIMENT 2

Implement a python program for using a singly linked list. managing a train station and need to keep track of passengers on a particular train

4 Hours

EXPERIMENT 3

Create a python program that allows users to search for a person's phone number quickly in the phone directory.

2 Hours

EXPERIMENT 4

Implement a Python program to sort the student grades for the quiz competition.

2 Hours

EXPERIMENT 5

Implement a digital signature generator and verifier using hash functions and public-key cryptography. Users can sign documents and verify the authenticity of signed documents.

10 Hours

EXPERIMENT 6

Implement a python program to give a direction for a Stranger. Landmark will be considered as a node and the path between the two landmark is the link

Total: 45 +30= 75 Hours

Reference(s)

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures & Algorithms in Python, Wiley, 2013.
2. Larry Wall, Tom Christiansen & Randal L. Schwartz, Progrmaming Perl, O"Reilly, 3rd edition, 2000.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2016.
4. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
5. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011.
6. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009.

22IT303 COMPUTER ORGANIZATION AND ARCHITECTURE 3 1 0 4

Course Objectives

- Understand the computer architecture concepts related to design of processors, memory management and I/O system.
- Explore the GPU computing architecture and develop an environment for creating high performance GPU-accelerated applications using CUDA programming.
- Gain knowledge on modern processor architecture to design the best processor/computing system.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the processor architecture and instruction sets of x86/x64 and ARM architecture.
2. Design a data path for a simple processor and compare the various techniques related to simultaneous execution of multiple instructions from a program.
3. Organize the computer memory to speed up the performance and facilitate the transfer of data between the computer's central processing unit and the external devices.
4. Analyze the GPU computing architecture and develop applications to run on NVIDIA GPUs using the CUDA programming environment.
5. Analyze the modern processor architectures and instruction sets and implement a RISC-V processor in a low-cost FPGA board.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2								2		1
2	3	3	2	2								2		2
3	2	2	2									2	2	2
4	2	2	2	2	3							2	1	1
5	2	2	2	2								2		2

UNIT I **9 Hours**

UNDERSTANDING PROCESSOR ARCHITECTURE AND INSTRUCTION SETS

Basic Computer Organization and Design - Instruction Set principles - x86 and x64 architecture & instruction sets - 32 bit and 64 bit ARM architecture & instruction sets.

UNIT II **9 Hours**

PROCESSOR DESIGN

Designing a Data path for a Simple Processor - DLX Pipeline - Super Pipelining - Super scalar processor - Instruction level parallelism (ILP) - Speculative Execution - Side channel attack (Spectre and Meltdown)

UNIT III **9 Hours**

MEMORY UNIT AND I/O ORGANIZATION

Memory Hierarchy - Cache Architectures - Levels in Cache - Improving Cache Performance - Memory Prefetch - Tera MTA - Connecting I/O Devices to the Processor.

UNIT IV **8 Hours**

EXPLORING GPU ARCHITECTURE

GPU Vs CPU architecture - GPU Architecture Basics - NVIDIA"s CUDA Toolkit - CUDA Programming

UNIT V **10 Hours**

MODERN COMPUTER ARCHITECTURE

Domain-Specific Computer Architectures - Sony PlayStation design PS3/PS5, MAC M1 chip, Xbox, Cerebas - Wafer Scale Computing, Accelerators (FPGA, ASIC) - RISC-V Architecture and Instruction Set - Implementing RISC-V in a field-programmable gate array (FPGA).

Tutorial: 15 Hours
Total: 60 Hours

Reference(s):

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill,Third Reprint, 2015.
2. David A, Patterson and John L, Hennessy, Computer Organization and Design: The hardware/ software interface, MorganKaufmann,4th edition, 2014.
3. Jim Ledin, Modern Computer Architecture and Organization - Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers - Second Edition,2022.

22IT304 PRINCIPLES OF PROGRAMMING LANGUAGES 3 0 2 4

Course Objectives

- Understand the history and evolution of programming language.
- Gain knowledge about the different data types and control flow statements.
- Impart knowledge about the subprograms, functions, debugging and error handling mechanisms.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Outline the programming paradigms and the basic structure of programming language.
2. Assess the implementation of different types of data, variable and types system.
3. Analyze suitable conditional statements and control structures for real world applications.
4. Develop programs using subprograms and explore their types for problem solving.
5. Determine the tools for error handling and event handling in Programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1	1	3						1	2	1	
2	2	3	3	1	3						2	2	1	
3	1	2	3	1	3						2	2	2	
4	1	2	3	1	3						2	2		2
5	1	2	3	1	3						2	2		2

UNIT I **8 Hours**

UNDERSTANDING PROGRAMMING PARADIGMS

Natural Vs Artificial language - Common Programming Paradigms - Syntax and semantics - Language Evaluation Criteria - Programming Language Grammar.

UNIT II **10 Hours**

VARIABLES AND DATA TYPES

Variable Declarations - Guidelines for Initializing Variables - Power of Variable names - Fundamental Data types - Type Systems - Type Inference and Polymorphism.

UNIT III **10 Hours**

STATEMENTS

Expressions and Assignment statements - Organizing straight-line code - Using conditionals - Controlling loops - Unusual control structures - General control issues.

UNIT IV **9 Hours**

SUBPROGRAMS

Fundamentals of Subprograms - Design issues - Parameter passing methods - Overloaded subprograms - Generic subprograms - Implementing subprograms.

UNIT V **8 Hours**

DEBUGGING AND ERROR HANDLING

Debugging - Debugging Strategies - Debugging Tools - Error Messages - Documentation - Test cases - Debugging with print statements - Debugging with comments and questions - Exception handling and Event handling

EXPERIMENT 1 **6 Hours**

Online shopping cart: Develop an application to implement online shopping cart and generate bill for the purchased products.

EXPERIMENT 2 **3 Hours**

Pocket Bazaar: Develop an application to manage an inventory of products for grocery stores

EXPERIMENT 3 **3 Hours**

Vacation Destination Decision Maker: Create an application program that helps a user decide on their next vacation destination based on their preferences.

EXPERIMENT 4 **3 Hours**

Temperature monitor: Develop an application for temperature monitoring system and provide an alert message.

EXPERIMENT 5 **3 Hours**

Develop an access control system that simulates the granting access to authorized personnel based on their credentials, such as ID cards and PIN codes.

EXPERIMENT 6 **6 Hours**

Math Quiz Generator: Design a math quiz generator that generates questions of various difficulty levels and arithmetic operations.

EXPERIMENT 7 **6 Hours**

Build a maze solver application that finds a path from the entrance to the exit of a maze

Total:45+30 = 75 Hours

Reference(s)

1 Code Complete, Steve McConnell, Microsoft Press, 2004.
2 Concepts of Programming Languages Robert. W. Sebesta 10/E, Pearson Education.
3 Programming Language Design Concepts, D. A. Watt, Wiley Dreamtech, 2007.
4 Programming Languages, 2nd Edition, A.B. Tucker, R. E. Noonan, TMH.
5 Programming Languages, K. C. Louden, 2nd Edition, Thomson, 2003

22IT305 SOFTWARE ENGINEERING 3 0 0 3

Course Objectives

- Understand the systematic approach related to the design, development and maintenance of a software system
- Analyze the limitations of manual testing process and provide a succinct summary of those limitations with the help of automated testing tools.
- Understand the Enterprise Architecture (EA) framework that provides the building blocks for successful digital business transformation.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverseteams, and in multidisciplinary settings.

PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the software development methodologies to various real life scenarios.
2. Apply modern tools and techniques to develop scalable, maintainable, and reliable software systems.
3. Analyze the coding strategies and techniques to write well-structured, efficient, and error-free code.
4. Apply specific modern testing tools to ensure the quality and reliability of software products.
5. Analyze the elements, structure, and positioning of an Enterprise Architecture framework used for successful digital business transformation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	1	
2	3	3	2	2	3		2		2			2		2
3	2	2	2				2		2			2	1	
4	2	2	2		3		2		2			2		2
5	2	2	2						2				1	

UNIT I **9 Hours**

SOFTWARE DEVELOPMENT PROCESS

Phases in Software Development - Traditional Software Development Models - Agile Methodologies - Agile Scaling Frameworks - Lean Software Development - Software Requirements Specification (SRS) - Project Scheduling and Estimation.

UNIT II **10 Hours**

TOOLS AND TECHNIQUES FOR SOFTWARE DEVELOPMENT

DevOps - Version control with Git - Containerization Using Docker and Kubernetes- Application Performance Monitoring (APM) - Continuous Integration Continuous deployment (CICD) - Clean Room build.

UNIT III **9 Hours**

CODE QUALITY

Software Metaphors - Upstream Prerequisites - Key Construction Decisions - Defensive Programming - Code Tuning Strategies and Techniques.

UNIT IV **9 Hours**

TESTING

Writing good test cases - Test driven development - Test Automation - Testing using Selenium tool - Continuous Testing - Exploratory Testing - Testing in Agile and DevOps Environments.

UNIT V **8 Hours**

ENTERPRISE ARCHITECTURE AND MODELING

Enterprise Architecture (EA) in Digital Transformation - Agility in Digital Business - Measuring EA: Metrics, KPIs and Risks.

Total: 45 Hours

Reference(s)

1. Roger S.Pressman, Software Engineering: A Practitioners Approach, McGraw Hill International edition, Seventh edition, 2020.
2. Steve Mc Connell, Code Complete - A practical handbook of software construction, Second Edition, 2004.
3. Tushar K Hazra, Bhuvan Unhelker, Enterprise Architecture for Digital Business -Integrated Transformation Strategies- Integrated Transformation strategies, First edition, 2021.
4. Gene Kim, Kevin Behr, and George Spafford, The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win, IT Revolution Press, 2018.

22HS004 HUMAN VALUES AND ETHICS 2 0 0 2

Course Objectives

- Understand the concept of good values and comprehend the importance of value-based living.
- Recognize the culture of peace through education.
- Identify and apply the practices for value development and clarification.

Programme Outcomes (POs)

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the importance of human values and ethics in life.
2. Execute the importance of harmonious living in a diverse society.
3. Analyze the sensitivity to the crying needs of society such as ungodliness, corruption, poverty, and suffering, and play a vital role in eradicating them.
4. Plan intellectually mature, morally upright, ethically correct, and spiritually inspired decisions.
5. Execute a correct balance between professional excellence and social commitment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1								3	2	1			2	
2								3	2	1			2	
3								3	2	1			2	
4								3	2	1			2	
5								3	2	1			2	

UNIT I **6 Hours**

COURSE INTRODUCTION - NEED, BASIC GUIDELINES AND ANALYSIS

Importance of Human Values & Ethics in 21st Century - Understanding the theory of basic human values and ethics - Openness to change - Self enhancement - Conservation - Self transcendence - Schwartz Value Survey: Self-Assessment

UNIT II **6 Hours**

EMBRACING THE COMMON ETIQUETTE

Altruism- Integrity - Freedom - Justice - Honesty - Truthfulness - Responsibility - Compassion

UNIT III **6 Hours**

CONTINUOUS HAPPINESS AND PROSPERITY

An overview on basic Human Aspirations - Understanding and living in harmony at various levels of life - Embracing self-love and wellness - Understanding harmony in the family and society

UNIT IV **6 Hours**

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

Reflection on growing global multifold problems: poverty, pollution, hunger, disease, unemployment, caste system, child labour, gender equality, politics and violence. Understanding the challenges in cultural, personal, social, political, and economic environment

UNIT V **6 Hours**

UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS CO-EXISTENCE

Understanding the harmony in Nature - Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions

Total: 30 Hours

Reference(s)

1 Martin, G. The Little Book of Ethics: A Human Values Approach. Australia: G.P. Martin. 2011.

2 Gupta, N. L. Human Values for The 21St Century. India: Anmol Publications Pvt. Limited. 2002.

3 Mishra, A. Happiness Is All We Want. India: Bloomsbury Publishing.2017.

4 Universal Human Values. (n.p.): Booksclinic Publishing. 2023.

5 A Textbook on Professional Ethics and Human Values. India: New Age International (P) Limited.2007.

22HS005 SOFT SKILLS AND EFFECTIVE COMMUNICATION 0 0 2 1

Course Objectives

- Communicate in formal discussions at the workplace efficaciously and proficiently.
- Describe experiences and events, and briefly give reasons and explanations for opinions andplans.
- Convey agreement and disagreement in a polite but firm manner in both written and spoken formats.

Programme Outcomes (POs)

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1 Enhance confidence in expressing thoughts in grammatically proper language and etiquette inwaiting for the opportunity to provide input.

2 Effectively communicate in English on formal occasions and proficiency in the use of linkwords and other discourse markers

3 Provide constructive feedback and file logical complaints.

4 Analyse the understanding of oral and written communication in real-world situations.

5 Apply the improved spelling and punctuation in writing and heightened understanding of tone,pitch and stress in oral formats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT I **10 Hours**

SELF-EXPRESSION

Group discussion/ Peer discussion - Communicating decisions and opinions - Tone, Pitch, Stress - Agreeing, Disagreeing, Suggesting, Speculating - Comparing and Contrasting - Comparatives and Superlatives - Discourse markers – Interjections - Decision making - Synthesis - Higher order thinking Group discussion/Peer discussion - Effective Communication Types of communication - Written vs Spoken - Contractions Intonation Stress Active voice - Question tags - Confidence and body language Guided writing- Outlining Main Points - Group discussion/Peer discussion - Avoiding common errors Reduction of MTI - Common errors - Barriers to communication Accent

UNIT II **10 Hours**

CREATIVE EXPRESSION

JAM, Debate, Review writing, Social media posts Synonyms - Antonyms Cloze test Phrasal verbs Spotting errors Collocation - Commonly mispronounced

UNIT III **10 Hours**

FORMAL EXPRESSION

Writing: Giving written feedback, Review writing, and Letter of complaint. Speaking: Giving constructive feedback and offering suggestions, asking for inputs, commenting politely on appropriate phrases - Giving written feedback, Review writing, and Letter of complaint. Critical reasoning - Modal verbs - Polite ways to express negatives

Total: 30 Hours

Reference(s)

1 Word Power Made Easy by Norman Lewis, W. R. Goyal Pub. & Distributors, 2009.

2 Sasikumar, V, et al., A Course in Listening & Speaking Foundation Books, 2005.

3 Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.

4 Prasad, Hari Mohan. A Handbook of Spotting Errors, Mcgraw Hill Education, 2010.

5 Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012

6 Business English by Ken Taylor, Orient Blackswan, 2011

22IT401 DISCRETE MATHEMATICS 3 1 0 4

Course Objectives

- Implement the definitions of relevant vocabulary from graph theory and combinatorics and be able to perform related calculations.
- Understand and use the terms Cardinality, finite, countably infinite and uncountably infinite, and determine which of these characteristics is associated with a given set.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand and apply the concepts of Boolean algebra and characteristics in computers.
2. Apply formalized arguments to classify and assess real-world arguments.
3. Represent the characteristics of predicate logic in computer engineering.
4. Apply different properties of injection, surjection, bijection, composition and inverse functions in software engineering.
5. Interpret the concepts of Permutations, Combinations and Mathematical induction in the phenomena of real world.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1											1	
3	1	2												
4	2	2												
5	1	2												2

UNIT I **9 Hours**

BOOLEAN ALGEBRA

Introduction of Boolean algebra - Truth table - Basic logic gate - Basic postulates of Boolean algebra - Principle of duality- Canonical form - Karnaugh map.

UNIT II **9 Hours**

PROPOSITIONAL CALCULUS

Propositions- Logical connectives-Compound propositions-Conditional and biconditional propositions-Truth tables - Tautologies and Contradictions - Logical and equivalences and implications-DeMorgans Laws-Normal forms-Principal conjunctive and disjunctive normal forms - Rules of inference- Arguments-Validity of arguments.

UNIT III **9 Hours**

PREDICATE CALCULUS

Predicates-Statement Function - Variables-free and bound variables- Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements- Theory of inference- The rules of universal specification and generalization-Validity of arguments.

UNIT IV **9 Hours**

SET THEORY AND FUNCTIONS

Set Operations-properties-Power set-Relations-Graph and matrix of a relation- Partial Ordering-Equivalence relations-Partitions- Functions -Types of Functions- composition of relation and functions-inverse functions.

UNIT V **9 Hours**

COMBINATORICS

Basics of Counting - Counting arguments- Pigeonhole Principle- Permutations and Combinations-Recursion and recurrence relations-Generating Functions- Mathematical Induction- Inclusion - Exclusion

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Trembly J P and Manohar R, Discrete Mathematical Structures with Applications to computer Science, Tata McGraw Hill Publications Co. Ltd., New Delhi 30th Re-print 2007.
2. Alan Doerr and Kenneth Levasseur, Applied Discrete Structures for Computer Science, Galgotia Publications Pvt. Ltd. Delhi. 2010.
3. Ralph P Girmaldi and Ramana B.V. Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education Asia, Delhi, 2007.
4. Kolman Busby Ross, Discrete Mathematical Structures , Prentice-Hall India, New Delhi, Fifth Edition, 2007.
5. Rosen K.H Discrete Mathematics and its Applications, Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.

22IT402 DATA STRUCTURES II 3 0 2 4

Course Objectives

- Understand and use the various major modern data structures like Trie, Rope, Segment tree and Octree.
- Apply the graph data structure and tree traversal algorithms for solving real time problems.
- Analyze the performance of algorithm design techniques with different data structures.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement the Trie data structure and its basic search operations.
2. Outline the traversal algorithm and its types with graph data structure.
3. Implement Minimum Spanning tree algorithms and analyze their performance.
4. Design and implement different problems using the backtracking and branch and bound techniques and analyze the time complexities of them.
5. Implement modern data structures like Segment tree, Quadtree and Octree for real world applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	2
2	2	2	2	2	2						2	2	2	2
3	2	3	3	2	2						2	2	2	2
4	3	3	3	3	2						3	3	2	2
5	3	2	3	3	3						3	3	2	2

UNIT I **9 Hours**

TRIE DATA STRUCTURES

Trie Structure-Types-Prefix-Based Search-Space Efficiency-Time Complexity-Compact Tries- Applications-Suffix Array and Suffix Tree-Rope.

UNIT II **9 Hours**

GRAPH

Graph representation-Breadth-first traversal-Depth-first traversal-Shortest Path Algorithms: Unweighted Shortest Paths-Dijkstras Algorithm-Travelling Salesman Problem-Analysis of shortest path algorithms.

UNIT III **9 Hours**

GRAPH MST

Minimum Spanning Tree: Prims Algorithm-Kruskals Algorithm-Disjoint-Set Union (Union-Find)-A* algorithm-Flood filling algorithm-Analysis of MST algorithms.

UNIT IV **9 Hours**

ALGORITHM DESIGN TECHNIQUES

NP Complete problems- Backtracking: N-Queens Problem and Subset-Sum problem - Branch and bound: Knapsack problem-Approximation algorithms for NP hard problems: Traveling salesman-P, NP, NP-Complete and NP-Hard Problems.

UNIT V **9 Hours**

MODERN DATA STRUCTURES

Segment Tree-Interval Tree-Fenwick Tree-K-D Tree-Quadtree and Octree-Circular Buffer (Ring Buffer)-Marshaling/Unmarshalling-JSON-benefits-Schema-limitations-Protobuf.

EXPERIMENT 1 **4 Hours**

Implement a trie data structure to efficiently support autocomplete suggestions based on user input in google docs.

EXPERIMENT 2 **4 Hours**

Implement an Algorithm to find the shortest route and travel time between two locations within a city's transportation network.

EXPERIMENT 3 **10 Hours**

Design a cost-efficient telecommunication network to connect multiple cities using Kruskal's algorithm.

EXPERIMENT 4 **4 Hours**

Implement a chess game application using backtracking.

EXPERIMENT 5 **4 Hours**

Implementing Segment Tree for Range Sum Query in a Real-time Data Analytics Platform for student management system.

EXPERIMENT 6 **4 Hours**

Implement a geographic information system (GIS) for locating a city as node using quadtree

Total:45 + 30= 75 Hours

Reference(s)

1. Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley publications,2013.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C,2nd Edition,Pearson Education,2016.
3. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures-A Pseudocode Approach with C, Thomson 2011.
4. Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.
5. Reema Thareja, Data Structures Using C, Second Edition , Oxford University Press, 2011

3 1 0 4

22IT403 OPERATING SYSTEMS

Course Objectives

- Establish a solid foundation in the introductory concepts of operating systems and gain insights into the structures, services, and roles of operating systems in computing environments.
- To apply process scheduling algorithms in a multi-programming environment and implement the various deadlock strategies effectively to prevent each other from accessing the computer resources
- To gain knowledge on the operations of memory management and File management.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the basic structure and architectural components of the operating system and interpret how application programs interact with the operating system through APIs.
2. Apply the various scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. Analyze memory allocation and deallocation mechanisms involved in memory management for a specific system.
4. Apply the various file handling strategies to manage files on a secondary storage structure and in a distributed environment.
5. Analyze the virtualization technologies and their types to simulate hardware functionality and create a virtual computer system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	2	
2	3	3	2	2	3		2		2			2	2	
3	2	2	2				2		2			2	2	
4	2	2	2		3		2		2			2	2	
5	2	2	2						2				2	

UNIT I **8 Hours**

INTRODUCTION TO OPERATING SYSTEMS

Basic Operating System Concepts-Operating System Structure and Components-Operating System Services and Interfaces-Role of the Kernel and User Space-System calls and System Programs-Open Source and Closed source operating systems.

UNIT II **12 Hours**

PROCESS MANAGEMENT

Processes and Threads-Process Scheduling and CPU Scheduling Algorithms-Process Synchronization and Concurrency Control-Deadlocks and Handling Strategies-Inter-Process Communication (IPC)- Multi-Core and Multi-Processor Management

UNIT III **9 Hours**

MEMORY MANAGEMENT

Memory Hierarchy-Address Spaces and Memory Allocation-Paging and Segmentation-Page Replacement Algorithms-NUMA (Non-Uniform Memory Access)-Memory Compression-Memory Tiering.

UNIT IV **8 Hours**

FILE SYSTEM DESIGN AND AND IMPROVEMENTS

File System Structures-Storage Technologies-SSD and Flash Storage Optimization-Copy-on-Write (CoW) File Systems-File System Journaling-Distributed File Systems and Cloud Storage-File System Monitoring and Analytics

UNIT V **8 Hours**

VIRTUALIZATION AND RECENT DEVELOPMENTS

Virtualization Principles and Types (Hardware, Software, Network, Storage)-Hypervisors and Virtual Machine Monitors-Microkernels and Exokernels-Security and Integrity in Virtualized Environments-Security in Operating Systems-Operating Systems for Quantum Computers-Cross-Platform Compatibility.

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2. Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. Ltd, 2014
3. William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4. Harvey M. DeitelM, Operating Systems, Pearson Education Pvt. Ltd, 2007.
5. Distributed file system for cloud: A Clear and Concise Reference Kindle Edition by Gerardus Blokdyk
6. https://www.redhat.com/en/topics/virtualization

22IT404 WEB TECHNOLOGY AND FRAMEWORKS 2 0 2 3

Course Objectives

- Understand the Web Application Architectures and trace the evolution of the web and introduce concepts like Web 3.0 and Decentralized Web.
- Familiar with the different Web development Frameworks and Full stack development.
- Explore the emerging web technologies and implement best practices for making web applications accessible to all users

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the architecture of various web applications and develop simple use cases for the real time web applications
2. Implement web applications using client-side scripting language and server-side scripting languages.
3. Integrate the web applications with databases using Web frameworks.
4. Develop a complete, functional web application that incorporates both front-end and back-end components.
5. Implement the emerging web technologies in web application development projects.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	2
2	2	2	2	2	2						2	2	2	2
3	2	3	3	2	2						2	2	2	2
4	3	3	3	3	2						3	3	2	2
5	3	2	3	3	3						3	3	2	2

UNIT I **5 Hours**

INTRODUCTION TO WEB APPLICATION

Evolution of the web-Understanding Web Application Architectures:Server Side Rendered Applications-Single Page Application SPA-Mobile Application Development-Comparison of Monolithic and Microservice architectures-Serverless computing-HTTP Protocol and Methods-Web Browsers and Rendering Engines-Use cases of various web applications, including Flipkart, BIT Discourse, BIP, Wiki and Moodle.

UNIT II **7 Hours**

SCRIPTING LANGUAGES

Client-side Scripting vs Server-Side Scripting-Client-side Scripting: Execution Location-Languages: JavaScript Fundamentals-Document Object Model DOM. Server-Side Scripting: Execution Location-Languages-PHP Programming fundamentals

UNIT III **6 Hours**

WEB DEVELOPMENT FRAMEWORKS

Introduction to Web Development Frameworks -MVC Architecture - Building APIs with a Framework - RESTful APIs and API Design - Building a RESTful API - Database Integration with ORM/ODM - Building a Basic Front-End Application.

UNIT IV **6 Hours**

FULL STACK DEVELOPMENT

Full-Stack Development - Combining Front-End and Back-End Technologies - Building a Full-Stack Web Application- 12 factor application model - Deployment and Hosting Options - Continuous Integration and Continuous Deployment CI/CD - Performance Optimization and Scalability.

UNIT V **6 Hours**

EMERGING WEB TECHNOLOGIES

Emerging Web Technologies-Progressive Web Apps PWAs-WebAssembly and WebRTC-Web Security Best Practices-Open Web Application Security Project OWASP-Web Accessibility and Inclusive Design-Web Performance Optimization.

EXPERIMENT 1 **6 Hours**

Create a Multipage Website that serves as a personal portfolio using the browser's developer tools and CSS to enhance the web page.

EXPERIMENT 2 **3 Hours**

Implement an animated web application for Rock, Paper, Scissors game to handle input validation ensuring that the user's choice is one of Rock, Paper, or Scissors.

EXPERIMENT 3 **3 Hours**

Create a simple inventory management system to generate QR code for each product thereby allowing user validation using PHP.

EXPERIMENT 4 **3 Hours**

Develop a secure online banking system using a server-side framework like Flask, Django, or Ruby to avoid risk to financial systems.

EXPERIMENT 5 **7 Hours**

Develop a Full Stack Web Application for task management system in a Corporate Environment for tracking project progress and streamlining work assignments.

EXPERIMENT 6 **4 Hours**

Create a RESTful API for an online store used to manage different products using Node.js or Express.

EXPERIMENT 7 **4 Hours**

Develop a real-time chat application with a continuous integration and continuous deployment (CI/CD) pipeline and set up monitoring to ensure optimal performance.

Total: 30 + 30= 60 Hours

Reference(s)

1. P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education,2009.
2. James Gillies and Robert Cailliau, How the Web Was Born: The Story of the World Wide Web, 2000
3. D Crockford , The Good Parts, O Reilly , 2009
4. Mark Masse , REST API Design Book,O Reilly,2011
5. Matti Luukkainen and Jarkko Moilanen , Fullstack Open: Deep Dive Into Modern Web Development
6. Michal Zalewski , The Tangled Web: A Guide to Securing Modern Web Applications 2011

3 0 2 4

22IT405 DATABASE MANAGEMENT SYSTEM

Course Objectives

- Analyze the data models, conceptualize and Design a database system using E-R diagrams.
- Gain knowledge on the design principles of relational and modern database systems like SQL, NoSQL and NewSQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the data models and the types of data used in databases.
2. Implement SQL queries for creating databases and performing the relational operations.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes.
5. Analyze the performance of NoSQL and NewSQL databases related to design.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	2
2	2	2	2	2	2						2	2	2	2
3	2	3	3	2	2						2	2	2	2
4	3	3	3	3	2						3	3	2	2
5	3	2	2	3	3						3	3	2	2

UNIT I **8 Hours**

INTRODUCTION TO DATABASES AND DBMS

Understanding Data and Information - Database vs DBMS - Modern Databases - DBMS Architecture and Components - Data Models - Relational Model - Codd"s 12 Rules - Object-Relational Mapping (ORM).

UNIT II **10 Hours**

STRUCTURED QUERY LANGUAGE (SQL)

SQL Basic Commands - Constraints - Database Objects - SQL Functions - Subqueries- Correlated Subqueries- Nested subqueries - Recursive queries - Common Table Expressions (CTEs) - Triggers and Stored procedures.

UNIT III **9 Hours**

DATABASE DESIGN AND NORMALIZATION

Database Design fundamentals - Entity-Relationship Diagrams (ERD) - ERD to tables - Functional Dependencies and Normal Forms: 1NF, 2 NF, 3 NF, BCNF, 4 NF, 5NF and 6 NF - Domain-Key Normal Form (DKNF) - Nested Normal Form (NNF) - Denormalization and Trade-offs - Emerging trends in Database Design - Dealing with real-world complexities in Database Design- CASE Tools for Database Design.

UNIT IV **9 Hours**

QUERY OPTIMIZATION AND TRANSACTION MANAGEMENT

Query Optimization and Execution Plans -Optimization Visualization Tool - DB Sharding - Vitess - Vitess vs MySQL- Table partitioning - Transaction Management and ACID Properties - Concurrency Control: Lock based protocols -Deadlock handling - Multi version concurrency control (MVCC) - Transaction isolation.

UNIT V **9 Hours**

NOSQL AND NEWSQL DATABASES

NoSQL Vs NewSQL- NoSQLDatabases: MongoDB and Cassandra - NewSQL databases: Redis and NuoDB -Selection of NoSQL or NewSQL over RDBMS - CAP Theorem and BASE Properties - HeidiSQL - In-Memory Databases and Caching - Database Security and Encryption - Database Performance Tuning

EXPERIMENT 1 **4 Hours**

Create a relational database with tables for storing employee details and perform CRUD operations.

EXPERIMENT 2 **6 Hours**

Create a relational database for e-commerce applications and add primary key, foreign key, check constraints and triggers.

EXPERIMENT 3 **6 Hours**

Create an ER diagram for the library management system and implement the database schema in RDBMS.

EXPERIMENT 4 **3 Hours**

Create a MongoDB database for an event management system.

EXPERIMENT 5 **4 Hours**

Design a distributed database for an e-commerce platform to handle order processing.

EXPERIMENT 6 **4 Hours**

Develop an in-memory caching solution using Redis for a content publishing platform (Blog).

EXPERIMENT 7 **3 Hours**

Develop a secure RDBMS solution for a banking financial transactions system.

Total: 45+30=75 Hours

Reference(s)

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, McGraw - Hill, Sixth Edition, 2018
2. Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems, Pearson Education, Seventh Edition, 2016
3. Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management, Thompson Learning Course Technology, Ninth edition, 2011
4. Guy Harrison, Next Generation Databases: NoSQLand Big Data, Apress.

22HS007 ENVIRONMENTAL SCIENCE **2 0 0 0**

Course Objectives

- Understand the interdisciplinary and holistic nature of the environment
- Identify the significance of natural resources and environment on the quality of life and stimulate the quest for sustainable development
- Assess the socio-economic, political and ethical issues in environmental science

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Examine the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources
2. Analyze the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation
3. Identify the existing environmental challenges related to pollution and its management
4. Select suitable strategies for sustainable management of components of environmental science
5. Correlate the impacts of population and human activities on environment

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1											1	
3	2	2					1							
4	1													
5	2													

UNIT I **6 Hours**

NATURAL RESOURCES

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer - pesticide problems (eutrophication, blue baby syndrome, biomagnification). Energy resources - renewable (solar, wind, and hydro).

UNIT II **6 Hours**

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features: desert ecosystem. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III **6 Hours**

ENVIRONMENTAL POLLUTION

Pollution: Definition - causes - effects - control measures of air pollution - Water pollution - Sewage water treatment by activated sludge and trickling filter process - Noise pollution - Thermal pollution. Disaster management - causes - effects - control measures of floods - Earthquake

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development - Definition - Unsustainable to sustainable development - solid waste management - causes - effects - 5R Principles - landfills, incineration, composting. Water conservation - rain water harvesting - watershed management. Climate change - Global warming - acid rain - Ozone layer depletion. E-waste

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

Human population: Population growth - characteristics - variation among nations - population explosion - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

Total: 30 Hours

Reference(s)

1. Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, 4th Edition, New Age International Publishers, New Delhi, 2014.
2. T.G.Jr. Miller and S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi, 2014.
3. A. K. De, Environmental Chemistry, 7th Edition, New age international publishers, New Delhi, 2014.
4. Raven, P.H , Hassenzahl, D.M. and Berg, L.R., Environment, 8th edition. John Wiley & Sons, 2012.
5. Pepper I.L, Gerba C.P. and Brusseau M.L, Environmental and Pollution Science. Academic Press, 2011.

22HS008 ADVANCED ENGLISH AND TECHNICAL EXPRESSION 0 0 2 1

Course Objectives

- To enable students to achieve proficiency in academic writing
- Effectively use and appreciate the nuances of the language and engage an audience
- Use advanced tools of language to improve communicative competence and prepare for professional demands at the workplace

Programme Outcomes (POs)

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1 Understand the clarity in articulating the objectives and aims and improved proficiency in usingthe English language

2 Communicate effectively and with good interpersonal skills; speak in public, engage the audience, and lead a group discussion

3 Critically evaluate the ethics of persuasive appeals and confidence to influence opinion

4 Analyse a specific piece of information; take in what is read, and use good writing techniqueswith proper grammar and syntax in all formal situations

5 Create awareness and empathy to emotional signals in communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT I **15 Hours**

CREATIVE EXPRESSION

Proposals & Grant applications, Argumentative essays & editorials, Sales Pitches, Campaigning, Commercials/advertisements, effectively answering the famous interview question: 'Why should we hire you?' Sentence and paragraph formation - Rhetorical questions - Emphasis & effective repetition - Empathetic expression, knowing the audience, capturing attention - Creating Memes, Comic Strips, Stand-up comedy, Caption writing, and Limericks, Vocabulary and slang words for comedy - Similes & Metaphors - Homophones, homonyms, alliteration, wordplay

UNIT II **15 Hours**

FORMAL EXPRESSION

Writing: Action plans, Cover letters, Mind-Mapping, Paragraph writing Logical reasoning - SVA - Advanced level - Style: Clarity, Concision, Coherence, Evocativeness, Efficacious Vocabulary - Conditional Clause - Be verbs- Tenses- advanced - Opening and closing sentences - Action plans, Anecdotal references, order of communication/ narration, complete communication- Wh-questions - Effective beginning and closing - Rhetorical questions - Appraising target audience - Pronunciation, Enunciation, Tone, Pace and Volume. - Writing: SOPs, Research Objectives, Thesis Statement, Indexing, Scholarly Articles, Academic Writing, Executive Summary, Survey Questionnaires, Citations and Bibliography - Reading: Quantitative & qualitative analysis, Analysis and paraphrasing of reference materials Speaking: Commentate live events, give instructions to operate machines/ conduct experiments Listening: Informational listening, Reflective listening, - Discriminative listening - Connective words - Prefixes and Suffixes - Quoting and paraphrasing Proofreading - Directed writing and writing formats - Note taking - Active verbs

Total: 30 Hours

Reference(s)

1 Sangeeta Sharma et.al. Communication Skills for Engineers and Scientists, PHI Learning Pvt.Ltd, 2011

2 Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.

3 Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, TataMcGraw Hill & Co. Ltd., 2001

4 Personality Development, Harold R. Wallace &L. Ann Masters, Cengage Learning, New Delhi

5 Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd.1990, Delhi

6 English Grammar, Composition and Usage by N.K. Agrawal&F.T. Wood, Macmillan India Ltd.,New Delhi

22IT501 PRINCIPLES OF COMMUNICATION **3 0 0 3**

Course Objectives

- Understand the basic concepts of communication and its types
- Convert analog signals to digital format and describe Pulse and digital Modulation techniques
- Gain knowledge on various mobile communication technologies and their performances

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PSO 2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the performance of AM, FM and PM systems
2. Analyze and design various pulse modulation schemes for the transmission of analog message signal
3. Analyze the performance of various digital modulation techniques
4. Compare and analyze different multiple access techniques used for wireless communication systems
5. Design the spread spectrum modulation schemes for secured communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												1
2	1	2												1
3	1	2												2
4		2	1											2
5		2	2											1

UNIT I **9 Hours**

ANALOG COMMUNICATION

Elements of Communication systems - Communication channels, Need for modulation, Baseband and Pass band signals, Amplitude Modulation: Double sideband with Carrier (DSB-C), Double side band without Carrier DSB-SC, Single Side Band Modulation SSB, Modulators and Demodulators, Vestigial Side Band (VSB), Quadrature Amplitude Modulator, Radio Transmitter and Receiver-Basic principles of Frequency Modulation and Phase Modulation - Frequency Translation – Super-heterodyne Receiver - Envelope Detector - FM Receiver.

UNIT II **9 Hours**

PULSE MODULATION

Sampling process - Pulse Amplitude modulation - Pulse width modulation - Pulse position modulation - Bandwidth Noise trade off - Quantization process - Pulse Code Modulation - Noise considerations in PCM systems - Time Division Multiplexing.

UNIT III **9 Hours**

DIGITAL MODULATION

Introduction to pass band data transmission - Pass band transmission model - Coherent binary modulation techniques: BPSK, QPSK - Coherent Quadrature modulation techniques: QAM - Non-coherent binary modulation: BFSK, DPSK - performance of digital modulation systems based on probability of error, band width.

UNIT IV **9 Hours**

MOBILE COMMUNICATION TECHNOLOGIES

Wireless transmission - Signal propagation - Medium access control: Motivation for a specialized MAC - TDMA - FDMA - CDMA - GSM: System architecture - Radio interface - Protocols - Localization and calling - Handover – Security-HSCSD-UMTS-LTE-3GPP (5G).

UNIT V **9 Hours**

SPREAD SPECTRUM MODULATION

Pseudo noise Sequences - A Notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Frequency hopping spread spectrum: Slow Frequency hopping, Fast Frequency hopping - RAKE receiver for wireless communication using CDMA

Total: 45 Hours

Reference(s)

1. Simon Haykin, Communication systems, 5th Edition, John Wiley and Sons, 2018.
2. Introduction to mobile network engineering : GSM, 3G-WCDMA, LTE and teh road to 5G,4th Edition,2018.
3. John Proakis, Massoud Salehi, Digital Communication, 5th Edition, McGraw-Hill, 2014.
4. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson, 2014.
5. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley, 2018.
6. A B Carlson and Paul Crilly, Communication Systems, 5th Edition, McGraw-Hill, 2017.

22IT502 COMPUTER NETWORKS **3 0 2 4**

Course Objectives

- Understand the division of network functionality into layers and to familiarize the functions and protocols of each layer of TCP/IP protocol suite.
- Understand the components required to build different types of network and to learn concepts related to network addressing.
- Understand the flow of information from one node to another node in the network and to learn the application layer utilities.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare OSI model with TCP/IP protocol suite and design a network based on four different topologies.
2. Design and analyze error and flow control algorithms for communication between adjacent nodes in a network.
3. Apply the suitable routing algorithms for the given network.
4. Develop a client/server application using TCP/UDP and design algorithms for end-end communication.
5. Analyze the capabilities of application layer utilities and replicate the same for new applications.

Articulation matrix:

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	3	1	3											2
2	1	2	3	1	1									2
3	3	2	2											2
4	1	3	2											2
5	3	2												2

UNIT I **9 Hours**

DATA COMMUNICATIONS

Introduction: Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, OSI Model - Physical Layer: Introduction to Physical Layer - Transmission Media: Guided Media, Unguided Media.

UNIT II **9 Hours**

DATA LINK LAYER

Introduction to Data Link Layer: Link Layer Addressing - Error Detection and Correction: Block Coding, Cyclic Codes, Checksum, Forward Error Correction - Data Link Control: DLC services, Data-Link Layer Protocols, HDLC, Point-to-Point Protocol - Media Access Control: Random Access and Controlled Access

UNIT III **9 Hours**

NETWORK LAYER

Network Layer Services - Packet Switching - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMPv4 - Routing Algorithms- Unicast Routing Protocols - Next Generation IP: IPv6 Addressing, IPv6 Protocol.

UNIT IV **9 Hours**

TRANSPORT LAYER

Introduction to Transport Layer: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol, Selective Repeat Protocol, Bidirectional Protocols: Piggybacking - User Datagram Protocol - Transmission Control Protocol - Congestion Control.

UNIT V **9 Hours**

APPLICATION LAYER

Client Server Programming - WWW - HTTP - FTP - DNS – SNMP - DHCP.

EXPERIMENT 1 **5 Hours**

Design a Local area network for organization of 5 laboratories with interdepartmental connectivity and show the simulated output.

EXPERIMENT 2 **5 Hours**

Implement Cyclic Redundancy Check and Checksum algorithms to detect and correct errors while transferring files (.jpeg, .txt, .csv) over unreliable networks.

EXPERIMENT 3 **5 Hours**

Configure routers and switches to manage and optimize network traffic, ensuring reliable internet connectivity and efficient data flow for home or office networks and show the simulated output.

EXPERIMENT 4 **5 Hours**

Configure the network address using Address Resolution Protocol (ARP) to map IP addresses to MAC addresses in a college network, and Reverse ARP (RARP) to obtain their IP addresses from an available server and show the simulated output.

EXPERIMENT 5 **5 Hours**

Implement Distance Vector and Link State Routing algorithms to determine the most efficient path for data transmission across large corporate networks.

EXPERIMENT 6 **5 Hours**

Develop a real-time chat application that uses Transmission Control Protocol (TCP) for reliable, ordered communication and User Datagram Protocol (UDP) for faster, connectionless messaging.

Total: 45+30=75 Hours

REFERENCE(S)

1. Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2017.
2. James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005
3. Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009
4. Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008
5. William Stallings, Data and Computer Communication, Pearson Education, 2007
6. Douglas E.Comer and M.S.Narayanan, Computer Networks and Internets, Pearson Education, 2008

22IT503 INFORMATION CODING TECHNIQUES 3 1 0 4

Course Objectives

- Apply the concept of probability to model information and compress text
- Use the principles of differential coding to compress speech
- Exploit the three types of redundancies to design image compression algorithms
- Understand compression and decompression techniques.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the concept of probability to model information and compress text
2. Apply the principles of differential coding to compress speech
3. Analyze the techniques involved in the design of audio and video compression algorithms
4. Apply compression techniques to compress text and images
5. Design algorithms to ensure error-free communication/information retrieval

Articulation Matrix

CO No	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	2	2											2
2	2		2											2
3		2	2											2
4	1	2	2											1
5		2	2											2

UNIT I **9 Hours**

INFORMATION ENTROPY FUNDAMENTALS

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II **9 Hours**

DATA AND VOICE CODING

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III **9 Hours**

AUDIO AND VIDEO CODING

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

UNIT IV **9 Hours**

COMPRESSION TECHNIQUES

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V **9 Hours**

ERROR CONTROL CODING

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1 Simon Haykin, Communication Systems, John Wiley and Sons, 4th Edition, 2014

2 Fred Halsall, Multimedia Communications, Applications Networks Protocols and Standards, Pearson Education, 2012

3 Mark Nelson, Data Compression Book, BPB Publication, 2010

4 Rafael C.Gonzalez and Richard E.Woods, Digital image processing, PHI, 2013

22IT504 INTERNET OF THINGS 2 0 2 3

Course Objectives

- Learn the IoT enabling technologies and understand the IoT reference architecture with realworld design constraints.
- Learn the working principle of IoT protocols with respect to various layers.
- Learn the programming concepts for microcontrollers and Raspberry Pi.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare the enabling technologies and communication models of internet of things.
2. Analyze the machine-to-machine communication model and IoT reference model for end to endcommunication.
3. Analyze the IoT protocols for various layers and apply for developing real time IoT applications
4. Develop applications using microcontrollers for addressing real world needs.
5. Develop applications for smart cities using Raspberry Pi.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													2
2	2	1	3											2
3	3	2	-											2
4	2	1	-											3
5	1	2	-											3

UNIT I **8 Hours**

INTRODUCTION TO INTERNET OF THINGS

Characteristics of IoT, Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems - Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates - Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.

UNIT II **5 Hours**

M2M AND IOT ARCHITECTURE

Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways, Local and Wide Area Networking, Data management, Everything as a Service, M2M and IoT Analytics, Knowledge Management - IoT Reference Model.

UNIT III **6 Hours**

IOT PROTOCOLS

PHY/MAC Layer: 3GPP MTC, IEEE 802.15 - WirelessHART- Z-Wave, BLE- Zigbee - DASH7 - Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP- DCCP- Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.

UNIT IV **5 Hours**

PROTOTYPING IOT OBJECTS USING MICROCONTROLLER

Introduction - Equivalent Microcontroller Platform - Setting up the Board - Programming for IoT - Reading from Sensors, Communication: Connecting Microcontroller with Mobile devices - Communication through Bluetooth, WiFi, and Ethernet.

UNIT V **6 Hours**

PROTOTYPING IOT OBJECTS USING RASPBERRY PI

Introduction to Raspberry Pi - About the board - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Interfacing external gadgets - Controlling Output, Reading Input from Pins. IoT Physical Servers & Cloud Offerings

EXPERIMENT 1 **5 Hours**

Write a code to measure and transmit the room temperature with date and time to the web server using Wi-Fi module.

EXPERIMENT 2 **5 Hours**

Implement the code for the detection of ethanol and carbon-dioxide in the air using Gas sensors.

EXPERIMENT 3 **4 Hours**

Create an Arduino software in pc to predict the obstacles using infrared sensors and measuring the distance between them.

EXPERIMENT 4 **4 Hours**

Created a simple local web server to display the location details and to find the speed of a moving object using an accelerometer sensor.

EXPERIMENT 5 **6 Hours**

Implement and set up Wi-Fi credentials on the Arduino to connect to the Raspberry Pi gateway for the Smart Home application.

EXPERIMENT 6 **6 Hours**

Create a dashboard to monitor all students details in one common link using of Pub Nub cloud server.

Total: 60 Hours

Reference(s)

1 Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2 Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, ISBN: 978-1-118-47347-4, Willy Publications.
3 Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
4 Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013.
5 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley, 2012.
6 CunoPfister, Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Kindle Edition.

22IT507 MINI PROJECT I 0 0 2 1

Course Objectives

- Identify the problem statement and apply the engineering concepts to find the solution.
- Improve the analyzing capability of the students.
- Increase the exuberance in finding the solution to various problems.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications. PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, and techniques that contribute to obtaining the solution ofthe project.
4. Test and validate through conformance of the developed prototype and analysis of the cost effectiveness.
5. Prepare the report and present oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2			2	2	2			1	1
2	1	2	1	1	2			2	2	2			1	1
3	1	2	1	1	2			2	2	2	2		1	1
4	1	2	1	1	2			2	2	2	2		1	1
5	1	2			2			2	2	2			1	1

22IT601 DATA MINING AND WAREHOUSING 3 0 2 4

Course Objectives

- Gather and analyze large sets of data to gain useful business understanding
- Understand the data mining functionalities, technologies and steps in preprocessing the data
- Learn data mining algorithms, methods and tools

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO12 Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Design data warehouse by applying principles of dimensional modelling and ETL concepts
2. Analyze various data pre-processing techniques for efficient data mining.
3. Apply association rule mining for finding hidden and interesting patterns in data.
4. Apply statistical procedure, machine learning and neural network-based classification algorithms for data prediction
5. Apply clustering algorithms for the application and generalizations for real time problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		3		2								1	
2			2		3	2						1	1	
3	1		3		2								2	
4	1		3		2	2						1	1	
5	1		3		2	2						1	1	

UNIT I **9 Hours**

INTRODUCTION TO DATA WAREHOUSING

Raw data to valuable information-Lifecycle of Data - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Basic elements of data warehousing - Principles of dimensional modeling: Star schema, Snowflake schema and Galaxy schema.

UNIT II **9 Hours**

INTRODUCTION TO DATA MINING

Introduction to Data Mining Systems, Knowledge Discovery Process -Data Objects and attribute types, Statistical description of data, Data Preprocessing- Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT III **9 Hours**

ASSOCIATION RULE MINING

Market Basket Analysis, Frequent Item sets, Closed Itemsets, Association Rules, Frequent Itemset Mining Methods- Apriori algorithm, Generating Association rules from Frequent Itemsets, A Pattern-Growth Approach for mining frequent Itemsets, Mining Frequent Itemsets using the Vertical Data Format.

UNIT IV **9 Hours**

CLASSIFICATION

Classification and Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Lazy learners.

UNIT V **9 Hours**

CLUSTERING

Types of Data in Cluster Analysis, Data similarity and dissimilarity measures, Categorization of Major Clustering Methods -Partitioning Methods-K-means, K-medoids, Hierarchical Methods-Agglomerative vs Divisive - Outlier Analysis and Detection.

EXPERIMENT 1 **4 Hours**

Creation of a Data Warehouse

EXPERIMENT 2 **4 Hours**

Apriori Algorithm for market Basket Analysis

EXPERIMENT 3 **4 Hours**

Frequent Pattern-Growth Algorithm

EXPERIMENT 4 **4 Hours**

Bayesian Classification

EXPERIMENT 5 **4 Hours**

Decision Tree Induction Algorithm

EXPERIMENT 6 **5 Hours**

K-means clustering algorithm

EXPERIMENT 7 **5 Hours**

Hierarchical clustering algorithm

Total: 75 Hours

Reference(s)

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques,Third Edition, Elsevier, 2012.
2. Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2010.
3. Alex Berson, Stephen J Smith, Data warehousing, Data mining, and OLAP, Tata McGraw Hill edition, 2007.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Introduction to Data Mining, Pearson Education, 2007.
5. G. K. Gupta ,Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.

22IT602 PRINCIPLES OF COMPILER DESIGN 3 1 0 4

Course Objectives

- Understand the principles, algorithms, and data structures involved in the design and construction of compilers
- Acquire knowledge in construction of scanners, parsers and in intermediate code generation
- Familiar with the code generation schemes and optimization methods.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the role of each phase of a compiler and the compiler construction tools
2. Construct Finite automata to recognize regular language
3. Construct Parser to recognize Context Free Grammar
4. Generate intermediate code for programming constructs
5. Apply optimization techniques in code generation and analyze the issues in code generation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2										1	
2	2	1	2										1	
3	1		2										2	
4	1		2										1	
5	1		2										2	

UNIT I **8 Hours**

INTRODUCTION TO FORMAL LANGUAGES AND COMPILERS

Formal Language – Elements of Language - Formal Grammar – Chomsky Classification. Compilers: Language Processors – Structure of a Compiler - Grouping of Phases into Passes - Compiler Construction Tools.

UNIT II **9 Hours**

LEXICAL ANALYSIS

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Specification of tokens - Recognition of Tokens. Finite automata - Regular expression to finite automata- Optimization of DFA based Pattern Matches-Lexical Analyzer Generator Lex.

UNIT II **11 Hours**

SYNTAX ANALYSIS

Introduction-Role of the parser - Context-Free Grammars -Writing a Grammar-Top Down parsing - LL(1) Grammars- Non-recursive Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing-LR Parsers: Simple LR Parser - Canonical LR Parser - LALR Parser – Parser Generator YACC.

UNIT IV **8 Hours**

INTERMEDIATE CODE GENERATION

Variants of Syntax Trees- Three-Address Code - Types and Declarations - Translation of Expressions - Control Flow - Switch-Statements - Backpatching

UNIT V **9 Hours**

CODE GENERATION

Issues in the Design of a Code Generator - The Target Language - Basic Blocks and Flow Graphs- Optimization of Basic Blocks - A Simple Code Generator- Principal Sources of Optimization.

Tutorial:15 Hours

Total: 60 Hours

REFERENCES

1. Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman Compilers: Principles, Techniques and Tools, 2nd Edition, Pearson, 2012.
2. Torbengidius Mogensen, “Basics of Compiler Design”, Springer, 2011.
3. Charles N, Ron K Cytron, Richard J LeBlanc Jr., “Crafting a Complier”, Pearson Education, 2010
4. D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, Modern Compiler Design, Wiley, 2008
5. Kennath C. Louden, Compiler Construction Principles and Practice. New Delhi: Vikas publishing House, 2006.
6. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2007.

22IT603 CLOUD COMPUTING 3 0 2 4

Course Objectives

- Provide the ideal solution to manage enterprise resources effectively and efficiently by cloud computing.
- Identify the security and privacy issues in cloud computing.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO12 Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Undersrand the concept of virtualization in Cloud Computing.
2. Deploy applications over different Cloud computing infrastructures.
3. Implement Cloud Dockers to automate the deployment of applications.
4. Analyze the security and privacy issues in cloud computing.
5. Implement the cloud applications to solve real time problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3					1			2	2	
2			1	3	2							2	1	
3			2	1	3							2	2	
4	1		2	1	3				1			2	2	
5	1		3		2				1			2	3	

UNIT 1 **9 Hours**

INTRODUCTION

Introduction to Cloud Computing –Characteristics and Benefits of Cloud Computing- Hardware and software - Evolution of cloud computing - Server virtualization: parallel and vector processing.

UNIT II **9 Hours**

CLOUD SERVICE MODELS

Software as a Service (SaaS) - Infrastructure as a Service (IaaS)- Platform as a Service (PaaS) - Cloud Data Center - Service Oriented Architecture (SoA) – Basic approach to a Data center Based SoA.

UNIT III **9 Hours**

CLOUD DOCKER

Introduction – Docker Architecture –Docker Engine - Docker Containers - Docker Objects – Docker Run - Pipeline – Automation Scripts.

UNIT IV **9 Hours**

CLOUD SECURITY

Securing cloud boundary – Service boundary – Security mapping – Brokered cloud storage access - Storage location and tenancy – Encryption – Establishing the Identity and Presence.

UNIT V **9 Hours**

CLOUD APPLICATIONS AND STORAGE

Applications in the cloud – Functionality mapping – Applications attributes – Cloud APIs-Cloud storage definition – Managed and Unmanaged cloud storage – Exploring cloud backup solutions – Cloud storage interoperability.

EXPERIMENT 1 **4 Hours**

Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows

EXPERIMENT 2 **4 Hours**

Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

EXPERIMENT 3 **4 Hours**

Implement the procedure to transfer the files from one virtual machine to another virtual machine for reliable data access with the help of any open stack virtual machine

EXPERIMENT 4 **4 Hours**

Install the single node private cloud environment to resource allocation

EXPERIMENT 5 **4 Hours**

Implement the procedure to create and deploy a simple web application in public cloud environment

EXPERIMENT 6 **4 Hours**

Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim

EXPERIMENT 7 **3 Hours**

Create and Deploy applications on Microsoft Windows Azure

EXPERIMENT 8 **3 Hours**

Install Hadoop single node cluster and run simple applications like word count.

Total: 75 Hours

Reference(s):

1. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.
2. Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014.
3. Adrian Mouat — Using Docker: Developing and Deploying software with containers,O'Reilly Media,2016.
4. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009., CRC Press, 2017
5. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.

22IT607 MINI PROJECT II 0 0 2 1

Course Objectives

- Identify the problem statement and apply the engineering concepts to find the solution.
- Improve the analyzing capability of the students.
- Increase the exuberance in finding the solution to various problems.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes thatmeet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communicate effectively on complex engineering activities with the engineering community andwith society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learningalgorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, and techniques that contribute to obtaining the solution oftheproject.
4. Test and validate through conformance of the developed prototype and analysis of the costeffectiveness.
5. Prepare the report and present oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2			2	2	2			1	1
2	1	2	1	1	2			2	2	2			1	1
3	1	2	1	1	2			2	2	2	2		1	1
4	1	2	1	1	2			2	2	2	2		1	1
5	1	2			2			2	2	2			1	1

22IT701 CRYPTOGRAPHY AND INFORMATION SECURITY 3 0 0 3

Course Objectives

- Understand information security's importance in our data-driven digital world.
- Acquire the knowledge of key concepts of information security and how they work.
- analyze situations of computer and network usage from a security perspective, identifying the salient issues, technologies, policies, laws, standards, and practices.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Understand the information security concepts.
2 Analyze the standards and practices involved in security policies.
3 Apply the security technologies to segregate the organizations systems from the insecure Internet.
4 Analyze the concepts behind traditional symmetric encryption systems with modern asymmetric encryption systems.
5 Analyze the key laws, policies, standards and practices in the field of information security

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	2								1	
2	2	2	2	3	3								2	
3	2	1	1	2	1					-			2	
4	1	2	2	3	3								2	
5	1	2	2	3	3								3	

UNIT I **9 Hours**

INTRODUCTION TO INFORMATION SECURITY

The History of Information Security-Key Information Security Concepts-The Security Systems Development Life Cycle- Security Professionals and the Organization- Need for Security.

UNIT II **9 Hours**

INFORMATION SECURITY POLICY, STANDARDS AND PRACTICES

Information Security Planning and Governance - Information Security Policy, Standards, and Practices – The Information Security Blueprint -Security Education, Training, and Awareness Program – Continuity Strategies.

UNIT III **9 Hours**

SECURITY TECHNOLOGIES

Introduction-Access Control, Identification, Authentication, Authorization and Accountability-Firewalls Virtual Private Networks (VPNs)- Intrusion Detection and Prevention Systems - Scanning and Analysis Tools- Biometric Access Controls.

UNIT IV **9 Hours**

CRYPTOGRAPHY

Foundations of Cryptology-Cipher Methods-Cryptographic Algorithms-Cryptographic Tools-Protocols for Secure Communications-Attacks on Cryptosystems.

UNIT V **9 Hours**

LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY

Law and Ethics in Information Security - General Computer Crime Laws - International Laws and Legal Bodies - Agreement on Trade-Related Aspects of Intellectual Property Rights - Digital Millennium Copyright Act (DMCA) - Ethics and Information Security-Codes of Ethics and Professional Organizations.

Total: 45 Hours

Reference(s)

1. Michael E Whitman, Herbert J Mattord , Principles of Information Security ,Sixth Edition, Cengage Learning,2017.
2. Mark Stamp, Information Security: Principles and Practices, Wiley, Second edition,2011
3. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India/Pearson Education, New Delhi, 2007.
4. Charles B.fleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson Education, 2014.
5. Dieter Gollmann, Computer Security, John Wiley & Sons Ltd., 2011.
6. SunitBelapure and Nina Godbole, Cyber Security, Wiley, 2011

22IT702 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM 3 0 2 4

Course Objectives

- Impart artificial intelligence principles, techniques and its history
- Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems
- Develop intelligent systems by assembling solutions to concrete computational problems

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1 Understand Artificial Intelligence (AI) methods and their foundations.
2 Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
3 Apply knowledge of reasoning and knowledge representation for solving real world problems
4 Analyze the role of learning algorithms in problem solving
5 Analyze the construction of learning and expert systems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3											1	
2	2	3	3										2	
3	2	3	3										2	
4	2	3	3	3									3	
5	2	2	3	3									3	

UNIT I **9 Hours**

ARTIFICIAL INTELLIGENCE AND ITS ISSUES

Definitions - Importance of AI, Evolution of AI - Applications of AI, Classification of AI systems with respect to environment, Knowledge Inferring systems and Planning, Uncertainty and towards Learning Systems.

UNIT II **9 Hours**

OVERVIEW TO PROBLEM SOLVING AND HEURISTIC APPROACH

Problem solving by Search - Problem space - State space - Performance Measurement - Game playing mini-max algorithm, Alpha-Beta Pruning - Search Algorithms - Breadth-first search - Depth-first search, A* search - The effect of heuristic accuracy on performance - Generating heuristics from relaxed problems - Local Search and Optimization Problem - Hill-climbing search - Constraint Satisfaction Problem - Variations on the CSP formalism.

UNIT III **9 Hours**

KNOWLEDGE REPRESENTATION, UNCERTAINTY AND KNOWLEDGE REASONING

Logical systems Knowledge Based systems - Propositional Logic Constraints - Predicate Logic First Order Logic - Inference in First Order Logic - Ontological Representations and applications -Overview Definition of uncertainty - Bayes Rule Inference - Belief Network - Decision Network.

UNIT IV **9 Hours**

LEARNING SYSTEMS

Knowledge in learning: Explanation based learning - Forms of Learning Types - Supervised, Unsupervised, Learning Decision Trees - Statistical learning methods: Instance based learning - Neural Network - Reinforcement learning: Passive and active communication: Formal grammar - Augmented Grammars - Future of AI.

UNIT V **9 Hours**

EXPERT SYSTEMS AND GAMES

Expert Systems - Stages in the development of an Expert System - Probability based Expert Systems - Expert System Tools - Difficulties in Developing Expert Systems - Applications of Expert Systems - Game theory, classification of games, game playing strategies, prisoner s Dilemma, Game playing techniques.

EXPERIMENT 1 **5 Hours**

Data pre-processing, annotation and creation of datasets using various AI tools

EXPERIMENT 2 **5 Hours**

Implementation of Breadth First and Depth First searching techniques

EXPERIMENT 3 **5 Hours**

Implementation of Hill Climbing algorithm and A* algorithm

EXPERIMENT 4 **5 Hours**

Designing a chat-bot application

EXPERIMENT 5 **5 Hours**

Implementation of Inference system

EXPERIMENT 6 **5 Hours**

Implementation of n-Queens problem where n>=1 to n<=9

Total: 45 + 30 = 75 Hours

Reference(s)

1 Russell, S. and Norvig, P, Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall,2015.
2 Poole, D. and Mackworth, A, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press,2010
3 Ric, E., Knight, K and Shankar, B, Artificial Intelligence, 3rd edition, Tata McGraw Hill,2009
4 Luger, G.F, Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson,2008.
5 Padhy, N.P, Artificial Intelligence and Intelligent Systems, Oxford University Press,2009.
6 David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010

22IT707 PROJECT WORK I 0 0 4 2

Course Objectives

- Work in teams to propose, formulate, and solve a challenging open-ended design problem ofsignificant scope, depth, and breadth.
- Understand and incorporate engineering standards and multiple realistic constraints, withinrealistic design time, budget, and performance objectives.
- Develop a prototype of the proposed design and demonstrate the prototype in accordance withthe specifications.
- Effectively communicate information relating to all aspects of the design process in written,oral, and graphical form.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the costeffectiveness.
5. Prepare report and present the oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	3	1	3	3	3	3	3		2	3	3
2	2	2	3	3	1	3	3	3	3	3		2	3	3
3	2	2	3	3	3	3	3	3	3	3	3	2	3	3
4	2	2	3	3	3	3	3	3	3	3	3	2	3	3
5	2	2			2			3	3	3		2	3	3

22IT001 EXPLORATORY DATA ANALYSIS 2 0 2 3

Course Objectives

- To outline an overview of exploratory data analysis
- To implement data cleaning and preparation techniques
- To perform descriptive statistics and data visualization techniques to present insights from the data
- To apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high-dimensional data

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the fundamentals of exploratory data analysis
2. Implement the data cleaning and preparation techniques
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3								2	3
2	2	2	2	3	3								2	2
3	2	3	2	2	3								3	2
4	2	2	2	2	3								2	2
5	2	2	3	2	1								2	3

UNIT I **6 Hours**

EXPLORATORY DATA ANALYSIS

Overview of Exploratory Data Analysis- importance of EDA - data analysis process: data collection, data cleaning, and data exploration- Introduction to common data types and formats - Introduction to Python - data analysis libraries

UNIT II **6 Hours**

DATA CLEANING AND PREPARATION

Introduction to data quality issues and common data cleaning techniques - Handling missing data and outliers - Data transformation techniques - Feature engineering and variable creation

UNIT III **6 Hours**

DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Descriptive statistics: measures of central tendency, dispersion, and shape - Data visualization principles and best practices - Exploratory data visualization using Matplotlib and Seaborn

UNIT IV **6 Hours**

EXPLORATORY DATA ANALYSIS TECHNIQUES

Univariate analysis: exploring single variables - Bivariate analysis: exploring relationships between variables - Multivariate analysis: analyzing relationships among multiple variables - Exploring time series data.

UNIT V **6 Hours**

DIMENSIONALITY REDUCTION TECHNIQUES

Introduction to dimensionality reduction - Principal Component Analysis (PCA) and its applications - Distributed Stochastic Neighbor Embedding (t-SNE) for visualization

EXPERIMENT 1 **6 Hours**

Apply the data preprocessing methods on the given student test performance dataset and visualize the results.

EXPERIMENT 2 **6 Hours**

Perform univariate analysis to analyze the distribution of each variable in student's exam results dataset and visualize the results

EXPERIMENT 3 **6 Hours**

Visualize the relationship between the features on students' exam results analysis dataset using bivariate analysis

EXPERIMENT 4 **6 Hours**

Visualize the relationship between the features on students' exam results analysis dataset using multivariate analysis.

EXPERIMENT 5 **6 Hours**

Implement the program to reduce the dimensionality of the MNIST dataset and visualize the reduced data using a scatter plot.

Total: 60 Hours

Reference(s)

1. Provost Foster and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking O Reilly Media Inc. 2013. (Unit 1)
2. McKinney Wes Python for Data Analysis O Reilly Media Inc 2022 Unit 1 3 5
3. Knaflic Cole Nussbaumer Storytelling with data A data visualization guide for business professionals John Wiley & Sons 2015 (Unit 2)
4. Kazil Jacqueline and Katharine Jarmul Data wrangling with python tips and tools to make your life easier O Rilly Media Inc 2016 (Unit 3)
5. Wickham Hadley and Garrett Grolemund R for data science import tidy transform visualize and model data O Reilly Media Inc 2016 (Unit 4, 5)
6. Matthew O Ward Georges Grinstein, Daniel Keim Interactive Data Visualization Foundations Techniques and Applications 2nd Edition CRC press 2015

22IT002 RECOMMENDER SYSTEMS 3 0 0 3

Course Objectives

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics
4. Implement a simple recommender system.
5. Learn about Evaluating Paradigms of recommender systems and its applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1									2
2	1	2	1	1	1									2
3	2	3	1	1	1									3
4	3	2	2	2	1									2
5	2	2	1	2	1									2

UNIT I **9 Hours**

INTRODUCTION

Introduction and basic taxonomy of recommender systems Traditional and non-personalized Recommender Systems Overview of data mining methods for recommender systems similarity measures Dimensionality reduction Singular Value Decomposition SVD

UNIT II **9 Hours**

CONTENT-BASED RECOMMENDATION SYSTEMS

High-level architecture of content-based systems Item profiles Representing item profiles Methods for learning user profiles Similarity-based retrieval and Classification algorithms.

UNIT III **9 Hours**

COLLABORATIVE FILTERING

A systematic approach Nearest-neighbor collaborative filtering (CF) user-based and item-based CF components of neighborhood methods (rating normalization similarity weight computation and neighborhood selection

UNIT IV **9 Hours**

ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction Types of Attacks Detecting attacks on recommender systems Individual attack Group attack Strategies for robust recommender design Robust recommendation algorithms.

UNIT V **9 Hours**

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms User Studies Online and Offline evaluation Goals of evaluation design Design Issues Accuracy metrics Limitations of Evaluation measures

Total: 45 Hours

Reference(s)

1. Charu C Aggarwal Recommender Systems The Textbook Springer 2016
2. Dietmar Jannach Markus Zanker Alexander Felfernig and Gerhard Friedrich Recommender Systems An Introduction Cambridge University Press (2011) 1st ed.
3. Francesco Ricci Lior Rokach Bracha Shapira Recommender Systems Handbook 1st ed Springer (2011)
4. Jure Leskovec Anand Rajaraman Jeffrey David Ullman Mining of massive datasets 3rd edition Cambridge University Press 2020

22IT003 BIG DATA ANALYTICS 3 0 0 3

Course Objectives

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in MapReduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the big data and use cases from selected business domains.
2. Understand NoSQL big data management.
3. Utilize map reduce analytics and related tools
4. Understand the basics of Hadoop
5. Apply the usage of Hadoop related tools for Big Data Analytics

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								2	2
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								1	3

UNIT I **9 Hours**

UNDERSTANDING BIG DATA

Introduction to big data Convergence of key trends Unstructured data Industry examples of big data Web analytics Big data applications Big data technologies Introduction to Hadoop Open source technologies Cloud and big data Mobile business intelligence Crowd sourcing analytics Inter and trans firewall analytics.

UNIT II **9 Hours**

NOSQL DATA MANAGEMENT

Introduction to NoSQL Aggregate data models Key value and document data models Relationships Graph databases Schema less databases Materialized views Distribution models Master-slave replication Consistency Cassandra Cassandra data model Cassandra examples Cassandra clients

UNIT III **9 Hours**

MAP REDUCE APPLICATIONS

MapReduce workflows Unit tests with MRUnit Test data and local tests Anatomy of MapReduce job run Classic Map reduce YARN Failures in classic Map-reduce and YARN Job scheduling Shuffle and sort Task execution MapReduce types Input formats Output formats

UNIT IV **9 Hours**

BASICS OF HADOOP

Data format Analyzing data with Hadoop Scaling out Hadoop streaming Hadoop pipes Design of Hadoop distributed file system (HDFS) HDFS concepts Java interface Data flow Hadoop I/O Data integrity Compression Serialization Avro File based data structures Cassandra Hadoop integration.

UNIT V **9 Hours**

HADOOP RELATED TOOLS

Hbase Data model and implementations Hbase clients Hbase examples Praxis. Pig Grunt Pig data model Pig Latin Developing and testing Pig Latin scripts. Hive Data types and file formats HiveQL data definition HiveQL data manipulation HiveQL queries.

Total: 45 Hours

Reference(s)

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today"s Businesses", Wiley,2013
2. Eric Sammer, "Hadoop Operations", O"Reilley, 2012.
3. Sadalage Pramod J. NoSQL distilled 2013
4. E. Capriolo D. Wampler and J. Rutherglen Programming Hive O Reilley 2012.
5. Lars George HBase The Definitive Guide O Reilley 2011
6. Eben Hewitt Cassandra The Definitive Guide O Reilley 2010.

22IT004 NEURAL NETWORKS AND DEEP LEARNING 2023

Course Objectives

- To understand the major concepts in deep neural networks.
- To apply Convolutional Neural Network architectures for any real-life applications
- To analyze the key computations underlying deep learning to build and train deep neural networks for various tasks.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply Convolution Neural Network for any suitable applications
2. Analyze the various categories of associative memory and unsupervised learning networks
3. Apply Convolutional Neural Networks and its variants for any suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks
5. Apply autoencoders and generative models for suitable applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **6 Hours**

UNDERSTANDING NEURAL NETWORKS

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II **6 Hours**

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III **6 Hours**

THIRD-GENERATION NEURAL NETWORKS

Spiking Neural Networks-Convolutional Neural Networks Deep Learning Neural Networks-Extreme Learning Machine Model Convolutional Neural Networks The Convolution Operation Mo ivation Pooling Variants of the basic Convolution Function Structured Outputs Data Types Efficient Convolution Algorithms Neuroscientific Basis Applications Computer Vision Image Generation Image Compression

UNIT IV **6 Hours**

DEEP FEEDFORWARD NETWORKS

History of Deep Learning A Probabilistic Theory of Deep Learning Gradient Learning Chain Rule and Backpropagation Regularization Dataset Augmentation Noise Robustness Early Stopping Bagging and Dropout batch normalization VC Dimension and Neural Nets

UNIT V **6 Hours**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks Introduction Recursive Neural Networks Bidirectional RNNs Deep Recurrent Networks Applications Image Generation Image Compression Natural Language Processing Complete Auto encoder Regularized Autoencoder Stochastic Encoders and Decoders Contractive Encoders

Total: 30 Hours

EXPERIMENT 1 — 3 Hours

Implement simple vector addition in TensorFlow.

EXPERIMENT 2 — 3 Hours

Implement a regression model in Keras.

EXPERIMENT 3 — 3 Hours

Implement a perceptron in TensorFlow/Keras Environment.

EXPERIMENT 4 — 3 Hours

Implement a Feed-Forward Network in TensorFlow/Keras.

EXPERIMENT 5 — 3 Hours

Implement an Image Classifier using CNN in TensorFlow/Keras.

EXPERIMENT 6 — 3 Hours

Improve the Deep learning model by fine tuning hyperparameters.

EXPERIMENT 7 **3 Hours**

Implement a Transfer Learning concept in Image Classification.

EXPERIMENT 8 **3 Hours**

Using a pre trained model on Keras for Transfer Learning

EXPERIMENT 9 **3 Hours**

Perform Sentiment Analysis using RNN

EXPERIMENT 10 **3 Hours**

Implement an LSTM based Autoencoder in TensorFlow/Keras.

Total: 60 Hours

Reference(s)

1. S Rajasekaran, G A Vijayalakshmi Pai, Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications, PHI Learning, 2017
2. Charu C. Aggarwal, Neural Networks and Deep Learning A Textbook, Springer International Publishing, 1st Edition, 2018
3. James A Freeman, David M S Kapura, Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016
5. Francois Chollet, Deep Learning with Python, Second Edition, Manning Publications, 2021
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

22IT005 NATURAL LANGUAGE PROCESSING 2 0 2 3

Course Objectives

- To understand the fundamental concepts for natural language processing and automatic speech recognition
- To understand technologies involved in developing speech and language applications.
- To demonstrate the use of deep learning for building applications in speech and natural language processing

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in natural language processing.
2. Implement basic and some advanced text processing and feature representation techniques
3. Implement, and evaluate advanced NLP applications, including sentiment classification, named entity recognition, text summarization, machine translation, and modern deep learning models.
4. Apply fundamental principles of speech production and perception and analyze speech signals.
5. Design automatic speech recognition systems and develop applications for speaker recognition

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **6 Hours**

INTRODUCTION TO NATURAL LANGUAGE PROCESSING

Overview of NLP - Introduction to Levels of NLP - Morhpology: Derivational & Inflectional Morphology - POS tagging - Parsing: Shallow and Dependency Parsing, Semantics: Word Level Semantics and Thematic roles.

UNIT II **6 Hours**

TEXT PROCESSING AND FEATURE REPRESENTATION

Introduction to Corpora, Sentence Segmentation, Stemming: Porter Stemmer, Bag of words and Vector Space Model, Topic Modeling, N-gram Language Model, Smoothing, Word Embeddings: Word2Vec, Glove and Fasttext.

UNIT III **6 Hours**

APPLICATIONS OF NLP

Sentiment Classification using ML & DL models, Named Entity Recognition - CRF and LSTMs, Text Summarization - Statistical and Deep Learning models - Machine Translation - Encoder & Decoder Model, Attention Models, Question Answering - Knowledge based Q&A and Deep Learning models for Q&A.

UNIT IV **6 Hours**

SPEECH PROCESSING AND FEATURE REPRESENTATION OF SPEECH SIGNAL

Fundamentals of speech production – Perception of sound – Vocal tract model – Phonetics - Short-Time analysis of the signal – Energy – Zero crossing – Autocorrelation – Short time Fourier analysis - Mel Frequency Cepstral Coeffecients, Perceptual linear prediction (PLP), Linear prediction cepstral coefficients (LPCC), Gammatone Frequency Cepstral Coefficients (GFCC), i-vector.

UNIT V **6 Hours**

AUTOMATIC SPEECH AND SPEAKER RECOGNITION

Automatic Speech recognition formulation: Isolated word recognition – Large vocabulary continuous speech recognition - HMM/GMM based speech recognition – DNN/HMM model -- CNN based speech recognition - RNN language Models – Evaluation metrics, Speaker - recognition model – Alexa/Google assistant-based application development.

EXPERIMENT 1 **3 Hours**

POS Tagging and Parsing using various python packages.

EXPERIMENT 2 **3 Hours**

Implementing N-gram language models for next word prediction.

EXPERIMENT 3 **3 Hours**

Implementing Word embedding based text classification.

EXPERIMENT 4 **3 Hours**

Implementing CNN for sentiment analysis.

EXPERIMENT 5 **3 Hours**

Implementing RNN for Named Entity recognition.

EXPERIMENT 6 **3 Hours**

Implementing text summarization using deep learning.

EXPERIMENT 7 **3 Hours**

Implementing chatbot using deep learning.

EXPERIMENT 8 **3 Hours**

Developing speech recognition system to recognize voice commands

EXPERIMENT 9 **3 Hours**

Developing speech recognition system to recognize continuous speech

EXPERIMENT 10 **3 Hours**

Implementing CNN based speech recognition using mel spectal images.

Total: 60 Hours

REFERENCE(S)

1. Dan Jurafsky, James H. Martin “Speech and Language Processing”, Draft of 3rd Edition,Prentice Hall 2022.
2. Jacob Benesty, M. M. Sondhi, Yiteng Huang "Springer Handbook of Speech Processing", Springer, 2008.
3. Uday Kamath, John Liu, James Whitaker "Deep Learning for NLP and Speech Recognition" Springer, ,2019.
4. Steven Bird, Ewan Klein, Edward Loper "Natural Language Processing with Python", O'Reilly Media. 2009.
5. Ben Gold, Nelson Morgan, Dan Ellis “Speech and Audio Signal Processing: Processing and Perception of Speech and Music”, John Wiley & Sons, 2011.

22IT006 COMPUTER VISION **2 0 2 3**

Course Objectives

- To understand the fundamental concepts related to Image formation and processing
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment, motion estimation and 3D reconstruction
- To understand image-based rendering and recognition.
- To learn to detect and analysis objects from motion or scene

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in image processing and computer vision.
2. Implement basic and some advanced image processing techniques in OpenCV.
3. Apply 2D feature-based based image alignment, segmentation, motion estimations and 3D image reconstruction techniques
4. Design and develop innovative image processing and computer vision applications.
5. Apply the concept in understanding the scene and process the background part of the image

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		2		2	1	2	2	3	
3	3	3	2	2	3				1	1	2	2	3	
4	2	3	3	2	3				2	1	2	3	2	
5	2	3	3	2	2	2			2	1	2	3	3	

UNIT I **6 Hours**

INTRODUCTION TO IMAGE FORMATION AND PROCESSING

Computer Vision Geometric primitives and transformations Photometric image formation The digital camera Point operators Linear filtering More neighborhood operators Fourier transforms Pyramids and wavelets Geometric transformations Global optimization.

UNIT II **6 Hours**

FEATURE DETECTION, MATCHING AND SEGMENTATION

Points and patches - Edge detection - Edges Lines Segmentation - Region Based Segmentation - Graph Based segmentation - Active contours - Split and merge Mean shift and mode finding - Normalized cuts Graph cuts and energy-based methods.

UNIT III **6 Hours**

FEATURE-BASED ALIGNMENT AND 3D RECONSTRUCTION

2D and 3D feature-based alignment Pose estimation Geometric intrinsic calibration - Triangulation Two frame structure from motion - Shape from X Active range finding - Surface representations - Point based representations - Volumetric representations - Model based reconstruction.

UNIT IV **6 Hours**

IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images Light fields - Video based Rendering - Object detection - Face recognition - Instance recognition - Category recognition Context and scene understanding.

UNIT V **7 Hours**

MOTION ANALYSIS AND SCENE ANALYSIS

Optical Flow – Detection and Correspondence of Interest Points - Detection of Motion Patterns – Video Tracking – Motion Models to aid tracking: Kalman Filters - stereo mapping - image fusion - Detection of known objects by linear filters - Detection of unknown objects - Corner detection - image tagging.

EXPERIMENT 1 **3 Hours**

Perform histogram equalization on the image.

EXPERIMENT 2 **3 Hours**

Perform the edge detection process and extract edges from the input image

EXPERIMENT 3 **5 Hours**

Perform segmentation, extract and display the segmented region.

EXPERIMENT 4 **3 Hours**

Program to detect an object from the input frame.

EXPERIMENT 5 **5 Hours**

Program to track the object between two frames from image/video.

EXPERIMENT 6 **5 Hours**

Program to demonstrate to understand a scene and generate caption.

EXPERIMENT 7 **5 Hours**

Program to classify defective object from the correct object.

Total: 60 Hours

REFERENCE(S)

1. Richard Szeliski, Computer Vision Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.
6. Jurgen Beyerer, Fernando Puente Leon, Christian Frese," Machine Vision Automated Visual Inspection: Theory, Practice and Applications", 2016, Springer
7. AI Bovik, "The Essential Guide to Image Processing", 2009, Academic Press

22IT007 AGILE SOFTWARE DEVELOPMENT 3 0 0 3

Course Objectives

- To provide students with a theoretical as well as practical understanding of agile software development practices.
- To understand the Agile Scrum framework and development practices.
- To apply software design principles and refactoring techniques to achieve agility.
- To understand Agile requirements and perform testing activities within an agile project.
- To understand the benefits and pitfalls of working in an Agile team in terms of quality assurance.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand genesis of Agile and driving forces for choosing Agile techniques.
2. Apply the Agile Scrum framework and development practices.
3. Apply iterative software development processes by planning and executing them.
4. Analyze the impact of the success of social aspects behind the software testing.
5. Analyze techniques and tools for improving team collaboration and management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2									2	2	
2	2	2	2										2	
3	1		2		2							2	2	
4	1		2		2							2	2	
5	1		2		2							2	2	

UNIT I **9 Hours**

AGILE METHODOLOGY

Theories for Agile management - agile software development - traditional model vs. agile model - classification of agile methods - agile manifesto and principles - agile project management - agile team interactions - ethics in agile teams - agility in design - testing - agile documentations - agile drivers - capabilities and values

UNIT II **9 Hours**

AGILE PROCESSES

Extreme Programming: Method overview - lifecycle - work products, roles and practices - Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Kanban model

UNIT III **9 Hours**

AGILITY AND KNOWLEDGE MANAGEMENT

Agile information systems - agile decision making - Earls schools of KM - institutional knowledge evolution cycle - development, acquisition, refinement, distribution, deployment, leveraging - KM in software engineering - managing software knowledge - challenges of migrating to agile methodologies - agile knowledge sharing - role of story-cards - Story - card Maturity Model (SMM)

UNIT IV **9 Hours**

AGILITY AND REQUIREMENTS ENGINEERING

Impact of agile processes in RE - current agile practices - variance - overview of RE using agile - managing unstable requirements - requirements elicitation - agile requirements abstraction model - requirements management in agile environment, agile requirements prioritization - agile requirements modeling and generation - concurrency in agile requirements generation

UNIT V **9 Hours**

AGILITY AND QUALITY ASSURANCE

Agile Interaction Design - Agile product development - Agile Metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - Agile approach to Quality Assurance - Test Driven Development - Pair programming: Issues and Challenges - Agile approach to Global Software Development

Total: 45 Hours

Reference(s)

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds), Agile Software Development, Current Research and Future Directions, Springer - Verlag Berlin Heidelberg, 2010
2. David J. Anderson; Eli Schragenheim, - Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003
3. Hazza& Dubinsky, - Agile Software Engineering, Series - Undergraduate Topics in Computer Science, Springer, VIII edition, 2009
4. Craig Larman, - Agile and Iterative Development -A manager""s Guide, Addison - Wesley, 2004
5. Kevin C. Desouza, - Agile information systems: conceptualization, construction, and managemen, Butterworth - Heinemann, 2007

22IT008 UI AND UX DESIGN 3 0 0 3

Course Objectives

- Study about designing web pages and understand the difference between UI and UX Design.
- To understand the concept of UX design and how it has evolved Able o to understand UX design process and methodology.
- Learning the Importance and scope of Interaction design, User centered design

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand to do user research, persona mapping, customer journey mapping
2. Design of interactive products Methods of interaction design Tools for interaction design
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests Learning steps for digital products.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1												1	1
2	1	2	2		1								2	1
3		3	3		1								2	1
4		2	2										1	2
5		2	2										1	2

UNIT I **9 Hours**

USER-CENTERED DESIGN PROCESS

Scripting Languages - HTML, CSS - Fundamentals of graphics design, principles of visual design - Overview of UI & UX Design - Overview of the UX Design Process - Difference between User Interface (UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation - Primary and Secondary persona - Requirement definition - Creative ideation - brainstorming and ideation techniques - Scenarios and functionality extraction - Information Architecture - Task flows - Wireframe design

UNIT II **9 Hours**

FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN

Design Principles for UX and UI Design - UI Elements-Patterns - Material Design (Google) and Human Interface Design (Apple) guidelines - Interaction Principles & Interaction Behaviour - Master the Brand Platforms & Style Guides - comments and current UI patterns - Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

UNIT III **9 Hours**

ELEMENTARY SKETCHING

Principles of Sketching - Core Responsive Design - Wireframing vs Wireflows - Click through Wireframing Prototyping - Wireflow Creation - Work with different tools - Figma - Low-High Fidelity Design : Inclusive Design and Designing for Accessibility - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Designing animations and interactions

UNIT IV **9 Hours**

UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING

Building a Design System - Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration - Use of grids in UI design - Design animations and interaction patterns for key UI elements

UNIT V **9 Hours**

USABILITY EVALUATION AND PRODUCT DESIGN

Type of usability evaluation - Qualitative & Quantitative evaluation - Guerilla testing , A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud - Think aloud - Introduction and advantages - Designing evaluation protocol - Conducting usability evaluation study - Conduct Usability Test explicit - Synthesize Test Findings - practices in corporate World Product Design : Types of products & solutions - Design Psychology for e-commerce sites , CMS - Design Thinking Life Cycle

Total: 45 Hours

Reference(s)

1. Norman, Donald A. The Design of Everyday Things. Basic Books, 2002. ISBN: 9780465067107.
2. Nielsen, Jakob. Usability Engineering. Morgan Kaufmann, 1993. ISBN: 9780125184069.
3. Mullet, Kevin, and Darrell Sano. Designing Visual Interfaces: Communication Oriented Techniques. Prentice Hall, 1994. ISBN: 9780133033892.
4. Wilbent. O. Galitz ,The Essential Guide To User Interface Design, John Wiley&Sons, 2001.
5. Ben Sheiderman, Design The User Interface, Pearson Education, 1998.
6. Alan Cooper, The Essential Of User Interface Design, Wiley- Dream Tech Ltd.,2002.

22IT009 WEB FRAMEWORKS 3 0 0 3

Course Objectives

- Understand the architecture behind an Angular application and how to use it
- To understand the significance of using MongoDB as a database system
- To understand the role of React in designing front-end components
- Build a Web Server in Node and understand how it really works
- Develop a web application and API using web frameworks

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply modules and components and Animations for creating Forms and developing web pages
2. Create web applications by performing CRUD operations in database using web frameworks
3. Design Progressive Web Application with dynamic HTML web pages using Angular.
4. Designing single page applications with reusable UI components using React CSS and SaaS
5. Use Node Package Manager and Node packages for Server-Side programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		2				2	2			2	
2	1		1		3				2	2			3	
3	1		2		2				2	2			3	
4	1		1		3				2	2			2	
5	1		1		3				1	1			2	

UNIT I **9 Hours**

ANGULAR FRONT-END FRAMEWORK

Introduction - Setup - Architecture: Modules, Components, Services and DI fundamentals - Components and Templates - Configuration - Forms - Observables & RxJS - Boot Strapping - Ng Modules - Dependency Injection - Http Client - Routing and Navigation - Animations

UNIT II **9 Hours**

FRAMEWORKS WITH DATABASES

MongoDB - MongoDB Basics - Documents - Collections - Query Language - Installation - The mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB - CRUD operations - projections - Indexing - Aggregation - Replication - Sharding - Creating backup - Deployment

UNIT III **9 Hours**

ANGULAR TECHNIQUES

Service workers & PWA - Server side rendering - Angular Libraries - Schematics - CLI Builders - Angular Ivy - Web Workers

UNIT IV **9 Hours**

REACT

React Introduction - React ES6 - React Render HTML - React JSX - Components - React Classes - Composing Components - Passing Data - Dynamic Composition - React state - setting State - Async State Initialization - Event Handling Communicating from Child to Parent - Stateless Components - Designing components - React Forms - React CSS - React SaaS

UNIT V **9 Hours**

NODE JS BACK-END FRAMEWORK

Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js EventEmitter - Frameworks for Node.js - Express.js Web App - Serving static Resource - Node.js Data Access

Total: 45 Hours

Reference(s)

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
2. Christoffer Noring, Pablo Deeleman,Learning Angular, Packt Publishing Limited, 2nd Revised edition edition, 2017.
3. Caleb Dayley Brad Dayley,Brendan Dayley ,Node.js, MongoDB and Angular Web Development, 2nd Edition,Pearson, 2018.
4. Shyam Seshadri, Angular: Up and Running- Learning Angular, Step by Step , O"Reilly; First edition, 2018

22IT010 APP DEVELOPMENT 2 0 2 3

Course Objectives

- To facilitate students to understand android SDK
- To help students to gain a basic understanding of Android application development
- To inculcate working knowledge of Android Studio development tool

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Identify fundamental concepts of mobile programming that make it unique from programming for other platforms
2. Analyze the essential of Android Application with their anatomy and terminologies
3. Apply rapid prototyping techniques to design, develop and deploy the Android Applications
4. Analyze the essentials of User Interface Design in IOS with SQLite Database
5. Design the flutter applications on the Android marketplace for distribution

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3								1	
2	1	2	2		3								2	
3	1		2		3								2	
4	1	1	2		3								3	
5	1	2	2		3								3	

UNIT I **5 Hours**

INTRODUCTION TO ANDROID

The Android Platform - Android SDK - Eclipse Installation - Android Installation - building your First Android application - Understanding the Android Manifest file

UNIT II **6 Hours**

ANDROID APPLICATION DESIGN ESSENTIALS

Anatomy of Android applications - Android terminologies - Application Context - Activities - Services - Intents - Receiving and Broadcasting Intents - Using Intent Filter - Permissions

UNIT III **6 Hours**

COMMON ANDROID APIS

Testing Android applications - Publishing Android applications - Using Android Data and Storage APIs - managing data using SQLite - Using Android Web APIs - Using Android Telephony APIs - Deploying Android Applications to the World

UNIT IV **6 Hours**

IOS USER INTERFACE DESIGN ESSENTIALS

IOS features - UI implementation - Touch frameworks - Data persistence using Core Data and SQLite - Integrating calendar and address book with social media application - Using WIFI - iPhone marketplace

UNIT V **7 Hours**

APP DEVELOPMENT WITH FLUTTER

Flutter Introduction - Create First Flutter Application - Exploring commonly used flutter widgets: Container - Margin - Padding and Box Constraints - Custom Fonts - Column and Expanded Widgets - Image Asset - Raised Button - and Alert Dialog

EXPERIMENT 1 **4 Hours**

Develop a simple application with one EditText so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice

EXPERIMENT 2 **4 Hours**

Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number

EXPERIMENT 3 **4 Hours**

Create a SIGNUp activity with Username and Password. Validation of password should happen based on the following rules:
Password should contain uppercase and lowercase letters.
Password should contain letters and numbers.
Password should contain special characters.
Minimum length of the password (the default value is 8).
On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that display a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another

EXPERIMENT 4 **4 Hours**

Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name

EXPERIMENT 5 **4 Hours**

Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds

EXPERIMENT 6 **5 Hours**

Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts

EXPERIMENT 7 **5 Hours**

Implement UI elements like TextFields, Label, Toolbar, Statusbar, Tabbar

Total: 60 Hours

Reference(s)

1 Lauren Darcey and Shane Conder, "Android Wireless Application Development", Second Edition, Pearson Education, 2011
2 Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
3 Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd 3. R3. Android Application Development All in one for Dummies by Barry Burd
4 Alberto Miola, "Flutter Complete Reference: Create beautiful, fast and native apps for any device" ISBN-13 9780141044804
5 David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.55

22IT011 SOFTWARE TESTING AND AUTOMATION 3 0 0 3

Course Objectives

- Understand the importance of software testing in the software development process
- Analyze different testing methodologies and techniques to create test plans, test cases, and test scripts
- Apply automation testing tools and frameworks to design and implement automated test suites

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the importance of testing in the software development process
2. Compare the different test case design strategies
3. Analyze the different levels of testing and their importance
4. Apply test management techniques and the role of a test specialist
5. Analyze the software test automation and its requirements

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		1								1	
2	2	3	2		2								1	
3	2	2	2		2								1	
4	2	3	2		3								1	
5	3	2	1		3								2	

UNIT I **9 Hours**

INTRODUCTION

Basic definitions - Software Testing Principles - The Tester's Role in a Software Development Organization - Origins of Defects - Cost of Defects - Defect Classes - The Defect Repository and Test Design - Defect Examples - Developer/Tester Support of Developing a Defect Repository

UNIT II **9 Hours**

TEST CASE DESIGN STRATEGIES

Test Scenarios - Test Cases - Test case Design Strategies - Black Box Approach to Test Case Design - Using White Box Approach to Test design - Test Adequacy Criteria - Static testing vs. Structural testing - Code functional testing - Coverage and Control Flow Graphs - Covering Code Logic - Paths - Code complexity testing - Additional White box testing approaches - Test Coverage

UNIT III **9 Hours**

LEVELS OF TESTING

Types of testing - manual and automation - Introduction to testing methods - White-box, Black-box and Grey-box - Functional testing - Non-functional testing - Introduction to levels of testing - Unit Testing, Integration Testing, System Testing, User Acceptance Testing - Introduction to types of testing - Regression Testing, Smoke Testing, Database Testing, Usability Testing, Load Testing, Stress Testing, Performance Testing, Compatibility Testing, Security Testing, Internationalization Testing, Localization Testing

UNIT IV **9 Hours**

TEST MANAGEMENT

People and organizational issues in testing - Organization structures for testing teams - testing services - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - test management - test process - Reporting Test Results - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group - The Structure of Testing Group - The Technical Training Program

UNIT V **9 Hours**

TEST AUTOMATION

Software test automation - Design and Architecture for Automation - Automation testing - Automation Tools - Selenium Web Driver - Create Selenese Commands - TestNG - TestNG Annotations - Jmeter - Assertions in JMeter - Junit

Total: 45 Hours

Reference(s)

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing - Principles and Practices", Pearson Education, 2006
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007
3. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003
4. Edward Kit, "Software Testing in the Real World - Improving the Process", Pearson Education, 1995
5. Boris Beizer, "Software Testing Techniques", Second Edition, Van Nostrand Reinhold, New York, 1990
6. Aditya P. Mathur, "Foundations of Software Testing - Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

22IT012 DEVOPS **3 0 0 3**

Course Objectives

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real-world problems

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand different actions performed through Version control tools like Git
2. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle
3. Ability to Perform Automated Continuous Deployment
4. Ability to do configuration management using Ansible
5. Understand to leverage Cloud-based DevOps tools using Azure DevOps

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2								3	
2	3	3	3	3	2								2	
3	2	2	2	3	2								2	
4	2	2	2	2	2								2	
5	2	2	2	2	2								3	

UNIT I **7 Hours**

INTRODUCTION TO DEVOPS

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and GitHub

UNIT II **10 Hours**

COMPILE AND BUILD USING MAVEN

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles - Maven repositories (local, central, global) - Maven plugins - Maven create and build Artifacts - Dependency Management - Installation of Gradle - understanding build using Gradle

UNIT III **12 Hours**

CONTINUOUS INTEGRATION USING JENKINS

Install & Configure Jenkins - Jenkins Architecture Overview - creating a Jenkins Job - Configuring a Jenkins job - Introduction to Plugins - Adding Plugins to Jenkins - commonly used plugins (Git Plugin, Parameter Plugin- HTML Publisher - Copy Artifact, and Extended choice parameters). Configuring Jenkins to work with Java - Git - and Maven - Creating a Jenkins Build and Jenkins workspace

UNIT IV **9 Hours**

CONFIGURATION MANAGEMENT USING ANSIBLE

Ansible Introduction - Installation - Ansible master/slave configuration - YAML basics - Ansible Modules - Ansible Inventory files - Ansible playbooks - Ansible Roles - and ad-hoc commands in Ansible

UNIT V **7 Hours**

BUILDING DEVOPS PIPELINES USING AZURE

Create GitHub Account, Create Repository - Create Azure Organization - Create a new pipeline - Build a sample code - Modify azure - pipelines - yaml file

Total: 45 Hours

Reference(s)

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014
3. Mitesh Soni, "Hands-On Azure DevOps: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure DevOps And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure, English Edition, Paperback - 1 January 2020
4. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015
5. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016
6. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019

22IT013 VIRTUALIZATION IN CLOUD COMPUTING 3 0 0 3

Course Objectives

- Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud-based applications
- Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure
- Identify major security and privacy problems in cloud computing environment
- Apply the ability to use the architecture of cloud, service and delivery models
- Implement the key enabling technologies that help in the development of cloud.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the concept of virtualization and its properties.
2. Apply different forms of virtualization.
3. Implement various architectures for implementing virtualization methods.
4. Create virtual machines and installing various operating systems.
5. Evaluate the performance of the virtual machines and deployed applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3									1	
2			1	2	3								1	1
3			2	1	3								1	2
4	1		2	1	3								2	2
5	1		3		2								2	2

UNIT I **9 Hours**

UNDERSTANDING VIRTUALIZATION

Describing Virtualization-Microsoft Windows Drives Server Growth -Explaining Moores Law-Understanding the Importance of Virtualization -Examining Todays Trends -Virtualization and Cloud Computing -Understanding Virtualization Software Operation -Virtualizing Servers -Virtualizing Desktops -Virtualizing Applications.

UNIT II **9 Hours**

HYPERVISORS

Describing a Hypervisor -Exploring the History of Hypervisors -Understanding Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor -Holodecks and Traffic Cops -Resource Allocation -Comparing Todays Hypervisors -VMware ESX -Citrix Xen -Microsoft Hyper-V -Other Solutions.

UNIT III **9 Hours**

UNIT III

Introduction to Virtual Machine - CPUs in a Virtual Machine -Memory in a Virtual Machine -Network Resources in a Virtual Machine - Storage in a Virtual Machine -Understanding How a Virtual Machine Works -Working with Virtual Machines -Virtual Machine Clones -Templates -Snapshots -OVF -Containers

UNIT IV **9 Hours**

CREATION OF VIRTUAL MACHINES

Understanding Configuration Options-Installing Windows on a Virtual Machine- Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions- Managing CPUs for a Virtual Machine-Configuring VM CPU Options-Managing Storage for a Virtual Machine- Managing Networking for a Virtual Machine- Copying a Virtual Machine- Managing Additional Devices in Virtual Machines

UNIT V **9 Hours**

AVAILABILITY

Increasing Availability-Protecting a Virtual Machine-Protecting Multiple Virtual Machines-Protecting Data Centers - Examining Virtual Infrastructure Performance Capabilities -Deploying Applications in a Virtual Environment-Understanding Virtual Appliances and vApps -Open Stack and Containers.

Total: 45 Hours

Reference(s)

1. Matthew Portney, Virtualization Essentials, John Wiley & Sons, Second Edition, 2016
2. Kailash Jayaswal, Jagannath Kallakurchi,Donald J.Houde,Dr.devan Shah, Cloud Computing Black Book, Dreamtech press, 2015
3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S,Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013
4. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
5. http//www.microsoft.com/learning/default.mspx
6. https://www.oreilly.com/library/view/cloud- security-and/9780596806453/ch04.html

22IT014 CLOUD SERVICES AND DATA MANAGEMENT **3 0 0 3**

Course Objectives

- Analyze the basic concepts of Cloud and capabilities across the various Cloud service models
- Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and OpenStack
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1									2
2	3	1	2	3	2									2
3	1	1	3	1	3									2
4	1	1	1	2	3									2
5	1	3	3	2	2									1

understanding of the limitations.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply Cloud Computing reference architecture for developing clouds
2. Analyze the different forms of cloud service models
3. Apply the characteristics and architecture of IaaS using various real-world applications.
4. Evaluate PaaS concepts and architectures with real-world examples
5. Analyze, and synthesize concepts related to the SaaS delivery model.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1									2
2	3	1	2	3	2									2
3	1	1	3	1	3									2
4	1	1	1	2	3									2
5	1	3	3	2	2									1

UNIT I **9 Hours**

CLOUD COMPUTING REFERENCE ARCHITECTURE (CCRA)

Introduction to Cloud Computing Reference Architecture (CCRA), Benefits of CCRA, Architecture Overview, Versions and Application of CCRA for Developing Clouds.

UNIT II **9 Hours**

INTRODUCTION OF DELIVERY MODELS IN CLOUD COMPUTING

Introduction to Cloud Delivery Models, List Various Cloud Delivery Models, Advantages of Delivery Models in Cloud, Trade-off in Cost to Install Versus Flexibility, Cloud Service Model Architecture.

UNIT III **9 Hours**

INFRASTRUCTURE AS A SERVICE (IAAS)

Introduction to Infrastructure as a Service Delivery Model, Characteristics of IaaS, Architecture, Examples of IaaS, Applicability of IaaS in the Industry.

UNIT IV **9 Hours**

PLATFORM AS A SERVICE (PAAS)

Introduction to Platform as a Service Delivery Model, Characteristics of PaaS, Patterns, Architecture and Examples of PaaS, Applicability of PaaS in the Industry.

UNIT V **9 Hours**

SOFTWARE AS A SERVICE (SAAS)

Introduction to Software as a Service Delivery Model, Characteristics of SaaS, Architecture, Examples of SaaS, Applicability of SaaS in the Industry.

Total: 45 Hours

Reference(s)

1. (IBM ICE), Cloud Computing Architecture, IBM Global Technology Services Thought Leadership White Paper, April 2011
2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
3. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, 2011
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O reilly, SPD, 2011

22IT015 CLOUD STORAGE TECHNOLOGIES 3 0 0 3

Course Objectives

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	3	3								2	
2	3	1	2	3	3									1
3	1	1	2	3	3									2
4	3	2	1	2	2									1
5	1	3	2	1	2									2

2. Apply the usage of advanced intelligent storage systems and RAID.
3. Evaluate various storage networking architectures - SAN, including storage subsystems and virtualization.
4. Execute the different roles in providing disaster recovery and remote replication technologies.
5. Implement the security needs and security measures to be employed in information storage management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	3	3								2	
2	3	1	2	3	3									1
3	1	1	2	3	3									2
4	3	2	1	2	2									1
5	1	3	2	1	2									2

UNIT I **8 Hours**

STORAGE SYSTEMS

Cloud Storage Fundamentals and Architecture - Cloud Storage Providers and Services - Access methods (RESTful APIs, SDKs) for cloud object storage - Block storage technologies in cloud environments - File Storage in the Cloud: Network File System (NFS) and Server Message Block (SMB) protocols -Hybrid Cloud Storage - Data Migration - Data Lifecycle Management in the Cloud

UNIT II **9 Hours**

INTELLIGENT STORAGE SYSTEMS AND RAID

Storage Tiering and Caching - Automated Data Placement and Load Balancing: Intelligent Algorithms for Data Placement, Load Balancing Strategies for Distributed Storage Systems, Dynamic Resource Allocation - RAID Technologies in Cloud Storage: RAID Levels - Data Striping, Mirroring, and Parity for Fault Tolerance - RAID Configuration and Performance Optimization

UNIT III **10 Hours**

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Storage Networking in Cloud Environments - Understanding storage protocols - Network-attached storage (NAS) vs. storage area network (SAN) - Storage virtualization techniques and technologies - Network-Attached Storage (NAS) - Storage Area Network (SAN) - iSCSI and Fiber Channel over IP (FCIP) in Cloud Storage - Network Virtualization and Overlay Networks - Storage Virtualization and Abstraction - Network Performance Optimization - Network Security in Cloud Storage

UNIT IV **9 Hours**

BACKUP, ARCHIVE AND REPLICATION

Cloud Backup: Strategies and Architecture, Data Deduplication and Compression, Security - Cloud Archive: Strategies and Architecture, Replication for Data Redundancy: Synchronous and asynchronous replication methods - Disaster Recovery in the Cloud - Hybrid Backup and Archiving in Cloud Environments - Backup and Archive Management in Cloud Environments

UNIT V **9 Hours**

SECURING STORAGE INFRASTRUCTURE

Storage Security Fundamentals: Key Security Principles, Threats and Vulnerabilities in Storage Infrastructure, Access Control and Authentication: Role-based Access Control (RBAC) and Permissions Management, Multi-factor authentication (MFA) for Storage Systems - Storage-level Encryption and Application-level Encryption - Storage infrastructure Management Functions and Processes.

Total: 45 Hours

Reference(s)

1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O Reilly, 2009.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Rittinghouse, John W., and James F. Ransome, Cloud Computing Implementation, Management and Security, CRC Press, 2017.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

22IT016 CLOUD AUTOMATION TOOLS AND APPLICATIONS **3 0 0 3**

Course Objectives

- To learn the options for running automation tools, and load balancers in the cloud-native applications.
- To learn the configuration management in the cloud.
- To know why cloud automation is important.
- To learn what types of cloud automation tools can be used.
- To learn load balancing and auto scaling in the cloud.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement cloud native applications on AWS, Terraform etc.
2. Apply VM provisioning and migration in the cloud.
3. Analyze cloud automation and configuration.
4. Apply balance load and auto scaling in the cloud.
5. Analyze the AWS cloud formation use-case.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2	1	3									2
2		2			3									1
3			3	2	3									2

4			2		3							2	
5			2		3								2

UNIT I **7 Hours**

UNDERSTANDING THE CLOUD AUTOMATION

Introduction to Automation & Configuration Tools. Introduction to Terraform. Understanding Terraform Vs CloudFormation. Deploying & Destroying AWS environment with Terraform. Introduction to Packer.

UNIT II **9 Hours**

ABSTRACTION AND VIRTUALIZATION

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding hypervisors Porting Applications, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Centre Automation.

UNIT III **9 Hours**

AUTOMATION AND CONFIGURATION MANAGEMENT IN THE CLOUD

Cloud automation at scale, Cloud Configuration Management unmanaged and managed configuration management, Modification of the capacity of the service, horizontal and vertical scaling, and automatic versus manual scaling. Migrating the business to Cloud. Automating cloud deployments Balancers.

UNIT IV **9 Hours**

LOAD BALANCING AND AUTO SCALING IN CLOUD

Managed instance groups, Auto scaling and health check, Overview of HTTP(S) load balancing. Example: HTTP load balancer, HTTP(S) load balancing, Configuring an HTTP Load Balancer with Auto scaling, SSL proxy load balancing, TCP proxy load balancing, Network load balancing, Internal load balancing, Configuring an Internal Load Balancer, Choosing a load balancer

UNIT V **11 Hours**

AWS CLOUDFORMATION USE-CASE

Introduction to AWS CloudFormation, AWS CloudFormation Features and Components, Working of AWS CloudFormation, setting up AWS CloudFormation, building a Pipeline for Test and Production Stacks, AWS CloudFormation Artifacts, Parameter Override Functions with Code Pipeline, Using AWS CLI. AWS CloudFormation, Terraform, VMware vs Center Configuration Manager (VCM), and Puppet.

Total: 45 Hours

Reference(s)

1. Bernd Ruecker, Practical Process Automation: Orchestration and Integration in Micro services and Cloud Native Architectures, O"Reilly Media, First Edition, 2021.
2. Douglas Comer, The Cloud Computing Book: The Future of Computing Explained, Chapman and Hall/CRC, First Edition, 2021.
3. Karen Tovmasyan, Mastering AWS CloudFormation: Plan, develop, and deploy your cloud infrastructure effectively using AWS CloudFormation, Packt Publishing Limited, First Edition, 2020.
4. Mikael Krief, Mitchell Hashimoto, Terraform Cookbook: Efficiently define, launch, and manage Infrastructure as Code across various cloud platforms, Packet Publishing Limited, 2020.
5. Yogesh Raheja, Dennis McCarthy, Automation with Puppet 5.0, Wiley, First Edition, 2018.

22IT017 SOFTWARE DEFINED NETWORKS 2 0 2 3

Course Objectives

- Understand the need for SDN and its data plane operations
- Understand the functions of control plane
- Comprehend the migration of networking functions to SDN environment
- Explore various techniques of network function virtualization
- Comprehend the concepts behind network virtualization

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply the motivation behind SDN
2. Analyze the functions of the data plane and control plane
3. Evaluate and develop network applications using SDN
4. Execute network services using NFV
5. Implement various use cases of SDN and NFV

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3	1	3								2	
2	2	1	2	2	3								1	
3	2	2	2	3	3								2	
4	2	2	2	3	1								2	
5	3	3	1	1	3								2	

UNIT I **5 Hours**

SDN: INTRODUCTION

History of Software Defined Networking (SDN)-Modern Data Center - Traditional Switch Architecture - Why SDN - Evolution of SDN - How SDN Works - Centralized and Distributed Control and Date Planes

UNIT II **6 Hours**

SDN DATA PLANE AND CONTROL PLANE

Data Plane functions and protocols - OpenFLow Protocol - Packet Processing and Performance Optimization - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface - SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III **6 Hours**

SDN APPLICATIONS

SDN Application Plane Architecture - Network Services Abstraction Layer - Traffic Engineering - Measurement and Monitoring - Security - Data Center Networking - Wide Area Networks (WAN) - Service Provider Networks - Internet Service Providers (ISPs)

UNIT IV **6 Hours**

NETWORK FUNCTION VIRTUALIZATION

Network Virtualization - NFV Architecture - Virtual LANs - OpenFlow VLAN Support - NFV Standards and Frameworks - NFV Concepts - Benefits and Requirements - Reference Architecture

UNIT V **7 Hours**

NFV FUNCTIONALITY

NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use Cases: Virtual Customer Premises Equipment, Virtual Evolved Packet Cor, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV

EXPERIMENT 1 **6 Hours**

Design, and Test the LAN connection for an organization to create a risk-free virtual environment using GNS3 network simulation tool.

EXPERIMENT 2 **8 Hours**

Design a Mininet topology with a single SDN controller and two hosts connected to a switch, and use Wireshark to capture for an institution.

EXPERIMENT 3 **8 Hours**

Design and implement an SDN-based network infrastructure for a smart campus that uses the Northbound API to program flow table rules on the switch for various use cases.

EXPERIMENT 4 **8 Hours**

Install a network topology using the OSM GUI or CLI, connecting the necessary VNFs to form service chains or network service graphs for an organization.

Total: 60 Hours

Reference(s)

1. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design, 1st Edition, CRC Press, 2014.
2. Ken Gray, Thomas D. Nadeau, Network Function Virtualization, Morgan Kauffman, 2016.
3. Oswald Coker, Siamak Azodolmolky, Software-Defined Networking with OpenFlow, 2nd Edition, O"Reilly Media, 2017.
4. Paul Goransson, Chuck Black Timothy Culver, Software Defined Networks: A Comprehensive Approach, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Thomas D Nadeau, Ken Gray, SDN: Software Defined Networks, O"Reilly Media, 2013.

22IT018 SECURITY AND PRIVACY IN CLOUD 3 0 0 3

Course Objectives

- To Introduce Cloud Computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To understand the Identity, Access control in Cloud.
- To follow best practices for Cloud security using various design patterns.
- To be able to monitor and audit cloud applications for security.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the cloud security concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Analyze the cloud policy, identity and Access Management.
4. Delivers various risks, audit and monitoring mechanisms in the cloud.
5. Applying the various architectural and design considerations for security in the cloud.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1	2									2
2	1	3	2	3	1									2
3	3	2	2	3	2									2
4	2	1	2	3	3									2
5	1	3	3	1	1									3

UNIT I **8 Hours**

FUNDAMENTALS OF CLOUD SECURITY CONCEPTS

Overview of Cloud Security - Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of Cryptography - Conventional and Public-key cryptography, Hash Functions, Authentication and Digital Signatures

UNIT II **10 Hours**

SECURITY DESIGN AND ARCHITECTURE FOR CLOUD

Security Design Principles for Cloud Computing - Comprehensive Data Protection - End-to-end access control - Common Attack Vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III **9 Hours**

ACCESS CONTROL AND IDENTITY MANAGEMENT

Access Control Requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection

UNIT IV **9 Hours**

CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud Bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V **9 Hours**

MONITORING, AUDITING AND MANAGEMENT

Proactive Activity Monitoring - Incident Response, Monitoring for Unauthorized Access, Malicious Traffic, Abuse of System Privileges - Events and Alerts - Auditing - Record generation, Reporting and Management, Tamper-Proofing Audit logs, Quality of Services, Secure Management, User Management, Identity Management, Security Information and Event Management

Total: 45 Hours

Reference(s)

1. Dave Shackleford, Virtualization Security, SYBEX a Wiley Brand, 2013
2. Mark C. Chu-Carroll, Code in the Cloud, CRC Press, 2011
3. Mather, Kumaraswamy and Latif, Cloud Security and Privacy, Oreilly, 2011
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, 2013.
5. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing, Wiley 2013.

22IT019 CYBER SECURITY 3 0 0 3

Course Objectives

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the basics of cyber security, cybercrime and cyber law.
2. Classify various types of attacks and learn the tools to launch the attacks.
3. Apply various tools to perform information gathering for data security and integrity.
4. Apply intrusion techniques to detect intrusion and to observe network traffic for malicious transactions in the network.
5. Apply intrusion prevention techniques to prevent intrusion and to protect against known and unknown threats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	2								2	
2	1	3	1	3	3								2	
3	2	1	1	1	2								2	
4	3	3	2	2	1								3	
5	3	2	2	2	3								3	

UNIT I **9 Hours**

INTRODUCTION

Cyber Security - History of Internet - Impact of Internet - CIA Triad; Reason for Cyber Crime - Need for Cyber Security - History of Cyber Crime; Cybercriminals - A Global Perspective on Cyber Crimes - Classification of Cybercrimes

UNIT II **9 Hours**

ATTACKS AND COUNTER MEASURES

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks - Security Breach - Types of Malicious Attacks - Malicious Software - Common Attack Vectors - Social engineering Attack - Wireless Network Attack - Web Application Attack - Attack Tools - Countermeasures

UNIT III **9 Hours**

RECONNAISSANCE

Harvester - Who is - Netcraft - Host - Extracting Information from DNS- Extracting Information from E-mail Servers - Social Engineering Reconnaissance; Scanning - Port Scanning - Network Scanning and Vulnerability Scanning - Scanning Methodology - Ping Sweer Techniques - Nmap Command Switches - SYN - Stealth - XMAS - NULL - IDLE - FIN Scans - Banner Grabbing and OS Fingerprinting Techniques

UNIT IV **9 Hours**

INTRUSION DETECTION

Host -Based Intrusion Detection-Network -Based Intrusion Detection-Distributed or Hybrid Intrusion Detection-Intrusion Detection Exchange Format -Honeypots - Example System Snort -Cyber Laws-The Indian IT Act - Cyber Crime and Punishment

UNIT V **9 Hours**

INTRUSION PREVENTION

Firewalls and Intrusion Prevention Systems: Need for Firewalls -Firewall Characteristics and Access Policy - Types of Firewalls - Firewall Basing - Firewall Location and Configurations - Intrusion Prevention Systems - Example Unified Threat Management Products

Total: 45 Hours

Reference(s)

1. Anand Shinde,Introduction to Cyber Security Guide to the World of Cyber Security, Notion Press, 2021
2. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publishers, 2011
3. David Kim, Michael G. Solomon, Fundamentals of Information Systems Security, Jones & Bartlett Learning Publishers, 2013.
4. Patrick Engebretson,The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy, Elsevier, 2011.
5. Kimberly Graves,CEH Official Certified Ethical hacker Review Guide, Wiley Publishers, 2007.
6. William Stallings, Lawrie Brown,Computer Security Principles and Practice, Third Edition, Pearson Education, 2015.

22IT020 MODERN CRYPTOGRAPHY 3 0 0 3

Course Objectives

- To learn about the basics of modern cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct the basics of cryptanalytic techniques for ensuring data integrity.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authentication.
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Apply the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Demonstrate the use of Message Authentication Codes to authenticate information transmitted between the users.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	
2	1	3	2	1	2							2	2	
3	1	1	2	3	2							3	1	
4	3	1	2	1	3							2	3	
5	2	3	3	3	3							1	2	

UNIT I **9 Hours**

INTRODUCTION

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations

UNIT II **9 Hours**

FORMAL NOTIONS OF ATTACKS

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model

UNIT III **9 Hours**

RANDOM ORACLES

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV **9 Hours**

BUILDING A PSEUDORANDOM PERMUTATION

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

UNIT V **9 Hours**

MESSAGE AUTHENTICATION CODES

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir"s Secret Sharing Scheme- Formally Analyzing Cryptographic Protocols- Zero Knowledge Proofs and Protocols

Total: 45 Hours

Reference(s)

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 7th Edition, 2017.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), 2009.
3. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2007.
4. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2004.

22IT021 CYBER FORENSICS 3 0 0 3

Course Objectives

- To understand the principles and concepts of computer forensics.
- To learn to utilize forensic tools for network-based attacks.
- To identify and apply appropriate methodologies for forensics data.
- To identify and analyze the vulnerabilities in the network.
- To analyze the various hacking techniques and their impacts.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. To understand the basics of computer forensics, legal and ethical considerations, and the importance of maintaining the integrity of digital evidence.
2. Apply different types of computer forensic tools to preserve the integrity of data in the network.
3. Analyze and validate forensics data from the communicating devices to detect intruders.
4. Apply the various firewall techniques to detect the vulnerabilities in the networks.
5. Implement real-world hacking techniques to test system security and to ensure the system's safety from hackers.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	2			2					2	
2	2	2	3	2	3			2					2	
3	2	1	3	2	2			3					2	
4	2	1	2	3	3			3					3	
5	2	2	2	2	3			3					3	

UNIT I **9 Hours**

INTRODUCTION TO COMPUTER FORENSICS

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques Incident and incident response methodology Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. Forensics Technology and Systems, Understanding Computer Investigation, Data Acquisition.

UNIT II **9 Hours**

EVIDENCE COLLECTION AND FORENSICS TOOLS

Processing Crime and Incident Scenes, Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT III **9 Hours**

ANALYSIS AND VALIDATION

Validating Forensics Data, Data Hiding Techniques, Performing Remote Acquisition, Network Forensics, Email Investigations, Cell Phone and Mobile Devices Forensics.

UNIT IV **9 Hours**

E-MAIL SECURITY

PGP - S/MIME, Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology, Types of Firewalls, Firewall designs, SET for E-Commerce Transactions

UNIT V **9 Hours**

ETHICAL HACKING IN WEB

Social Engineering, Denial of Service, Session Hijacking, Hacking Web servers, Hacking Web Applications, SQL Injection, Hacking Wireless Networks, Hacking Mobile Platforms.

Total: 45 Hours

Reference(s)

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
4. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, Cengage Learning, 2nd Edition, 2005.
5. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

22IT022 ETHICAL HACKING 3 0 0 3

Course Objectives

- To learn about the importance of information security.
- To learn different scanning and enumeration methodologies and tools.
- To understand various hacking techniques and attacks.
- To be exposed to programming languages for security professionals.
- To understand the different phases in penetration testing

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Enumerate the numerous assaults carried out during ethical hacking and penetration testing.
2. Apply the hacking techniques and understand the tools to be used for hacking
3. Understand the various vulnerabilities of Windows and Linux OS
4. Apply the techniques to hack web servers and tools for it.
5. Determine the characteristics of the firewall, the intruder detection mechanisms, and the malicious software to protect the system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	2								1	
2	2	2	2	3	3								2	
3	2	1	1	2	1								2	
4	1	2	2	3	3								2	
5	1	2	2	3	3								3	

UNIT I **9 Hours**

INTRODUCTION

Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II **9 Hours**

SCANNING AND ENUMERATION

Introduction to Scanning - Objectives - Scanning Methodology - Tools - Introduction to Enumeration - Enumeration Techniques - Enumeration Procedure - Tools

UNIT III **9 Hours**

SYSTEM HACKING

Introduction - Cracking Passwords - Password Cracking Websites - Password Guessing - Password Cracking Tools - Password Cracking Countermeasures - Escalating Privileges - Executing Applications - Keyloggers and Spyware

UNIT IV **9 Hours**

PROGRAMMING FOR SECURITY PROFESSIONALS

Programming Fundamentals - C language - HTML - Perl - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures - Linux OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures

UNIT V **9 Hours**

NETWORK PROTECTION SYSTEMS

Access Control Lists - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams - Honeypots.

Total: 45 Hours

Reference(s)

1. EC-Council, “Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
2. Jon Erickson, “Hacking, 2nd Edition: The Art of Exploitation", No Starch Press Inc., 2008.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2013.
4. Patrick Engebretson,"The Basics of Hacking and Penetration Testing - Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
5. RafayBoloch,"Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.

22IT023 **2 0 2 3**

CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

Course Objectives

- To understand the basics of Blockchain Technology.
- To learn Different protocols and consensus algorithms in Blockchain.
- To learn the Blockchain implementation frameworks.
- To experiment the Hyperledger Fabric, Ethereum networks.
- To understand the Blockchain Applications.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand emerging abstract models for Blockchain Technology.
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
5. Analyze the real-life applications of Blockchain Technologies.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1	-								-	

4	-	2	2	-	3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain, Public Ledgers, Blockchain as Public Ledgers, Block in a Blockchain, Transactions, The Chain and the Longest Chain, Permissioned Model of Blockchain, Cryptographic, Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH, the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW), Hashcash PoW , Bitcoin PoW, Attacks on PoW, monopoly problem, Proof of Stake, Proof of Burn, Proof of Elapsed Time, Bitcoin Miner, Mining Difficulty, Mining Pool, Permissioned model and use cases.

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue, DApps, NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc, Case Study.

EXPERIMENT 1 **5 Hours**

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

EXPERIMENT 2 **5 Hours**

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

EXPERIMENT 3 **5 Hours**

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.

EXPERIMENT 4 **5 Hours**

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.

EXPERIMENT 5 **5 Hours**

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

EXPERIMENT 6 **5 Hours**

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan.

Total: 60 Hours

Reference(s)

1. Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Melanie Swan, Blockchain: Blueprint for a New Economy, OReilly, 2015
4. Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

22IT024 MALWARE ANALYSIS 3 0 0 3

Course Objectives

- Understand the fundamentals of malware, types and its effects.
- Identify and analyze various malware types by static and dynamic analysis.
- To deal with detection, analysis, understanding, controlling, and eradication of malware.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the various concepts of malware analysis and their technologies used.
2. Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.
3. Understand the methods and techniques used by professional malware analysts.
4. To be able to safely analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	2								2	
2	3	3	2	2	2								2	
3	3	3	3	3	3								3	
4	3	3	3	3	3								3	
5	3	3	3	3	3								3	

UNIT I **9 Hours**

INTRODUCTION AND BASIC ANALYSIS

Introduction to Malware - Malware threats - Malware types: Viruses, Worms, Rootkits, Trojans, Bots, Spyware, Adware, Logic Bombs - Goals of Malware Analysis - AV Scanning - Hashing - Finding Strings - Packing and Obfuscation - PE file format - Static - Linked Libraries and Functions - Static Analysis tools - Virtual Machines and their usage in Malware analysis - Sandboxing - Basic dynamic analysis - Malware execution - Process Monitoring - Viewing processes - Registry snapshots

UNIT II **10 Hours**

ADVANCED STATIC ANALYSIS

The Stack - Conditionals - Branching - Rep Instructions- Disassembly - Global and local variables - Arithmetic operations - Loops - Function Call Conventions - C Main Method and Offsets. Portable Executable File Format - The PE File Headers and Sections - IDA Pro - Function analysis - Graphing - The Structure of a Virtual Machine - Analyzing Windows programs - Anti-static analysis techniques - obfuscation - packing - metamorphism - polymorphism

UNIT III **10 Hours**

ADVANCED DYNAMIC ANALYSIS

Live malware analysis - dead malware analysis - analyzing traces of malware - system calls - api calls - registries - network activities. Anti-dynamic analysis techniques - VM detection techniques - Evasion techniques - Malware Sandbox - Monitoring with Process Monitor - Packet Sniffing with Wireshark - Kernel vs. User-Mode Debugging - OllyDbg - Breakpoints - Tracing - Exception Handling - Patching

UNIT IV **8 Hours**

MALWARE FUNCTIONALITY

Downloaders and Launchers - Backdoors - Credential Stealers - Persistence Mechanisms - Handles - Mutexes - Privilege Escalation - Covert malware launching - Launchers - Process Injection - Process Replacement - Hook Injection - Detours - APC injection.

UNIT V **8 Hours**

ANDROID MALWARE ANALYSIS

Android Malware Analysis: Android architecture - App development cycle - APKTool - APKInspector - Dex2Jar - JD-GUI - Static and Dynamic Analysis - Case Study: Smartphone (Apps) Security

Total: 45 Hours

Reference(s)

1. Michael Sikorski and Andrew Honig,"Practical Malware Analysis" by No Starch Press, 2012, ISBN: 9781593272906
2. Bill Blunden,"The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System", Second Edition, Jones & Bartlett Publishers, 2009.
3. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel" by 2005, Addison-Wesley Professional.
4. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SÃƒÂ©bastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
5. Victor Marak,"Windows Malware Analysis Essentials" Packt Publishing, O"Reilly, 2015.
6. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere,"Android Malware and Analysis", CRC Press, Taylor & Francis Group, 2015.

22IT025 MULTIMEDIA AND ANIMATION 2 0 2 3

Course Objectives

- Understand the basic knowledge of multimedia Systems and related technologies
- To learn about multimedia elements in a comprehensive way
- Understand the basics of digital 2D animation to create story and multimedia production
- Design the technical and artistic skills to produce 3D animations.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the multimedia elements, image processing and animation
2. Analyze the encode and decode the multimedia elements
3. Apply the author 2D and 3D creative and interactive presentations for different target multimedia applications.
4. Create the 2D animation and develop the storyboards.
5. Create and animate the 3D models using software tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		2									
2	2	1	1	1	2								3	
3	3												2	2
4	2	2	2											2
5	2	3	2											2

UNIT I **6 Hours**

INTRODUCTION TO MULTIMEDIA ELEMENTS

Multimedia-Medium Properties of a Multimedia System-Traditional Data Stream Characteristics-Text-Basic Sound Concept-Speech-Computer Image Processing

UNIT II **6 Hours**

MULTIMEDIA COMPRESSION

Storage Space-Coding Requirements-Hybrid Coding-JPEG Image Preparation-Lossy Mode-Lossless Mode-Hierarchical Mode-H.261- MPEG Video Encoding-Data Stream-MPEG3-MPEG7-MPEG21

UNIT III **6 Hours**

MULTIMEDIA AUTHORING

Authoring metaphors-Tools Features and Types-Card and Page Based Tools-Icon and Object Based Tools-Time Based Tools-3D Modeling and Animation Tools-Image Editing Tools-audio Editing Tools- Digital Movie Tools-Creating interactive presentations-virtual learning-simulations.

UNIT IV **6 Hours**

2D ANIMATION

Introduction to 2D Animation-Colour theory and basics-Layout and Designing Basic of sketching-Composition of basic elements-Graphics and advertising-Creating Digital Layout-Professional image editing-Story Boarding-stop motion animation-Production-Post-Production-Background composition, 2D animation and techniques

UNIT V **6 Hours**

3D ANIMATION

3D Modeling-Modeling Techniques-Types of Modeling-3D Shading-Use of Material-Shader and Texture editing-Introduction to 3D Animation-3D Animation and Rigging-Setting up controllers for joints-Simple Skeleton structure with proper joint orientation-3D Lighting and Rendering

EXPERIMENT 1 **3 Hours**

Image Editing and Manipulation - Basic Operations on images using any image editing software

EXPERIMENT 2 **3 Hours**

Implementation of audio and Video Editing techniques

EXPERIMENT 3 **3 Hours**

Sketching of cartoon characters

EXPERIMENT 4 **3 Hours**

Design 2D Logo using the image editing tool

EXPERIMENT 5 **3 Hours**

Creating gif animated images in 2D Animation

EXPERIMENT 6 **3 Hours**

Exploring the Interface of 3D application

EXPERIMENT 7 **3 Hours**

Create different types of Materials and Shading

EXPERIMENT 8 **3 Hours**

Create a simple walk cycle using the character Rigs

EXPERIMENT 9 **3 Hours**

Create a 3-point Light Setup

EXPERIMENT 10 **3 Hours**

Create particle Simulation and Rendering

Total: 60 Hours

Reference(s)

1. Ze-Nian Li,Mark S Drew,Jiangchuan Liu,Fundamentals of Multimedia,Third Edition,Springer Texts in Computer Science-2021
2. Andleigh,P K and Kiran Thakrar,Multimedia Systems and Design,PHI,2003 Multimedia: Making It Work, Tay Vaughan, 9th Edition
3. The Illusion of Life:Disney Animation-Frank Thomas and Ollie Johnston Maraffi, Chris, Maya Character Creation: Modeling and Animation Controls New Riders,2008
4. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016
5. Mark Gaimbruno, 3D Graphics and Animation, Second Edition, New Riders, 2002.
6. Rogers David,Animation master-A Complete Guide,Charles River Media,2006

22IT026 AUGMENTED REALITY AND VIRTUAL REALITY 2 0 2 3

Course Objectives

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the tools and technologies related to AR/VR.
2. Design various models using modelling techniques.
3. Apply programming concepts and techniques specific to VR development, including 3D graphics.
4. Develop AR/VR applications in different domains.
5. Apply the technologies related to AR to build AR-enabled devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2			2	2	2		2	2	2
2	2	3	3	3	3			2	2	2		2	3	3
3	2	2	2	2	2			2	2	2		2	3	3
4	3	3	3	3	3			2	2	2		2	3	3
5	3	3	3	3	3			2	2	2		2	3	3

UNIT I **6 Hours**

INTRODUCTION

Introduction to Virtual Reality and Augmented Reality - Definition - Introduction to Trajectories and Hybrid Space -Three Is of Virtual Reality - Virtual Reality Vs 3D Computer Graphics - Benefits of Virtual Reality - Components of VR System - Introduction to AR-AR Technologies - Input Devices - Types of Trackers - Human Visual System - Personal Graphics Displays - Human Auditory System.

UNIT II **6 Hours**

VR MODELING

Modelling - Geometric Modelling - Virtual Object Shape - Object Visual Appearance - Kinematics Modelling - Transformation Matrices - Object Position - Transformation Invariants - Object Hierarchies - Physical Modelling - Behavior Modelling - Model Management.

UNIT III **6 Hours**

VR PROGRAMMING

VR Programming - Toolkits and Scene Graphs - World ToolKit - Java 3D - Comparison of World ToolKit and Java 3D

UNIT IV **6 Hours**

APPLICATIONS

Human Factors in VR - Methodology and Terminology - VR Health and Safety Issues - VR and Society- Medical Applications of VR - Education, Arts and Entertainment - Military VR Applications - Emerging Applications of VR.

UNIT V **6 Hours**

AUGMENTED REALITY

Introduction to Augmented Reality - Computer vision for AR - Interaction - Modelling and Annotation Navigation - Wearable devices.

EXPERIMENT 1 **3 Hours**

Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.

EXPERIMENT 2 **3 Hours**

Use the primitive objects and apply various projection types by handling camera.

EXPERIMENT 3 **3 Hours**

Download objects from asset store and apply various lighting and shading effects

EXPERIMENT 4 **3 Hours**

Model three dimensional objects using various modelling techniques and apply textures over them.

EXPERIMENT 5 **3 Hours**

Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.

EXPERIMENT 6 **3 Hours**

Add audio and text special effects to the developed application.

EXPERIMENT 7 **3 Hours**

Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity

EXPERIMENT 8 **3 Hours**

Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.

EXPERIMENT 9 **3 Hours**

Develop AR enabled simple applications like human anatomy, DNA/RNA structure visualization and surgery simulation

EXPERIMENT 10 **3 Hours**

Develop simple MR enabled gaming applications

Total: 60 Hours

Reference(s)

1. Charles Palmer, John Williamson, Virtual Reality Blueprints :Create compelling VR experiences for mobile , Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, Augmented Reality: Principles & Practice, Addison Wesley, 2016
3. John Vince, Introduction to Virtual Reality, Springer - Verlag, 2004
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality - Interface, Application, Design, Morgan Kaufmann, 2003

22IT027 GAME DEVELOPMENT 2 0 2 3

Course Objectives

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the foundations of 2D and 3d Graphics
2. Design game design documents
3. Implementation of gaming engines.
4. Survey gaming environments and frameworks.
5. Develop and construct a simple game in Pygame.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								1	1
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **6 Hours**

3D GRAPHICS FOR GAME DESIGN

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components - 2D and 3D Transformations - Projections -Color Models - Illumination and Shader Models - Animation -Controller Based Animation.

UNIT II **6 Hours**

GAME DESIGN PRINCIPLES

Character Development, Storyboard Development for Gaming -Script Design - Script Narration, Game Balancing, Core Mechanics, Principles of Level Design - Proposals - Writing for Preproduction, Production and Post - Production.

UNIT III **6 Hours**

GAME ENGINE DESIGN

Rendering Concept - Software Rendering - Hardware Rendering -Spatial Sorting Algorithms - Algorithms for Game Engine - Collision Detection - Game Logic - Game AI - Pathfinding.

UNIT IV **6 Hours**

OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS

Pygame Game development - Unity - Unity Scripts - Mobile Gaming, Game Studio, Unity Single player and Multi - Player games.

UNIT V **6 Hours**

GAME DEVELOPMENT USING PYGAME

Developing 2D and 3D interactive games using Pygame - Avatar Creation - 2D and 3D Graphics Programming - Incorporating music and sound - Asset Creations - Game Physics Algorithms Development - Device Handling in Pygame - Overview of Isometric and Tile Based Arcade Games - Puzzle Games.

EXPERIMENT 1 **3 Hours**

Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game

EXPERIMENT 2 **3 Hours**

Character design, sprites, movement and character control

EXPERIMENT 3 **3 Hours**

Level design: design of the world in the form of tiles along with interactive and collectible objects

EXPERIMENT 4 **4 Hours**

Design of interaction between the player and the world, optionally using the physics engine.

EXPERIMENT 5 **4 Hours**

Developing a 2D interactive using Pygame

EXPERIMENT 6 **4 Hours**

Developing a Puzzle game

EXPERIMENT 7 **3 Hours**

Design of menus and user interaction in mobile platforms.

EXPERIMENT 8 **3 Hours**

Developing a 3D Game using Unreal

EXPERIMENT 9 **3 Hours**

Developing a Multiplayer game using unity

Total: 60 Hours

Reference(s)

1. Sanjay Madhav, Game Programming Algorithms and Techniques: A Platform Agnostic Approach, Addison Wesley,2013.
2. Will McGugan, Beginning Game Development with Python and Pygame: From Novice to Professional, Apress,2007.
3. Paul Craven, Python Arcade games, Apress Publishers,2016.
4. David H. Eberly, 3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, Second Edition, CRC Press,2006.
5. Jung Hyun Han, 3D Graphics for Game Programming, Chapman and Hall/CRC, 2011.

22IT028 VIDEO CREATION AND EDITING 2 0 2 3

Course Objectives

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare the strengths and limitations of Nonlinear editing
2. Identify the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Address the core issues of advanced editing and training techniques.
5. Design and develop projects using AVID XPRESS DV 4.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	1	1				1	2	3	2	3	1
2	2	3	3	3	1				1	2	2	1	1	1
3	2	2	3	3	1				3	1	1	1	2	1
4	2	2	2	2	1				3	1	1	1	2	2
5	2	1	3	3	1				3	2	1	2	2	2

UNIT I **6 Hours**

FUNDAMENTALS

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II **6 Hours**

STORYTELLING

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - Understanding video color - Color Correcting Basics - Color Enhancement Effects mechanics of digital editing - pointer files - media management.

UNIT III **6 Hours**

USING AUDIO AND VIDEO

Audio: Timeline Audio Tracks - Editing Audio- Gaining, Fading and Balancing Audio- Video: Capturing digital and analog video - importing audio on putting video - exporting digital video to tape - recording to CDs and VCDs.

UNIT IV **6 Hours**

WORKING WITH FINAL CUT PRO

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V **6 Hours**

WORKING WITH AVID XPRESS DV 4

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

EXPERIMENT 1 **3 Hours**

Write a Movie Synopsis (Individual/Team Writing)

EXPERIMENT 2 **3 Hours**

Present team stories in class

EXPERIMENT 3 **3 Hours**

Script/Storyboard Writing(Individual Assignment)

EXPERIMENT 4 **4 Hours**

Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts

EXPERIMENT 5 **4 Hours**

Production: Single camera production personnel

EXPERIMENT 6 **3 Hours**

Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching

EXPERIMENT 7 **4 Hours**

Write Documentary and Animation Treatment

EXPERIMENT 8 **5 Hours**

Post-production: Editing, Sound design, Finishing

Total: 60 Hours

Reference(s)

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw - Hill 2003.

22IT029 DIGITAL MARKETING 3 0 0 3

Course Objectives

- Understand the overview of Digital Marketing.
- Examine the role and importance of digital marketing in the business environment.
- Determine the focuses on digital marketing and its measure

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Identify some of the latest digital marketing trends and skills sets needed for today's Marketer.
2. Compare the strengths and limitations of search engine optimisation.
3. Apply the suitable techniques for E-Mail Marketing.
4. Discover the hottest techniques to help to successfully plan, predict, and manage your digital Marketing campaigns.
5. Evaluate the importance of your digital marketing assets, which ones actually matter the most to your business.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								1	1
2	2	2	3		3								2	3
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **9 Hours**

INTRODUCTION TO ONLINE MARKET

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II **9 Hours**

SEARCH ENGINE OPTIMISATION

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT IV **9 Hours**

SOCIAL MEDIA MARKETING

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V **9 Hours**

DIGITAL TRANSFORMATION

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

Total: 45 Hours

Reference(s)

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373
2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition(April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Michael Millerth, B2B Digital Marketing: Using the Web to Market Directly to Businesses,first edition, Que Biz-Tech series2012.
5. Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice, Paperback - Import, 2012.

22IT030 PROGRAMMING ON EDGE DEVICES **3 0 0 3**

Course Objectives

- Compare Fog and Edge Computing with different sets of use cases.
- Illustrate the architecture for the edge device.
- Implement the Microcomputer RaspberryPi and device Interfacing.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze, with different use cases, the difference between Fog and Edge Computing.
2. Develop the architecture for IoT edge computing devices based on the requirements.
3. Design and configure the edge devices using RaspberryPi.
4. Implement the Microcomputer RaspberryPi and device Interfacing.
5. Analyze the requirements of Industrial and Commercial edge devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1		2										
2	3	2	2	3	2								2	
3	3	2	3	3	3								3	
4	3	2	3	2	3								3	
5	3	2	-	-	-								2	

UNIT I **9 Hours**

IOT AND EDGE COMPUTING DEFINITION AND USE CASES

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

UNIT II **9 Hours**

IOT ARCHITECTURE AND CORE IOT MODULES

A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples.

UNIT III **9 Hours**

RASPBERRYPI

Introduction to Aurdino and RaspberryPi, RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools.

UNIT IV **9 Hours**

IMPLEMENTATION OF DEVICE INTERFACING

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT communication formats.

UNIT V **9 Hours**

INDUSTRIAL AND COMMERCIAL IOT

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Total: 45 Hours

Reference(s)

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, Wiley publication, 2019, ISBN: 9781119524984.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O"Reilly Media, Inc., 2019, ISBN: 978149204322.
3. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition, 2020 by Perry Lea.

22IT031 ROBOTIC PROCESS AUTOMATION 3 0 0 3

Course Objectives

- Understand the basic concepts, methodologies and tools in RPA.
- Implement the exception handling and automation techniques using RPA.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Interpret the basic concepts and methodologies in RPA.
2. Infer the UiPath building blocks in the RPA.
3. Apply the RPA techniques to automate the application.
4. Implement the exception handling and BOT in RPA.
5. Implement the RPA to solve real time problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2		2								2	
2	2	2	3		3								2	
3	2	2	3		3								3	
4	2	3	3		3								3	
5	2	3	3		3								3	

UNIT I **9 Hours**

RPA AND PROCESS METHODOLOGIES

BPM, and BPA-Understanding RPA Skills: On-Premise Vs. the Cloud - Lean and Six Sigma Methodologies for Process Improvement - Overview of Agile Methodologies and its importance in RPA

UNIT II **9 Hours**

UIPATH ESSENTIALS

Introduction to UiPath: Installation and activation-UiPath Activities: Flowcharts, Sequences, and Data Manipulation-UiPath Variables and Data Types-Debugging techniques in UiPath-Overview of UiPath Orchestrator: BOT Development and Management-UiPath Automation Best Practices

UNIT III **9 Hours**

ADVANCED RPA TECHNIQUES

Data Manipulation: Collections and Data Table Usage-File Operations: CSV/Excel to data table and vice versa-Working with UiExplorer and Desktop Automation-Web Automation: Basic and Desktop Recording-Advanced Screen Scraping Techniques-Data Scraping and Extraction from Websites

UNIT IV **9 Hours**

HANDLING EXCEPTIONS AND USER EVENTS

Exception Handling Techniques: Try-Catch, Re-throwing Exceptions, and Custom Exception Handling-Logging, Debugging, and Error Reporting Techniques- Handling User Events: Assistant bots, System Event Triggers, and Image and Element Triggers- Monitoring Techniques in RPA- Launching an Assistant bot on a Keyboard Event

UNIT V **9 Hours**

DEPLOYMENT AND MAINTENANCE OF BOT

Overview of Orchestration Server and its functionalities- Orchestrator to Control Bots and Deploy Bots-Uploading Packages, Managing Packages, and Deleting Packages- Publishing and Managing Updates-Continuous Integration and Continuous Deployment (CI/CD) in RPA

Total: 45 Hours

Reference(s)

1. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant.
2. Srikanth Miranda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.

22IT032 AI ON EDGE COMPUTING 3 0 0 3

Course Objectives

- Understanding of the fundamental concepts, principles, and techniques of Artificial Intelligence, including its history, subfields, and applications.
- Reduce network latency and improve response times by processing data and running computations closer to the source or at the network edge.
- Address data privacy and security concerns by keeping sensitive data and computations localized at the edge devices or edge nodes.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Enable the application of machine learning and deep learning approaches to real-world problems.
2. Explore the software services, standard bodies and open source communities available for edge computing.
3. Design and optimize edge device architectures, enabling efficient and resource-constrained processing for AI applications at the edge
4. Build an intelligent data driven applications by applying the edge data processing and analytics techniques to enable the easier decision making process.
5. Deploying AI models on edge devices, ensuring efficient inference, optimization, and integration to enable AI capabilities directly at the edge.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2								2		2
2	2	2	3	3								2		2
3	2	2	3	3								2		2
4	2	3	3	3								2		2
5	2	3	3	3								2		2

UNIT I **9 Hours**

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Introduction to Artificial Intelligence and its subfields - Machine Learning algorithms and techniques - Supervised Learning - Unsupervised Learning - Reinforcement Learning - Deep Learning models and architectures

UNIT II **9 Hours**

INTRODUCTION TO EDGE COMPUTING

Overview of Edge Computing and its significance in AI applications - Edge devices and infrastructure - Challenges and opportunities in AI on Edge Computing

UNIT III **9 Hours**

EDGE DEVICE ARCHITECTURES

Edge devices and hardware platforms for AI - Accelerators and GPUs for Edge Computing - Edge computing frameworks and software tools

UNIT IV **9 Hours**

EDGE DATA PROCESSING AND ANALYTICS

Data preprocessing and feature extraction at the Edge - Real-time analytics and decision-making at the Edge - Edge-based data storage and retrieval

UNIT V **9 Hours**

AI MODEL DEPLOYMENT ON EDGE DEVICES

Model compression and optimization for resource-constrained Edge devices - On-device training and transfer learning - Model deployment and inference techniques on Edge devices

Total: 45 Hours

Reference(s)

1. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.
2. Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014.
3. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor), Wiley, 2019
4. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press)
5. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, PHI 2009.
6. Edge Computing for Internet of Things: From Device to Cloud-Based Services" by Hassan Fouad and Ammar Rayes.

22IT033 IOT ANALYTICS 3 0 0 3

Course Objectives

- * Understand the challenges of IoT analytics systems development and deployment
- * To learn about data analytics and use cloud offerings related to IoT.
- * Ability to understand the Searching and security requirements of IoT.
- * Acquire the knowledge of Tools, Platform and Services for IoT Analytics
- * To Develop IoT infrastructure for real time scenarios.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Identify the networking protocols for connecting devices and challenges of IoT Analytics
2. Understand the cloud based IoT and IoT in Data Analytics
3. Explain the concepts of Security requirements and Searching the IoT
4. Apply the different tools and services for the IoT Analytics platform
5. Analyze applications of IoT Analytics in a real time scenario

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1	3				2	2			2	
2	2	1	3	2	3				2	2			2	
3	2	2	2	3	3				2	2			2	
4	3	2	3	3	3				2	2			3	
5	3	3	3	3	3				2	3			3	

UNIT I **8 Hours**

INTRODUCTION TO IOT ANALYTICS

Introduction-IoT Data and Big Data - Challenges of IoT Analytics - Applications - IoT Devices and Networking Protocols

UNIT II **9 Hours**

IOT CLOUD, WEB SERVICES AND DATA ANALYTICS

IoT Hardware devices and its limitation - Cloud based IoT Platform - Iaas, Paas and Saas paradigms - Requirements of IoT in Big Data Analytics Platform - Functional Architecture - Data Collection Using Low-power, Long-range Radios - Web server: Web server for IoT applications

UNIT III **10 Hours**

SEARCHING THE INTERNET THINGS AND IOT SECURITY

Introduction - A search architecture for social and physical sensors - Local Event Retrieval - Sensor Metadata - Venue Recommendation - Security Requirements in IoT - Security Concerns in IoT Applications - Security Architecture in the Internet of Things - Insufficient Authentication Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT

UNIT IV **9 Hours**

TOOLS AND SERVICE FOR IOT ANALYTICS

Architecture for IoT Analytics Applications - Nodes - Development Examples - Open source framework for IoT Analytics as a service - Sensing as a service Infrastructure Tools and Platforms

UNIT V **9 Hours**

IOT ANALYTICS APPLICATIONS AND CASE STUDIES

Data Analytics and smart Building - Smart City - Data collection to deployment and operationalization using the vital platform - Transportation - Energy - Agriculture - Healthcare

Total: 45 Hours

Reference(s)

1 Andrew Minteer, Analytics for the Internet of Things: Intelligent analytics for your intelligent devices, Packt Publishing, first edition, July 2017

2 John Soldatos, Building Blocks for IoT Analytics, River Publishers Series In Signal, Image and Speech Processing, 2017

3 Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

4 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things Key applications and Protocols, Wiley, 2012

5 Practical Internet of Things Security by Brian Russell, Drew Van,2018

22IT034 **2 0 2 3**

AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES

Course Objectives

- To understand the basics of Blockchain Technology
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To experiment the Hyperledger Fabric, Ethereum networks
- To understand the Blockchain Applications

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain
3. Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application
5. Analyze the real life applications of Blockchain Technologies

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1										

4		2	2		3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions - The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic-Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH-the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue- DApps-NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc - Case Study.

EXPERIMENT 1 **5 Hours**

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

EXPERIMENT 2 **5 Hours**

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

EXPERIMENT 3 **5 Hours**

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules

EXPERIMENT 4 **5 Hours**

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network

EXPERIMENT 5 **5 Hours**

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

EXPERIMENT 6 **5 Hours**

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

Total: 60 Hours

Reference(s)

1 Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.

2 Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O Reilly, 2014

3 Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017

4 Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

5 Melanie Swan,Blockchain: Blueprint for a New Economy, O Reilly, 2015

6 Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

22IT035 XML AND WEB SERVICES 3 0 0 3

Course Objectives

- Understand the proficiency in creating, manipulating, and validating XML documents, including understanding XML syntax, structure, and key concepts and use XML technologies such as XML Schema, XPath, and XSLT
- Understanding of web services and their role in distributed systems. Explore SOAP and REST architectures, understand their differences
- Acquire practical skills in implementing XML-based web services using industry-standard technologies like SOAP and WSDL

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Infer XML technologies including XML Schema, XPath, and XSLT, enabling effective data transformation and manipulation in XML-based systems
2. Design scalable and secure web service architectures using industry-standard protocols like SOAP and REST, ensuring interoperability and efficient communication between distributed systems
3. Design and implement XML-based solutions for electronic data interchange (EDI), data validation, and interoperability, ensuring compliance with industry standards and optimizing e-business processes
4. Design and implement XML-based content management solutions, including content modeling, metadata management, and content transformation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3					2	2	1		1	1	
2	2	2	3					2	2	1		2	2	
3	2	3	3					2	2	2		2	2	
4	2	3	3					2	2	2		3	3	

UNIT I **9 Hours**

XML TECHNOLOGY FAMILY

XML - benefits - Advantages of XML over HTML - EDL -Databases - XML based standards - DTD - XML Schemas - X- Files - XML processing - DOM -SAXpresentation technologies - XSL - XFORMS - XHTML - voice XML - Transformation - XSLT - XLINK - XPATH -XQ

UNIT II **9 Hours**

ARCHITECTING WEB SERVICES

Business motivations for web services - B2B - B2C- Technical motivations - limitations of CORBA and DCOM - Service - oriented Architecture (SOA) - Architecting web services - Implementation view - web services technology stack - logical view - composition of web services - deployment view - from application server to peer to peer - process view - life in the runtime

UNIT III **9 Hours**

WEB SERVICES BUILDING BLOCK

Transport protocols for web services - messaging with web services - protocols - SOAP - describing web services - WSDL - Anatomy of WSDL - manipulating WSDL - web service policy - Discovering web services - UDDI - Anatomy of UDDI- Web service inspection - Ad-Hoc Discovery - Securing web services.

UNIT IV **9 Hours**

IMPLEMENTING XML IN E-BUSINESS

B2B - B2C Applications - Different types of B2B interaction - Components of ebusiness XML systems - ebXML - Rosetta Net Applied XML in vertical industry - Web services for mobile devices

UNIT V **9 Hours**

XML AND CONTENT MANAGEMENT

Semantic Web - Role of Meta data in web content - Resource Description Framework - RDF schema - Architecture of semantic web - content management workflow - XLANG -WSFL

Total: 45 Hours

Reference(s)

1 Ron schmelzer et al, XML and Web Services, Pearson Education, 2002
2 Sandeep Chatterjee and James Webber, Developing Enterprise Web Services: An Architects Guide, Prentice Hall, 2004.
3 Frank P. Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2002
4 Keith Ballinger,NET Web Services Architecture and Implementation, Pearson Education, 2003.
5 Henry Bequet and MeerajKunnumpurath, Beginning Java Web Services, Apress, 2004.
6 Russ Basiura and Mike Batongbacal, Professional ASP.NET Web Services, Apress,2. ASP .NET Web Services, Apress, 2003.

22IT036 MINING AND SOCIAL MEDIA WEB ANALYTICS **3 0 0 3**

Course Objectives

- To understand the foundations of Social Media and Web Analytics.
- To visualize and understand the data mining aspects in social networks.
- To solve mining problems by different algorithms.
- To understand network measures for social data.
- To understand behavioral part of web applications for Analysis.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand social media, web and social media analytics and their potential impact.
2. Understand the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Apply network measures for social media data.
5. Apply Behavior Analytics techniques to applications that leverage social media data, such as Facebook and Twitter.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		2			2				1	3	2
2	2	2	3		2			2				1	1	2
3	2	2	3		2			1				1	2	3
4	2	2	3		2			1				1	1	2
5	2	2	3		2			2				1	2	2

UNIT I **10 Hours**

ANALYTICS IN SOCIAL MEDIA AND WEB ANALYTICS TOOLS

Social Media Analytics: The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics.
Web Analytics: Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT II **9 Hours**

VISUALIZING SOCIAL NETWORKS

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

UNIT III **9 Hours**

TEXT MINING IN SOCIAL NETWORKS

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

UNIT IV **8 Hours**

NETWORK MEASURES

Centrality: Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Betweenness Centrality, Closeness Centrality, Group Centrality, Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence.

UNIT V **9 Hours**

BEHAVIOR ANALYTICS

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction.

Case Study: Mining Twitter: Overview, Exploring Twitters API, Analyzing 140 Characters; Mining Facebook: Overview, Exploring Facebooks Social Graph APIs, Analyzing Social Graph Connections.

Total: 45 Hours

Reference(s)

1. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 9th Edition, 2019.
2. Matthew A. Russell, Mining the Social Web, O"Reilly, 3rd Edition, ISBN:10:1449367615, 2019.
3. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.
4. Eric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004.
5. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
6. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.

22IT037 OPERATION AND SUPPLY CHAIN ANALYTICS **3 0 0 3**

Course Objectives

- Evaluate the effectiveness of different supply chain analytics techniques in optimizing supply chain operations.
- Synthesize data from multiple sources to develop comprehensive supply chain optimization strategies.
- Create and implement solutions to complex supply chain problems using advanced analytics techniques.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the fundamental concepts of operation in supply chain analytics.
2. Analyze supply chain data and identify opportunities for improvement.
3. Use various tools and techniques for supply chain analytics.
4. Develop strategies for optimizing supply chain operations.
5. Analyze Understand the impact of analytics on supply chain management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2			1	1			1	1	1
2	3	3	3	3	3			1	1				1	1
3	2	2	2	3	3			1	1			1		1
4	2	2	2	2	2			1	1			1		1
5	2	2	2	2	2			1	1					1

UNIT I **9 Hours**

INTRODUCTION TO OPERATION AND SUPPLY CHAIN ANALYTICS

Introduction to Supply chain management - Overview of operation and supply chain analytics - Importance of data-driven decision-making in supply chain management - Key performance indicators (KPIs) in supply chain management.

UNIT II **9 Hours**

DATA ANALYSIS FOR SUPPLY CHAIN MANAGEMENT

Data collection and analysis techniques - Data visualization and reporting - Statistical analysis for supply chain management.

UNIT III **9 Hours**

FORECASTING AND DEMAND PLANNING

Forecasting techniques for supply chain management - Demand planning and management - Sales and operations planning (S&OP).

UNIT IV **10 Hours**

INVENTORY MANAGEMENT AND OPTIMIZATION

Inventory management techniques - Safety stock and lead time optimization - Economic order quantity (EOQ) and reorder point (ROP) analysis.

UNIT V **8 Hours**

LOGISTICS AND TRANSPORTATION ANALYTICS

Transportation network optimization - Route optimization and scheduling - Warehouse and distribution center optimization

Total: 45 Hours

Reference(s)

1. "Supply Chain Analytics: Quantitative Methods for Decision Making" by Nada R. Sanders.
2. "Operations and Supply Chain Management" by F. Robert Jacobs and Richard B. Chase.
3. "Data Analytics for Supply Chain Management: Research and Applications" by Xi Chen, Hui Yang, and Lei Yu.
4. "Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl.
5. "Business Analytics: Data Analysis and Decision Making" by Christian Albright and Wayne Winston.

22IT038 SOCIAL NETWORK SECURITY 3 0 0 3

Course Objectives

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Work on the internals components of the social network.
2. Model and visualize the social network.
3. Mine the behavior of the users in the social network.
4. Predict the possible next outcome of the social network.
5. Apply social network in real time applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3									
2	1	2	2		3									
3	1		2		3									
4	1	1	2		3									
5	1	2	2		3									

UNIT I **9 Hours**

FUNDAMENTALS OF SOCIAL NETWORKING

Introduction to Semantic Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Historical overview of privacy and security - Major paradigms for understanding privacy and security.

UNIT II **9 Hours**

MODELING AND VISUALIZATION

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data - Random Walks and their Applications - Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III **9 Hours**

EXTRACTION AND MINING IN SOCIAL NETWORKING DATA

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Big data and Privacy.

UNIT IV **9 Hours**

EVOLUTION

Evolution in Social Networks - Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation - Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V **9 Hours**

ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT

Understand the access control requirements for Social Network - Enforcing Access Control Strategies - Authentication and Authorization - Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network - Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.

Total: 45 Hours

Reference(s)

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, - Computational Social Network Analysis: Trends, Tools and Research Advance, Springer, 2012.
4. Borko Furht, - Handbook of Social Network Technologies and Applications, Springer, 1 st edition, 2011
5. Charu C. Aggarwal, - Social Network Data Analytics, Springer; 2014
6. Giles, Mark Smith, John Yen, - Advances in Social Network Mining and Analysis, Springer, 2010.

22IT039 HUMAN COMPUTER INTERACTION 3 0 0 3

Course Objectives

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To learn the model and theories of human computer interaction.
- To be aware of mobile computer systems and its applications.
- To learn the guidelines for designing web user interfaces.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Collect fundamental design and evaluation methodologies of computer.
2. Design effective HCI for individuals and persons with disabilities.
3. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.
4. Design mobile application framework using HCI tools
5. Develop a web interface using various tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2				2	2			2	
2	1	2	2	2	2				2	2			2	
3	1	2	2	3					3	3			2	
4	2	2	3	2	3				2	2			2	
5	2	2	1	2	3				2	2			2	

UNIT I **9 Hours**

FOUNDATIONS OF HCI

The Human: I/O channels - Memory - Reasoning and problem solving; The Computer: Devices - Memory - processing and networks; Interaction: Models - frameworks - Ergonomics - styles - elements - interactivity- Paradigms. - Case Studies.

UNIT II **9 Hours**

DESIGN

Interactive Design: Basics - process - scenarios - navigation - screen design - Iteration and prototyping. HCI in software process: Software life cycle - usability engineering - Prototyping in practice - design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques - Universal Design.

UNIT III **9 Hours**

MODELS AND THEORIES

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements - Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV **9 Hours**

MOBILE HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V **9 Hours**

WEB INTERFACE DESIGN

Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

Total: 45 Hours

Reference(s)

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Brian Fling, -Mobile Design and Development, First Edition, OReilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, -Designing Web Interfaces, First Edition, OReilly, 2009.

22IT040 E-COMMERCE 3 0 0 3

Course Objectives

- Learn the Various e-commerce business models.
- Understand how companies use e-commerce to gain competitive advantages.
- Familiarize with the planning and execution of e-commerce projects.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Develop an understanding of the foundations, importance and applications of E-commerce
2. Understand various electronic payment types and the ways to protect against them.
3. Develop innovative new mobile commerce technologies and systems to improve the consumer experience
4. Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
5. Discuss legal issues and privacy in M-Commerce.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2			2					2	2	1	
2	2		2			2					2	2	2	
3	1		3			2					3	3	3	
4	2		2			2					2	2	2	
5	2		2			2					2	2	2	

UNIT I **9 Hours**

ELECTRONIC COMMERCE

Frame work, anatomy of ECommerce applications, ECommerce Consumer applications, ECommerce organization applications.

UNIT II **9 Hours**

CONSUMER ORIENTED ELECTRONIC COMMERCE

Mercantile Process models, Electronic payment systems: Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT III **9 Hours**

E-C OMMERCE APPLICATIONS DEVELOPMENT

The Changing Face of Application Development, Enterprise Development Needs, Enhanced Web Server, Based ECommerce Site Business Objectives, Categories of Business Value, Assessing a Site"s Current Business Value, Improving Business Value, Managed Solutions.

UNIT IV **9 Hours**

MOBILE ELECTRONIC COMMERCE

Wireless Industry Standards, Wireless Communication Platforms for LANs, Wireless WANs, Facilitators of a Wireless Environment, Concerns for the Mobile Enterprise.

UNIT V **9 Hours**

MOBILE COMMERCE: TECHNOLOGY

A Framework For The Study Of Mobile Commerce, NTT Docomos IMode, Wireless Devices For Mobile Commerce, Towards A Classification Framework For Mobile Location Based Services, Wireless Personal And Local Area Networks, The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

FOR FURTHER READING

Security Issues in ECommerce, Social media and Online Retailing, Interaction Design for ECommerce Websites.

Total: 45 Hours

Reference(s)

1. Kenneth C.Laudon, Carol Guercio Traver ECommerce 2021:Business, Technology, and society, Pearson, 16th Edition, 2021.
2. Mobile Commerce: Framework, Development, and Strategies edited by Paul S. Minhas and Zahir Irani,2019
3. Mobile Commerce: Technology, Theory and Applications by Hannu Verkasalo,3rd Edition, 2019
4. Ravi Kalakota, Andrew B Whinston, Frontiers of Electronic Commerce, Pearson, 2017
5. Gary P Schneider ,E-commerce: Strategy, Technology and Implementation, eleventh edition, Cengage Learning, 2011.

22IT041 C# and .NET 3 0 0 3

Course Objectives

- To understand the concept of Object Oriented Programming
- To apply the Object oriented concepts to solve problems using C#
- To develop Web Applications using .NET
- To develop console applications using C#
- To develop database application on .NET

Course Outcomes:

1. Understand the basics of C# and .NET framework
2. Develop applications using object-oriented aspects of C#
3. Design Windows applications
4. Create Database applications using ActiveX Data Objects
5. Develop Web based applications

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	-
2	1	3	2	1	2							2	2	-
3	1	1	2	3	2							3	1	-
4	3	1	2	1	3							2	3	-
5	2	3	3	3	3							1	2	-

UNIT I **9 Hours**

INTRODUCTION TO C#

Understanding .NET Framework - Literals – Variables- Data Types – Operators – Constants - Expressions- Program Control Statements: Branching, Looping-Casting - Methods-Arrays: Array Class, Array List- Strings: String, String Builder-Structures - Enumerations

UNIT II **9 Hours**

OBJECT ORIENTED ASPECTS OF C#

Class – Objects, Constructors – Types of Constructors - Inheritance and its types- Indexers and Properties - Polymorphism – Operator and Method Overloading - Interfaces, Abstract Class- Event Handling, Errors and Exception Handling

UNIT III **9 Hours**

APPLICATION DEVELOPMENT ON .NET

Building Windows Application - Creating Window Forms with Events and Controls - Menu and Toolbar - Delegates - Inheriting Window Forms - SDI and MDI Application - Dialog Box: Modal and Modeless

UNIT IV **9 Hours**

DATABASE APPLICATION ON .NET

Accessing data with ADO.NET: DataSet, Typed Dataset, Data Adapter - Updating Database using Stored Procedures - SQL Server with ADO.NET - Handling Exceptions – Validating Controls - Windows Application Configuration

UNIT V **9 Hours**

WEB BASED APPLICATION DEVELOPMENT ON .NET

Programming Web Application with Web Forms - Introduction to ASP.NET, Working with XML and .NET - Creating Virtual Directory and Web Application - Session Management - Web Services – web.config, Passing Datasets and Returning Datasets from Web Services - Transaction Handling, Exception Handling – Returning Exceptions from SQL Server

References:

1. Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2012
2. Christian Nagel et al. “Professional C# 2012 with .NET 4.5”, Wiley India, 2012
3. Andrew Troelsen , “Pro C# 2010 and the .NET 4 Platform, Fifth edition, APress, 2010
4. Ian Griffiths, Matthew Adams, Jesse Liberty, “Programming C# 4.0”, Sixth Edition, O’Reilly, 2010
5. Matthew MacDonald, “Beginning ASP.NET 4.5 in C#”, APress, 2012
6. Stephen C. Perry, “Core C# and .NET”, Prentice Hall, 2005

22IT042 MANAGEMENT INFORMATION SYSTEMS 3 0 0 3

Course Objectives

To understand the importance of information in business and to know the technologies and methods used for effective decision making in an organization.

Course Outcomes (COs)

1. Describe the principles of a management information system explain how computers process data into useful information and knowledge
2. Identify and describe the major types of computer hardware, software, data storage, and input/output technology used in business today
3. Describe the principal technologies and standards for networking communication and Internet access and how they support communication and e-business
4. Evaluate the role of information systems in helping people working individually and in groups make decisions more effectively
5. Analyze the relationship among ethical, social, and political issues that are raised by information systems and how they affect everyday life

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	-
2	1	3	2	1	2							2	2	-
3	1	1	2	3	2							3	1	-
4	3	1	2	1	3							2	3	-
5	2	3	3	3	3							1	2	-

UNIT I **7 Hours**

INTRODUCTION TO MANAGEMENT INFORMATION SYSTEMS

Formation of differential equations- Solutions of first order linear ODE: Leibnitzs and method of separation of variables- Cooling/Heating of an object - A falling object- Modeling of electric circuits: RL and RC circuits - Modeling of population dynamics: Exponential growth and decay - Logistic growth model

UNIT II **11 Hours**

TYPES OF INFORMATION SYSTEM (IS)

Resources and components of Information System, integration and automation of business functions and developing business models. Role and advantages of Transaction Processing System, Management Information System, Expert Systems and Artificial Intelligence, Executive Support Systems and Strategic Information Systems.

UNIT III **9 Hours**

ARCHITECTURE & DESIGN OF INFORMATION SYSTEM

Architecture, development and maintenance of Information Systems, Centralized and Decentralized Information Systems, Factors of success and failure, value and risk of IS.

UNIT IV **9 Hours**

INFORMATION SYSTEMS AND DECISION MAKING PROCESS

Programmed and Non - Programmed decisions, Decision Support Systems, Models and approaches to DSS

UNIT V **9 Hours**

Information Systems Development

Planning the Use of IT - Managing the Computing Infrastructure - Enterprise Applications - Outsourcing - user Rights and Responsibilities

Total: 45 Hours

Reference(s)

1 Management Information System, W.S Jawadekar, Tata Mc Graw Hill Publication.
2 Management Information System, David Kroenke, Tata Mc Graw Hill Publication.
3 MIS: Management Perspective, D.P. Goyal, Macmillan Business Books.
4 MIS and Corporate Communications, Raj K. Wadwha, Jimmy Dawar, P. Bhaskara Rao, Kanishka Publishers.
5 MIS: Managing the digital firm, Kenneth C. Landon, Jane P. Landon, Pearson Education.

22ITM43 PROBLEM SOLVING USING C 2 0 2 3

Course Objectives

- Understand various algorithmic techniques for solving problems.
- Learn the construct of a programming language viz. conditional and iteration
- Analyze arrays and strings, and functions

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Recollect various programming constructs and to develop C programs
2. Develop simple applications in C using basic constructs, decision making and looping
3. Implement different Operations on arrays, strings and functions
4. Implement Programs with Structures and pointers
5. Demonstrate the use of sequential and random-access file processing with the help of programs

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2		2									
2	3	3	2		2		2							
3	3	3	2		2		2							
4	3	3	2		2		2						2	
5	3	3	2		2		2						2	

UNIT I **6 Hours**

PROBLEM SOLVING USING ALGORITHMS

Algorithm Implementation - Top down design - Simple strategies for developing algorithms - Iteration - Recursion - Fundamental algorithms - Anticipating and Dealing with Errors– Scratch tool.

UNIT II **5 Hours**

BASICS OF C PROGRAMMING

Introduction to C programming - C Program Structure - Program Compilation & Execution - Character Set - Keywords - Data Types - Library functions - Control Statements: Branching and Looping.

UNIT III **7 Hours**

ARRAYS AND FUNCTIONS

One dimensional array –Two dimensional arrays –Multidimensional Array-Strings: Defining, initializing of strings, Processing strings, Array of Strings- Introduction to functions- Storage Classes - Scope Rules - Built-in and user defined functions –Passing Arrays to Function - Call by value – Call by reference - Recursion

UNIT IV **7 Hours**

POINTERS AND STRUCTURES

Wireless Industry Standards, Wireless Communication Platforms for LANs, Wireless WANs, Facilitators of a Wireless Environment, Concerns for the Mobile Enterprise.

UNIT V **5 Hours**

FILE PROCESSING

Files — Basic file handling functions - Types of file processing: Sequential access file - Random access file – Transaction processing using random access files — Command line arguments – Macros and Pre-processor directives.

EXPERIMENT 1 **3 Hours**

Write a C program to perform arithmetic operations on integers and floating point numbers..

EXPERIMENT 2 **3 Hours**

Write a C program to implement ternary operator and relational operators.

EXPERIMENT 3 **3 Hours**

Write a C program to read the values of A, B, C through the keyboard. Add them and after addition check if it is in the range of 100 to 200 or not. Print separate message for each.

EXPERIMENT 4 **3 Hours**

Write a C program to display the roots of a quadratic equation with their types using switch case.

EXPERIMENT 5 **3 Hours**

Write a C program to generate the following triangle.

1
1 2 3
1 2 3 4 5
1 2 3 4 5 6 7

EXPERIMENT 6 **3 Hours**

Write a C program to get a matrix of order 3x3 and display a matrix of order of 4x4, with the fourth row and column as the sum of rows and columns respectively.

EXPERIMENT 7 **3 Hours**

Write a C program to remove the occurrence of "the" word from entered string

EXPERIMENT 8 **3 Hours**

Write a C program to find the factorial of given number.

EXPERIMENT 9 **3 Hours**

Design a structure to hold the following details of a student. Read the details of a student and display them in the following format Student details: rollno, name, branch, year, section, cgpa.
****

NAME:
ROLL NO:
BRANCH:
YEAR:
SECTION:
CGPA:

EXPERIMENT 10 **3 Hours**

Create two files test1.txt and test2.txt and write a C program to read the file text1.txt character by character on the screen and paste it at the end of test2.txt.

Total: 60 Hours

Reference(s)

1 Herbert Schildt, C -The complete Reference, Tata McGraw-Hill, 2013
2 Byron Gottfried , Programming with C, Schaum's Outlines, Tata Mcgraw-Hill,
3 E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012
4 Kernighan B W and Ritchie O M, The C programming Language. Prentice-Hall of India, 2009

22ITM44 DATA STRUCTURES USING C++ 2 0 2 3

Course Objectives

- To understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures
- To analyze the performance of algorithms using time and space complexity.
- To understand the behavior of Linear and Non-Linear data structures
- To choose the appropriate data structures for a specified application
- To write programs in C++ to solve problems using various data structures.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the performances of the sorting and searching algorithms
2. Apply linked list linear data structures operations using dynamic memory allocation
3. Apply stack and Queue data structure operations to solve computational problems
4. Design tree data structures and hashing techniques for effective searching of data
5. Build algorithms for solving real world problems using Graph data structure

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2		2									
2	3	3	2		2		2							
3	3	3	2		2		2							
4	3	3	2		2		2						2	
5	3	3	2		2		2						2	

UNIT I **5 Hours**

INTRODUCTION

Introduction to data structures-types of data structures- Pseudo code - Abstract data types - ADT Implementations performance analysis- time complexity and space complexity- basics of OOPS concepts.

UNIT II **6 Hours**

SORTING AND SEARCHING TECHNIQUES

Searching methods: Linear and binary search methods, Sorting techniques: Insertion Sort - Selection Sort - Bubble Sort - Merge sort - Quick sort.

UNIT III **6 Hours**

LINEAR DATA STRUCTURES

Stack operation - Stack ADT - Applications of stack - Queues operations - Queue ADT - Queue applications – Linked List - Circular - Doubly linked list.

UNIT IV **6 Hours**

TREE

Basic Tree concepts - Binary Trees - Tree Traversals - Binary Search Trees – B Tree - Heap concepts - Heap ADT.

UNIT V **7 Hours**

GRAPHS

Introduction – types of graph- Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm. Minimum Spanning Tree: Prim's Algorithm - Kruskal's Algorithm- graph search methods DFS, BFS

EXPERIMENT 1 **3 Hours**

Implementation of searching algorithms
a) Linear Search
b) Binary Search

EXPERIMENT 2 **4 Hours**

Implementation of sorting algorithms
a) Insertion sort
b) Selection sort
c) Quick sort
d) Merge sort

EXPERIMENT 3 **4 Hours**

Construct a stack ADT and perform push and pop operations.

EXPERIMENT 4 **4 Hours**

Construct a Queue ADT and perform enqueue and dequeue operations.

EXPERIMENT 5 **3 Hours**

Develop a program to create a Binary Search Tree and to traverse the tree.

EXPERIMENT 6 **3 Hours**

Compute the shortest path from a single source node using Dijikstras Algorithm.

EXPERIMENT 7 **4 Hours**

Construct a graph and perform graph traversal (BFS, DFS)

EXPERIMENT 8 **5 Hours**

Develop a program to construct a minimum spanning tree with the given graph using:
a) Prims Algorithm
b) Krushkals Algorithm

Total: 60 Hours

Reference(s)

1. A Abirami, Priya R L , Advanced Data Structures and Algorithms , BPB publisher, 2023 March.
2. Data Structures using C++, Special Edition-MRCET, Tata McGraw-Hill Publishers 2017.
3. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and Mount, Wiley student edition, John Wiley and Sons, 2011.
4. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition, 2013.
5. D.S. Malik, Data Structures Using C++, Second Edition 2010.

22ITM45 DATABASE PROGRAMMING USING SQL 2 0 2 3

Course Objectives

- Understand the basics of database design and relational model.
- Use SQL commands to interact with the database and perform various operations in the database.
- Design a real-world application connected with backend database

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PSO1: Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Identify and analyze the essential concepts and key issues involved in the design of a database.
2 Apply the concepts of relational model and relational query language to perform various database operations.
3 Design database using basic SQL commands.
4 Implement integrity constraints, authorization and TCL commands in SQL.
5 Implement PL/SQL programming and database connectivity using JDBC/ODBC.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		2		2			3					1	
2	2	3	3		2								2	
3	3		2		3								1	
4	3		3		3								1	
5	3	2	3										1	

Unit I **5 Hours**

DATABASE DESIGN

Database-System Applications, Purpose of Database Systems – File system drawbacks, Data Models, View of Data, Database Languages, Database Architecture, Database Users and Administrators.

Unit II **5 Hours**

RELATIONAL MODEL

Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Algebra operations – select, project, union, set difference, Cartesian product, rename.

Unit III **8 Hours**

BASIC SQL QUERY

Introduction to SQL, SQL domain types, Basic DDL commands – Create, Insert, delete, alter, drop, and rename, SQL Clause - select, where, from, order by, between, and, or, not, String operations in SQL, Set operations, null values in SQL, Aggregate functions and its clauses.

Unit IV **6 Hours**

INTERMEDIATE SQL QUERY

SQL Join operations, Views in SQL, Integrity constraints in SQL – not null, primary key, foreign key, unique and check, Assertions, TCL Commands – Commit, Save point and Rollback, Authorization in SQL – grant, revoke and roles.

UNIT V **6 Hours**

PL/SQL PROGRAMMING AND DATABASE CONNECTIVITY

PL/SQL Programming - Functions, Procedures, Triggers and Cursors, Database connectivity with an application.

List of Laboratory Experiments

EXPERIMENT 1 **5 Hours**

Data Definition Language and Data Manipulation Language commands

EXPERIMENT 2 **3 Hours**

SQL Clause, String operations in SQL, Set operations and Aggregate functions.

EXPERIMENT 3 **3 Hours**

Views, Joins and Integrity constraints in SQL

EXPERIMENT 4 **3 Hours**

Transaction Control Language and Authorization commands in SQL

EXPERIMENT 5 **2 Hours**

Database Programming: Implicit and Explicit Cursors

EXPERIMENT 6 **2 Hours**

Procedures and Functions

EXPERIMENT 7 **2 Hours**

Database Programming: Triggers

EXPERIMENT 8 **3 Hours**

Database Connectivity with Front End Tools

EXPERIMENT 9

Case Study using real life database applications

Total 60 Hours

References

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.
3. C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
5. G.K.Gupta, Database Management Systems, Tata McGraw Hill, 2011.

Online Resources

1. https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/
2. https://www.javatpoint.com/dbms-tutorial
3. https://onlinecourses.nptel.ac.in/noc22_cs91

22ITM46 ROBOTIC PROCESS AUTOMATION TECHNIQUES **2 0 2 3**

Course Objectives

- To provide insights on robotic process automation (RPA) technology and its value proposition.
- To introduce different platforms for RPA.
- To illustrate basic programming concepts and the underlying logic/structure related to RPA.
- To describe the different types of variables, Control Flow and data manipulation techniques in a RPA platform.
- To describe automation to Email and various types of Exceptions and strategies to handle.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PSO1: Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the need for Robotic Process Automation Technology.
2. Compare several types of data inside a workflow and build workflows in a RPA platform.
3. Interpret Image, Text and Data Tables Automation.
4. Demonstrate Desktop, Web and Citrix Automation.
5. Design automation to Email and various types of Exceptions and strategies to handle.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2		1					2	1		1	

2	2	3	3		2					2	1		1	
3	3	2	3		2					3	2		2	
4	2	2	3		3					2	3		2	
5	2	3	3		3					2	3		3	

Unit I **8 Hours**

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION

Evolution of RPA- Future of RPA- Differentiating RPA from Automation- Benefits- Types of Bots- Application areas of RPA- Working of Robotic Process Automation- RPA development methodology and key considerations- Basic components in a RPA platform- Types of Templates- User Interface- Domains in Activities- Workflow Files in the RPA platform.

Unit II **6 Hours**

PROCESS COMPONENTS AND ACTIVITIES

User Interface Automation Activities - System Activities – Variables - Managing Variables - Naming Best Practices – The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables – Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices – The Arguments Panel - Using Arguments - Imports Panel and User Events.

Unit III **5 Hours**

APP INTEGRATION, RECORDING AND SCRAPING

App Integration - Recording- Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - Workflow Activities.

Unit IV **6 Hours**

DATA MANIPULATION AND PDF AUTOMATION

Data Manipulation- Automation of Virtual Machines- Introduction to Native Citrix Automation- Image based automation - Keyboard based automation – Information Retrieval - Advanced Citrix Automation challenges - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

UNIT V **5 Hours**

WORKFLOW MANAGEMENT AUTOMATION

Programming – Debugging - Error Handling – Logging – Extensions -Project Organization -RPA Orchestrator Overview, Orchestrator activities, Introduction to Orchestrator Community Edition (CE).

List of Laboratory Experiments

EXPERIMENT 1 **3 Hours**

Install UI path and UI path Studio

EXPERIMENT 2 **3 Hours**

Create a sequence with user's first and last name as input, and order user's favorite snacks, and display the amount

EXPERIMENT 3 **3 Hours**

Design a Process to perform a basic calculation using Arguments.

EXPERIMENT 4 **3 Hours**

Build a Guessing game using Flow Chart

EXPERIMENT 5 **3 Hours**

Create a workflow to display welcome message when the user enters the correct password.

EXPERIMENT 6 **3 Hours**

Create a workflow that will input data from a spreadsheet into the form fields of RPA Challenge.

EXPERIMENT 7 **3 Hours**

Create an automation process that goes through each element of an array, write the length of array and each element to the output panel.

EXPERIMENT 8 **3 Hours**

Design a process to read and closes all PDF files from a folder.

EXPERIMENT 9 **3 Hours**

Automate Calculator Application using Desktop recording

EXPERIMENT 10 **3 Hours**

Handel the Format exception and System exception in basic calculation program.

Total 60 Hours

References

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, Mumbai, 2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.
3. Richard Murdoch, "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant" (1st Edition), Independently published, 2018. ISBN 978-1983036835
4. A Gerardus Blokdyk, "Robotic Process Automation RpaA Complete Guide ", 2020

Online Resources

1. https://www.automationanywhere.com/rpa/robotic-process-automation
2. https://www.geeksforgeeks.org/robotics-process-automation-an-introduction/

22ITM47 FRONT END DESIGN USING HTML, CSS 2 0 2 3

Course Objectives

- Provide basic knowledge of web design using HTML and CSS
- Develop elegant and responsive Front-end by leveraging latest technologies

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Understand foundational web concepts, architectures, and technologies.
2 Demonstrate proficiency in creating well-formed and semantically meaningful HTML documents.
3 Apply class attributes of HTML elements to use multimedia contents in their webpage design.
4 Apply various CSS styling techniques to enhance the visual presentation of web pages.
5 Analyze control layout and positioning of HTML elements to grasp the user attention on web pages.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3	2		1						1	2	1	
2	2	3	2		3						3	3	2	
3	2	3	2		3						3	3	2	
4	3	3	2		3						3	3	1	
5	1	3	2		3						3	3	2	

Unit I **6 Hours**

INTRODUCTION

Web Basics: Internet, Intranet, WWW, Static and Dynamic Web Page; Web Clients; Web Servers; Client Server Architecture: Single Tier, Two-Tier, Multi-Tier; HTTP: HTTP Request and Response; URL, Client Side Scripting, Server Side Scripting, Web 1.0, Web 2.0.

Unit II **6 Hours**

HYPER TEXT MARKUP LANGUAGE – PART 1

Introduction to HTML; Elements of HTML Document; HTML Elements and HTML Attributes, Headings, Paragraph, Division, Formating: b, i, small, sup, sub; Spacing: Pre, Br; Formatting Text Phrases: span, strong, tt; Image element; Anchors; Lists: Ordered and Unordered and Definition; Tables; Frames.

Unit III **6 Hours**

HYPER TEXT MARKUP LANGUAGE – PART 2

Forms: Form Elements, ID attributes, Class Attributes of HTML Elements; Meta Tag, Audio, Video, Canvas, Main, Section, Article, Header, Footer, Aside, Nav, Figure Tags; HTML Events: Window Events, Form Element Events, Keyboard Events, Mouse Events.

Unit IV **6 Hours**

CASCADING STYLE SHEETS

Introduction; Cascadding Style Sheets (CSS); CSS Syntax; Inserting CSS: Inline, Internal, External, ID and Class Selectors; Colors; Backgrounds; Borders; Text; Font; List; Table; CSS Box Model; Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin; Positioning: Relative, Float, Absolute; CSS3 Borders, Box Shadows, Text Effects and shadow; Basics of Responsive Web Designs; Media Queries, Introduction to Bootstrap.

UNIT V **6 Hours**

LAYOUTS: FLOATS, FLEXBOX, AND CSS GRID FUNDAMENTALS

The 3 ways of building layout - Building a simple float layout – Introduction to Flexbox – Spacing and Aligning Flex Items – The Flex Property - Building a simple flexbox layout – Introduction to CSS Grid – Sizing Grid Columns and Rows – Placing and Spanning Grid Items – Aligning Grid Items and Tracks – Building a Simple CSS Grid Layout.

List of Laboratory Experiments

EXPERIMENT 1 **2 Hours**

Introduction to Web Design and HTML

EXPERIMENT 2 **3 Hours**

HTML Tags:-Develop and demonstrate a HTML document that illustrates

a. Use of Formatting Text.
b. Headings tags(H1,H2,H3,H4,H5,H6)
c. Font Details (Font Size,Style, Type, Color)
d. Setting Color(BG Color)

EXPERIMENT 3 **3 Hours**

Table & Lists:- Develop and demonstrate a HTML document that illustrates

a. Unordered List (UL)
b. Ordered List (OL) and Definition list (DL)
c. Table Alignment (Cell Spacing, Cell Padding, Height, Width, Border, Rowspan, colspan)
d. Setting Different Table Attributes (Color, Image)

EXPERIMENT 4 **4 Hours**

Image & Link:- Develop and demonstrate a HTML document that illustrates

a. Image as a background
b. Hyperlink using an image
c. Hyperlink with another web page (A, Base, Href)
d. Link to email address, FTP Websites

EXPERIMENT 5 **5 Hours**

Forms:- Develop and demonstrate a HTML document that illustrates

Create "Website Login Form" which consists of following details User Name , Password Address, Ph no, Sex, Hobbies, Date Of Birth ,Country , along with submit and Reset Button.

EXPERIMENT 6 **4 Hours**

Multimedia:-

a. Develop a web page to play audio file using Tag.
b. Develop a web page to play video file using Tag.

EXPERIMENT 7 **4 Hours**

DHTML

a. Create a CSS document on Internal style sheet
b. Create a CSS document on External style sheet
c. Create a CSS document on In line style sheet
d. Create a CSS document on placing Images at different position

EXPERIMENT 8 **5 Hours**

Use Inspector/Firebug to try different layouts using the CSS position directive. Move picture, interests and course info around. Here's a reference on CSS positioning. Put picture on the right and the rest of info on the left.

Total 60 Hours

References

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education,2007.
3. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
4. Marty Hall and Larry Brown, Core Web Programming Second Edition, Volume I and II,Pearson Education, 2001.

Online Resources

1. https://www.w3schools.com/html/html_css.asp
2. https://www.javatpoint.com/html-with-css
3. https://www.geeksforgeeks.org/html-tutorial/

22ITM48 DATA ANALYSIS USING PYTHON 2 0 2 3

Course Objectives

- To impart knowledge about the basic of python, class and objects, modules and files
- To understand the steps in preprocessing the data.
- To perform descriptive statistics and data visualization techniques to present insights from the data.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PSO2: Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1 Understand the basics of python for performing data analysis.

2 Implement standard data visualization and data analysis procedures.

3 Analyze the data with a wider range of exploratory and inferential methods.

4 Perform simple statistical analysis, create meaningful data visualizations and predict future trends from data.

5 Implement python packages for mathematical, scientific applications and for web data analysis.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2			3	2								3
2	2	3	2		3									2
3		3			3	3								2
4	3	2	2		3									3
5			2		3	2								3

Unit I **7 Hours**

PYTHON FUNDAMENTALS FOR DATA ANALYSIS

Python data structures - Control statements – Functions - Object Oriented programming concepts using classes - objects and methods - Exception handling - Implementation of user-defined Modules and Package -File handling in python.

Unit II **5 Hours**

INTRODUCTION TO DATA UNDERSTANDING AND PREPROCESSING

Data Analysis process - Dataset generation - Importing Dataset: Importing and Exporting Data - Basic insights from Datasets - Cleaning and Preparing the Data: Identify and Handle Missing Values.

Unit III **8 Hours**

DATA PROCESSING AND VISUALIZATION

Data Formatting - Exploratory Data Analysis - Filtering and hierarchical indexing using Pandas - Data Visualization: Basic Visualization Tools - Specialized Visualization Tools - Seaborn Creating and Plotting Maps.

Unit IV **5 Hours**

MATHEMATICAL AND SCIENTIFIC APPLICATIONS FOR DATA ANALYSIS

Numpy and Scipy Package - Understanding and creating N-dimensional arrays - Basic indexing and Slicing - Boolean indexing - Fancy indexing - Universal functions.

UNIT V **5 Hours**

ANALYZING WEB DATA

Data wrangling - Web scraping - Combining and merging data sets - Reshaping and pivoting - Data Transformation - String Manipulation - Case study for web scraping.

List of Laboratory Experiments

EXPERIMENT 1 **4 Hours**

Programs to demonstrate usage of control

a. Program that reads a set of integers and displays the first and second largest numbers.
b. Program to print the sum of first ‘n’ natural numbers.
c. Program to find the product of two matrices.

EXPERIMENT 2 **4 Hours**

Clean and prepare the California housing dataset for analysis.

a. Identify and handle missing data.
b. Identify and remove outliers.
c. Convert categorical variables to numerical variables.
d. Explore the distribution of the data after cleaning and preparing it.

EXPERIMENT 3 **8 Hours**

Visualizations

a. Find the data distributions using box and scatter plot.
b. Visualizing Measures of Central Tendency, Variation, and Shape.
c. Show the outliers using plot.
d. Plot the histogram, bar chart and pie chart on sample data.
e. Find the mean, median, standard deviation and quantiles of a set of observations

EXPERIMENT 4 **6 Hours**

Write a program to create numpy arrays and do slice arrays, add array indexes, and apply arithmetic, logic, and aggregation functions to some or all array elements.

EXPERIMENT 5 **8 Hours**

Implement Data wrangling with the below functionalities:

a. Load the data into a dataframe, and visualize the data in a tabular format.
b. Dealing with missing values
c. Data Replace
d. Filtering data
e. Merge two raw data into the desired format
f. Remove Duplication

Total 60 Hours

References

1. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media.
2. ReemaThareja, "Python Programming using Problem Solving approach",Oxford University press .
3. Wes Mckinney "Python for Data Analysis", First edition, Publisher O'Reilly Media.

Online Resources

1. https://www.w3schools.com/datascience/ds_python.asp
2. https://www.geeksforgeeks.org/data-science-with-python-tutorial/

22ITM49 **SOFTWARE ENGINEERING METHODOLOGIES** **2 0 2 3**

Course Objectives

- To understand Software Engineering Lifecycle Models
- To Perform software requirements analysis
- To gain knowledge of the System Analysis and Design concepts
- To understand software testing and maintenance approaches

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO2: Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1 Understand various Software Development Lifecycle Models.
2 Classify end-user requirements into system and software requirements
3 Analyze project management approaches as well as cost and schedule estimation strategies
4 Apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices
5 Develop a simple testing report

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3									1		3
2	2	1	2		1									2
3	2	1	3											2
4	1	2	3	2								1		3

5	1	2	3									1		3

Unit I **6 Hours**

SOFTWARE PROCESS AND PROJECT MANAGEMENT

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile process-Extreme programming-XP Process.

Unit II **5 Hours**

REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document — Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management.

Unit III **8 Hours**

SOFTWARE DESIGN

Design process — Design Concepts-Design Model– Design Heuristic — Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design

Unit IV **6 Hours**

TESTING AND MAINTENANCE

Software testing fundamentals-Internal and external views of Testing-white box testing — basis path testing-control structure testing-black box testing- Regression Testing — Unit Testing — Integration Testing — Validation Testing — System Testing and Debugging

UNIT V **5 Hours**

PROJECT MANAGEMENT

Software Project Management: Estimation — LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model — Project Scheduling — Scheduling, Earned Value Analysis Planning — Project Plan, Planning Process, RFP Risk Management — Identification, Projection — Risk Management-Risk Identification- RMMM Plan-CASE TOOLS

List of Laboratory Experiments

EXPERIMENT 1 **3 Hours**

Development of problem statements.

EXPERIMENT 2 **5 Hours**

Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents.

EXPERIMENT 3 **4 Hours**

Preparation of Software Configuration Management and Risk Management related documents.

EXPERIMENT 4 **8 Hours**

Performing the design by using any design phase CASE tools

EXPERIMENT 5 **4 Hours**

Develop test cases for unit testing and integration testing

EXPERIMENT 6 **6 Hours**

Develop test cases for various white box and black box testing techniques.

Laboratory	**30 Hours**
Theory	**30 Hours**
Total	**60 Hours**

Referenc

es

1. Roger S. Pressman, "Software Engineering – A practitioner's Approach", Sixth Edition, McGraw-Hill International Edition, 2010 220- 294
2. Ian Sommerville, ―Software Engineering‖, 9th Edition, Pearson Education Asia, 2011 360- 427

Online Resources

1. https://www.geeksforgeeks.org/software-engineering-software-design-process/
2. https://www.geeksforgeeks.org/test-case/
3. https://www.javatpoint.com/test-case

22OIT01 DATA STRUCTURES 3 0 0 3

Course Objectives

- To understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures
- To analyze the performance of algorithms using time and space complexity.
- To understand the behavior of Linear and Non-Linear data structures
- To choose the appropriate data structures for a specified application
- To write programs in C++ to solve problems using various data structures.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the performances of the sorting and searching algorithms
2. Apply linked list linear data structures operations using dynamic memory allocation
3. Apply stack and Queue data structure operations to solve computational problems
4. Design tree data structures and hashing techniques for effective searching of data
5. Build algorithms for solving real world problems using Graph data structure

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2		2									
2	3	3	2		2		2							
3	3	3	2		2		2							
4	3	3	2		2		2						2	
5	3	3	2		2		2						2	

UNIT I **8 Hours**

INTRODUCTION

Introduction to data structures-types of data structures- Pseudo code - Abstract data types - ADT Implementations performance analysis- time complexity and space complexity- basics of OOPS concepts.

UNIT II **9 Hours**

SORTING AND SEARCHING TECHNIQUES

Searching methods: Linear and binary search methods, Sorting techniques: Insertion Sort - Selection Sort - Bubble Sort - Merge sort - Quick sort.

UNIT III **11 Hours**

LINEAR DATA STRUCTURES

Stack operation - Stack ADT - Applications of stack - Queues operations - Queue ADT - Queue applications – Linked List - Circular - Doubly linked list.

UNIT IV **11 Hours**

TREE

Basic Tree concepts - Binary Trees - Tree Traversals - Binary Search Trees – B Tree - Heap concepts - Heap ADT.

UNIT V **6 Hours**

GRAPHS

Introduction – types of graph- Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm. Minimum Spanning Tree: Prim's Algorithm - Kruskal's Algorithm- graph search methods DFS, BFS

Total: 45 Hours

Reference(s)

1. A Abirami, Priya R L , Advanced Data Structures and Algorithms , BPB publisher, 2023 March.
2. Data Structures using C++, Special Edition-MRCET, Tata McGraw-Hill Publishers 2017.
3. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and Mount, Wiley student edition, John Wiley and Sons, 2011.
4. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition, 2013.
5. D.S. Malik, Data Structures Using C++, Second Edition 2010

22OIT02 C++ PROGRAMMING 2 0 2 3

Course Objectives

- To understand the concept of Object-Oriented Programming
- To apply the Object-Oriented concepts to solve problems using C++

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Implement C++ programs using classes and objects.
2. Develop C++ programs using the concept of Inheritance.
3. Design applications using virtual functions.
4. Understand the concept of Operator overloading.
5. Develop GUI applications using C++ library classes.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2			2									
2	1	2			2									
3	1	3	2		2								2	
4	1	3	1		2								2	
5	1	3	3		2								3	

UNIT I **5 Hours**

BASICS OF C++ PROGRAMMING

C++ Program Structure, Character Set and Tokens, Data Type, Type Conversion, Preprocessor Directives, Namespace, Input/output Streams and Manipulators, Dynamic Memory Allocation with new and delete, Control Statements. Functions: Function Overloading, Inline Functions, Default Argument, Pass by Reference, Return by Reference, Scope and Storage Class. Pointers: Pointer variables declaration & initialization, Operators in pointers, Pointers and Arrays, Pointer and Function.

UNIT II **6 Hours**

CLASSES & OBJECTS

A Simple Class and Object, accessing members of class, Initialization of class objects: (Constructor, Destructor), Default Constructor, Parameterized Constructor, Copy Constructor, The Default Copy Constructor, Objects as Function Arguments, Returning Objects from Functions, Structures and Classes, Memory allocation for Objects, Static members, Member functions defined outside the class.

UNIT III **7 Hours**

OPERATOR OVERLOADING & INHERITANCE

Fundamental of operator overloading, Restriction on operator overloading, Operator functions as a class member, Overloading unary and binary operator, Introduction to inheritance, Derived Class and Base Class, Access Specifiers (private, protected, and public), Types of inheritance.

UNIT IV **6 Hours**

VIRTUAL FUNCTION & POLYMORPHISM

Concept of Virtual functions, Late Binding, Abstract class and pure virtual functions, Virtual Destructors, Virtual base class, Friend function and Static function, Assignment and copy initialization, Copy constructor, This pointer, Concrete classes, Polymorphism and its roles.

UNIT V **6 Hours**

FUNCTION TEMPLATES AND EXCEPTION HANDLING

Function templates, Function templates with multiple arguments, Class templates, templates and inheritance, Exceptional Handling (Try, throw and catch), Use of exceptional handling.

List of Laboratory Experiments

Experiment 1 **3 Hours**

Introduction to Object Oriented Programming- Classes and Objects.

Experiment 2 **5 Hours**

Programs using Constructor, Destructor

Experiment 3 **4 Hours**

Programs on operator overloading.

Experiment 4 **5 Hours**

Programs on Inheritance

Experiment 5 **3 Hours**

Programs on Virtual Function

Experiment 6 **3 Hours**

Programs on Friend Function

Experiment 7 **3 Hours**

Programs on exception handling

Experiment 8 **4 Hours**

Programs on Function and Class Templates

Total 60 Hours

Reference(s)

1. E Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing, New Delhi, 2011.
2. Robert Lafore, Object Oriented Programming in C++, Galgotia Publication, 2010.
3. B Trivedi, Programming with ANSI C++, Oxford University Press, 2010
4. H M Deitel and P J Deitel, C++ How to Program, Seventh Edition, Prentice Hall, 2010
5. K R Venugopal, Rajkumar and T Ravishankar, Mastering C++, Tata McGraw Hill Publishing, New Delhi, 2010

22OIT03 PROGRAMMING IN JAVA 2 0 2 3

Course Objectives

- To understand the concept of Object-Oriented Programming
- To develop console applications using Java.
- To develop GUI applications using Java library classes.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Implement Java programs using classes and objects.
2. Develop Java programs using the concept of Inheritance.
3. Design applications using functions, files and exceptions.
4. Develop console applications using Java OOPS.
5. Develop GUI applications using Java library classes.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2			2									
2	1	2			2									
3	1	3	2		2								2	
4	1	3	1		2								2	
5	1	3	3		2								3	

UNIT I **6 Hours**

INTRODUCTION TO OOP AND JAVA FUNDAMENTALS

Object Oriented Programming — Abstraction — objects and classes — Encapsulation- Inheritance — Polymorphism- OOP in Java — Characteristics of Java — The Java Environment — Java Source File - Structure — Compilation. Fundamental Programming Structures in Java — Defining classes in Java — constructors, methods -access specifiers — static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages — JavaDoc comments.

UNIT II **6 Hours**

INHERITANCE AND INTERFACES

Inheritance — Super classes- sub classes –Protected members — constructors in sub classes- the Object class — abstract classes and methods- final methods and classes — Interfaces — defining an interface, implementing interface, differences between classes and interfaces and extending interfaces — Object cloning -inner classes, Array Lists — Strings

UNIT III **6 Hours**

EXCEPTION HANDLING AND I/O

Exceptions — exception hierarchy — throwing and catching exceptions — built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics — Streams — Byte streams and Character streams — Reading and Writing Console — Reading and Writing Files

UNIT IV **6 Hours**

MULTITHREADING AND GENERIC PROGRAMMING

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming — Generic classes — generic methods — Bounded Types — Restrictions and Limitations.

UNIT V **6 Hours**

EVENT DRIVEN PROGRAMMING

Graphics programming — Frame — Components — working with 2D shapes — Using color, fonts, and images — Basics of event handling — event handlers — adapter classes — actions — mouse events — AWT event hierarchy — Introduction to Swing — layout management — Swing Components — Text Fields, Text Areas — Buttons- Check Boxes — Radio Buttons — Lists- choices- Scrollbars — Windows –Menus — Dialog Boxes.

List of Laboratory Experiments

Experiment 1 **4 Hours**

Introduction to Object Oriented Programming- Classes and Objects.

Experiment 2 **5 Hours**

Programs using inheritance and polymorphism

Experiment 3 **5 Hours**

Programs on operator overloading.

Experiment 4 **5 Hours**

Programs on exception handling

Experiment 5 **5 Hours**

Programs on multi-threading in java

Experiment 6 **6 Hours**

Programs on java swing

Total 60 Hours

Reference(s)

1 Herbert Schildt, Java: The Complete Reference, Eleventh Edition, McGraw-Hill Education, 2018.
2 D.T. Editorial Services, Java 8 Programming Black Book, second edition, Dreamtech Press,2015.
3 Vaskaran Sarcar, Interactive Object-Oriented Programming in Java, Second edition, Apress, 2019

22OIT04 **FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS** **2023**

Course Objectives

- Understand functional components of the Database Management System
- Understand need for concurrency and transaction property
- Compare and contrast various indexing strategies in different database systems

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Identify and analyze the essential concepts and key issues involved in the design of a relational database
2. Apply the concepts of normalization and ER model to guarantee an efficient database
3. Analyze the concurrent execution of transaction process and various recoveries from failures
4. Apply indexing and query optimization techniques for a database design
5. Analyze the various advanced database systems for efficient data storage & NOSQL concepts.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		2		2			3					1	
2	2	3	3		2								1	
3	3		2		3								2	
4	3		3		3								2	
5	3	2	3										2	

Unit I RELATIONAL DATABASES 6 Hours

Purpose of Database System - Views of data - Data Models - Database System Architecture - Introduction to relational databases - Relational Model - Keys - Relational Algebra - SQL fundamentals - Advanced SQL features

Unit II DATABASE DESIGN 6 Hours

Entity-Relationship model - E-R Diagrams - Enhanced-ER Model - ER-to-Relational Mapping - Functional Dependencies - First, Second, Third Normal Forms, - Boyce/Codd Normal Form- Multivalued Dependencies and Fourth Normal Form

Unit III TRANSACTION 6 Hours

Transaction Concepts - ACID Properties - Schedules - Serializability - Concurrency Control -Need for Concurrency - Locking Protocols - Two-Phase Locking - Deadlock - Transaction Recovery - Save Points - Isolation Levels

Unit IV FILE AND QUERY PROCESSING 6 Hours

RAID - File Organization - Organization of Records in Files - Indexing and Hashing -Ordered Indices - Static Hashing - Dynamic Hashing - Query Processing Overview - Algorithms for SELECT and JOIN operations

UNIT V ADVANCED DATABASES 6 Hours

Distributed Databases: Architecture, Data Storage, Transaction Processing - Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - Graph Database.

List of Laboratory Experiments

Experiment 1 5 Hours

Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables with suitable examples.

Experiment 2 5 Hours

Implementation of different types of operators in SQL

- Arithmetic Operators
- Logical Operators
- Comparison Operator
- Special Operator
- Set Operation

Experiment 3 3 Hours

Database Querying - Simple queries, Nested queries, Sub queries & Joins

Experiment 4 3 Hours

Implement

- Group By & having clause

- Order by clause
- Indexing

Experiment 5 **4 Hours**

Create a student database table currently stored as a single table. Normalize these structures to meet the 3NF requirements and draw ER model Diagram

Experiment 6

Implementation of Database Backup & Recovery commands, Rollback, Commit & Savepoint. **5 Hours**

Experiment 7 **5 Hours**

Develop database for a BOOK PUBLISHING COMPANY

Total 60 Hours

References

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.
3. C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
5. G.K.Gupta,Database Management Systems, Tata McGraw Hill, 2011.

Online Resources

1. https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/
2. https://www.javatpoint.com/dbms-tutorial
3. https://onlinecourses.nptel.ac.in/noc22_cs91

22OCE01 ENERGY CONSERVATION AND MANAGEMENT 3 0 0 3

Course Objectives

- To develop an understanding and analyze the energy data of industries
- To carryout energy accounting and balancing
- To conduct energy audit and suggest methodologies for energy savings and
- To utilize the available resources in optimal ways

Course Outcomes (COs)

1. Classify and characterize the energy resources.
2. Illustrate the concept of green building.
3. Outline the sustainable construction practices.
4. Understand the hydropower production and conservation of water.
5. Emphasis the significance of energy and resource recovery from waste materials.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO2: Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-										1		
2	1	2					2					1		1
3	1	2					2					1		1
4	1	2					2					1		1
5	1	2					1					1		1

UNIT I **9 Hours**

INTRODUCTION TO ENERGY SCIENCE

Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment. Energy - Past & Present scenario of World; Renewable and Nonrenewable energy resources

UNIT II **9 Hours**

ENERGY CONSERVATION IN BUILDINGS

Principles of Planning of buildings: orientation, energy efficiency, utility. Components of building-classification of buildings. Green building - LEED building assessment standard – LEED certification process - Building rating system - Building energy issues – Building energy design strategies – Energy Auditing

UNIT III **9 Hours**

SUSTAINABLE CONSTRUCTION

Equipment use in excavations, foundation, concreting. Advanced Techniques in tunneling, under water construction, piling techniques, Innovations & efficiency in Highways, Railways & Harbours - linkages between economic and environmental outcomes

UNIT IV **9 Hours**

WATER CONSERVATION & SUSTAINABILITY

Types of reservoirs and its functions – Hydropower production – Types of Turbines & selections of turbines & Energy calculations. Water losses from reservoirs and channels – Canal lining & its economic aspects. Water supply systems & Irrigation methods - Rain Water Harvesting methods & benefits.

UNIT V **9 Hours**

ENERGY RECOVERY FROM WASTE

Classification and sources of wastes- Factors affecting MSW generation – Waste management hierarchy - Energy recovery from wastes: Thermochemical methods for energy production - Details of incineration, gasification and pyrolysis & biochemical conversions - Landfill gas recovery system - Principles of fermentation - Concept of MFC - Trans-esterification process - Biofuel processing - Biomass gasification - Organic waste for hydrogen production.

Total: 45 Hours

Reference(s)

1. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
2. Charles. J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, Inc., New Jersey, 2008.
3. H. M. Raghunath, Irrigation Engieering, Wiley India (P) Ltd, 2011
4. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company
5. M. Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House, ISBN-10: 8173191409,1997.
6. Lal, P.M. Sarma, Priyangshu M, Wealth from Waste: Trends and Technologies, 3rd Edition, The Energy and Resources Institute, New Delhi, ISBN: 9788179934241, 2011.
7. W. McDonough, M. Braungart, Cradle to Cradle: Remaking the Way We Make Things, United States: North Point Press, ISBN-10: 0865475873, 2002.

22OEC02 MICROCONTROLLER PROGRAMMING 3 0 0 3

Course Objectives

- Understand Series of Microcontrollers in terms of architecture, Programming and Interfacing.
- Learn Programming of PIC series of microcontrollers and learn building of hardware circuits using PIC 16F series of Microcontrollers
- Learn the emerging trends in the design of advanced Microncontrollers.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PSO2: Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Interpret the components and functionalities of 8051 Microcontrollers.
2. Develop microprocessor applications using Assembly Language Program
3. Illustrate the working nature of PIC microcontroller on various versions
4. Illustrate the interfacing of different peripherals using PIC Microcontroller
5. Analyze the architecture and instruction set of ARM Microcontroller

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											2
2		3	1											2
3			2		1									2
4			2		3									2
5			3		2									2

UNIT I **9 Hours**

8-BIT MICROCONTROLLER

Introduction-Intel 8051 architecture-Counters and Timers-Serial Interface- Interrupts- Interfacing to external memory and 8255- Instruction set- Address modes.

UNIT II **9 Hours**

8051 ALP AND APPLICATIONS

Assembly language program- Timers and Counters programming- DAC- ADC- Sensor- Keyboard and LCD.

UNIT III **9 Hours**

PIC MICROCONTROLLER

PIC Microcontroller features- PIC Architecture, Program Memory, Addressing Modes, Instruction Set, Instruction Format- Byte-oriented Instructions- Bit-oriented Instructions- Literal Instructions- Control Instructions (CALL & GOTO)- Destination Designator. MPLAB overview: Using MPLAB, Toolbars, Select Development Mode and Device type, Project, Text Editor, Assembler, MPLAB operations.

UNIT IV **9 Hours**

PIC HARDWARE

Reset, Clock, Control registers, Register banks, Program Memory Paging, Ports, Interrupts, Timer and Counter, Watchdog Timer, Power up timer, Sleep mode, I2C bus- A/D converter.

UNIT V **9 Hours**

HIGH PERFORMANCE RISC ARCHITECTURE

ARM: The ARM architecture- ARM organization and implementation- The ARM instruction set- The THUMB instruction set- Basic ARM Assembly Language Program- ARM CPU Cores.

Total: 45 Hours

Reference(s)

1. Ayala, Kenneth, "The 8051 Microcontroller", Thomson, 3rd Edition, 2004.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, " The 8051 Microcontroller and Embedded Systems", Person Education, 2nd Edition, 2004.
3. John B.Peatman, "Design with Microcontrollers", Person Education", 1st Edition, 2004.
4. Steave Furber, "ARM system-on-chip architecture" Addison Wesley, 2nd Edition, 2000.
5. A.V.Deshmukh, "Microcontrollers: Theory and Applications", Tata Mc Graw Hill, 12th reprint, 2005.

22OEI01 **PROGRAMMABLE LOGIC CONTROLLER**

L	T	P	C
3	0	0	3

Course Objectives

- To impart knowledge about automation and architecture of PLC
- To understand the PLC programming using timers, counters and advanced PLC functions.
- To familiarize the student with PLC based applications

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

The students will be able to

CO1 Outline the fundamental Concepts of Automation.

CO2 Conclude the architecture, interfacing and communication techniques of PLC.

CO3 Execute the suitable PLC Programming languages.

CO4 Attribute the various functions and instruction sets of PLC.

CO5 Generate a suitable logical programming for given applications.

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1		2	2		3							
2	2	1		2	2		3							
3	2	1		2	2		3							
4	2	1		2	2		3							
5	2	1		2	2		3							

Unit I **INTRODUCTION**

TO AUTOMATION **10 Hours**

Evolution of automation -Types of automation - Fixed, flexible and programmable automation - Batch process and continuous process - open loop system and closed loop system - Function of sensors - Proximity sensors: Capacitive and Inductive - Infrared and Laser Push-buttons and toggle switches - Actuators: Solenoid valve - servo motor - electromagnetic relays.

Unit II

ARCHITECTURE OF PLC **9 Hours**

Components of PLC - sink and source I/O cards - Processor - Memory: Types of memory, Input and Output modules: Discrete, Analog -Scan time of PLC -Interfacing computer and PLC: RS232, RS485, Ethernet - Selection criteria for PLC.

Unit III **PLC PROGRAMMING** **8 Hours**

Programming languages - Ladder logic components: User and bit Instructions, branch instructions, internal relay instruction Boolean logic using ladder logic programming, Latching -Timers: On Delay timer, OFF Delay timer and Retentive timer - Counters: Up Counter and Down Counter.

Unit IV **ADVANCED PLC FUNCTONS 10 Hours**

Instructions in PLC: Program Control Instructions, Math Instructions, Data Manipulation Instructions: Data compare operations, Data transfer operations - Sequencer and Shift register instructions- Analog Instructions: PID Controller - Scaling Instructions.

UNIT V **APPLICATIONS OF PLC 8 Hours**

Case Studies: Bottle filling system - Pick and place robot - Car Parking - Traffic light control (4 ways with pedestrian signal) -Elevators - Pneumatic stamping system - alarm annunciator system.

Total **45 Hours**

References

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2015.
2. Benjamin C Kuo, Automatic Control Systems, Prentice Hall of India, New Delhi, 2014.
3. John Park, Steve Mackay, Edwin Wright, Practical data communications for instrumentation and control, Newnes, Elsevier, 2015.
4. K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2014.
5. John W Webb and Ronald A Resis, Programmable Logic Controller, Prentice Hall of India Pvt. Ltd., New Delhi, 2013.

22OEI02 **SENSOR TECHNOLOGY** **3 0 0 3**

Course Objectives

- To impart knowledge about various sensors in multidisciplinary engineering domain.
- To familiarize students with different applications and its material handling technology
- To understand the concept of sensing circuits and its static and dynamic characteristics

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

The students will be able to

CO1 Conclude the static and dynamic characteristics of measuring instruments.

CO2 Compare the characteristics and working principles of Resistance, Inductance and Capacitance type sensors.

CO3 Construct the interfacing and signal conditioning circuit for measurement system using different types of sensor.

CO4 Analyze and select the suitable sensor for different industrial applications.

CO5 Combine the modern technologies and smart materials to design various sensors.

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	2	3	2	1	1									
3	1	2	3	3	1									
4	2	1	1	3	3									
5	1	2	1	2	3									

Unit I **SENSORS FUNDAMENTALS AND CHARACTERISTICS** **8 Hours**

Sensors: Principles of Sensing - Sensor Classification and terminology- Units of Measurements - Measurands- Sensor Characteristics: Static and Dynamic.

Unit II PHYSICAL PRINCIPLES OF SENSING 8 Hours

Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements.

Unit III INTERFACE ELECTRONIC CIRCUITS 9 Hours

Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.

Unit IV SENSORS IN DIFFERENT APPLICATION AREA 10 Hours

Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors.

UNIT V SENSOR MATERIALS AND TECHNOLOGIES 10 Hours

Materials, Surface Processing- MEMS microsystem components- Microfluidics microsystem components - Nano Technology- Smart Materials.

Total 45 Hours

References

1. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer, 2016.
2. D. Patranabis, Sensors and Transducers, 2nd Edition, Prentice Hall India Pvt. Ltd, New Delhi, 2009.
3. Guozhen Shen, Zhiyong Fan, “Flexible Electronics: From Materials to Devices”, 1st Edition, World Scientific Publishing Co, Singapore, 2015.
4. Horowitz, P., and W. Hill. The Art of Electronics. 2nd ed. Cambridge University Press, 1989.

22OEI03 **3 0 0 3**

FUNDAMENTALS OF VIRTUAL INSTRUMENTATION

Course Objectives

- Understand the basic components of Virtual Instrumentation system.
- Learn the developing VIs based on Lab VIEW software.
- To learn to develop applications based on Virtual Instrumentation system.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO10 Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12 Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

The students will be able to

CO1 Outline the concepts of traditional instruments and virtual instruments

CO2 Conclude the overview of modular programming and the structuring concepts in VI programming

CO3 Attribute the procedure to install DAQ in various OS and its interfacing methods

CO4 Implement the VI toolsets for specific applications

CO5 Generate the applications using Virtual Instrumentation software

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1										
2	3	3	2	2	2					2	2	2		
3	2	2	2	1										

4	3	3	3	1	2					1	2	2		
5	3	2	2	1	2					1	2	2		

Unit I INTRODUCTION 9 Hours

Virtual Instrumentation: Historical perspective - advantages - block diagram and architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

Unit II VI PROGRAMMING TECHNIQUES 9 Hours

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, State machine, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

Unit III DATA ACQUISITION 9 Hours

Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards - Data acquisition cards with serial communication - VI Chassis requirements. SCSI, PCI, PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

Unit IV VI TOOLSETS 9 Hours

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, windowing and filtering. Application of VI in process control designing of equipment like oscilloscope, Digital multimeter, Design of digital Voltmeters with transducer input Virtual Laboratory, Web based Laboratory.

UNIT V APPLICATIONS 9 Hours

Distributed I/O modules- Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

Total 45 Hours

References

1. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey,1997.
2. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newness, 2000.

22OEI04 **3 0 0 3**

OPTOELECTRONICS AND LASER INSTRUMENTATION

Course Objectives

- To enhance the student knowledge in fiber optics fundamentals and fabrication.
- To be recognized with industrial applications of fibers
- To understand the fundamental concepts about lasers
- To identify and describe various fiber optic imaging and optoelectronic sensor applications

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

The students will be able to

CO1 Attribute the properties of optical fibers, their light sources and detectors.

CO2 Implement the fiber-optic sensor for the measurement of various physical quantities.

CO3 Conclude the fundamentals of laser, types of laser and its working.

CO4 Outline the applications of laser for industrial applications.

CO5 Differentiate the use of laser instruments for various medical applications.

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	3	2	1	2										
3	3	2	1											
4	3	2	2	2										
5	3	2	2	2										

Unit I OPTICAL FIBERS AND THEIR PROPERTIES 9 Hours

Introduction to optical fibers - Light guidance - Numerical aperture - Dispersion - Different types of fibers and their properties - Light Sources for fiber optics, Photo detectors, source coupling, splicing and connectors.

Unit II INDUSTRIAL APPLICATION OF OPTICAL FIBERS 9 Hours

Fiber optics instrumentation system - optical fiber sensors, Measurement of pressure, temperature, current, voltage and liquid level - fiber optic communication set up - different types of modulators - detectors.

Unit III LASER FUNDAMENTALS 9 Hours

Fundamental characteristics of lasers: laser rate equation - three level system - four level system - properties of laser beams - laser modes - resonator configuration - Q- switching and mode locking - cavity dumping - types of lasers: gas lasers, solid state lasers, liquid lasers and semiconductor lasers.

Unit IV INDUSTRIAL APPLICATION OF LASERS 9 Hours

Lasers for measurement of distance and length, velocity, acceleration, atmospheric effects, sonic boom, pollutants - material processing: laser heating, melting, welding and trimming of materials - removal and vaporization - calculation of power requirements of laser for material processing.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9 Hours

Holography: basic principle, methods - holographic interferometry and application, holography for non-destructive - medical applications of lasers, laser and tissue interactive - laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

Total 45 Hours

References

1. John M. Senior, Optical Fiber Communications - Principles and Practice, Prentice Hall of India, 2010.
2. John F. Ready, Industrial Applications of Lasers, Academic Press, 2012.
3. Gerd Keiser, Optical Fiber Communication, Mc Graw Hill, New York, 2013.
4. S.C. Gupta, Textbook on Fiber Optics Communications and its application, Prentice Hall of India, 2012.
5. John Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2011.
6. R. P. Khare, Fiber Optics and Optoelectronics, Oxford University Press, 2011.

22OME01 DIGITAL MANUFACTURING 3 0 0 3

Course Objectives

- To understand the process of generating 3D Computer Aided Design (CAD) model by different method.
- To explain the constructional features and develop simple program for CNC lathe and Milling machines.
- To provide an exhaustive knowledge on various generic process and benefits of Additive Manufacturing.
- To familiarize about materials and process parameters of liquid and solid based AM techniques.
- To educate powder based methodology and emerging trends with case studies, applications of AM techniques.

Course Outcomes (COs)

1. Design a 3D model from the 2D data.
2. Develop a CNC program for simple components.
3. Generate stl file and manipulate parameters of AM machine
4. Select appropriate liquid or solid materials based AM process to the respective application
5. Select appropriate process to fabricate a functional/prototype for aerospace, automotive, electronics, manufacturing and medical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2		2								1	2	
2	2	2	2		2								1	2	
3	2	2	2		2								1	2	
4	2	2	2		2								1	3	
5	2	2	2		2								1	2	

UNIT I **9 Hours**

CAD MODELING

Introduction - Design process - Stages. CAD - Input and Output devices, Modeling methods - Wire frame modelling, Surface modelling, Solid modelling - Constructive Solid Geometry and Boundary Representation Techniques. CAD/CAM data exchange - IGES, STEP. Product Life cycle management (PLM).

UNIT II **10 Hours**

AUTOMATION AND CNC MACHINES

Introduction to Automation - Definition, types, reasons for automating. CNC Machines - Principles, types, features, advantages, applications. CNC Machine structure - Linear motion bearings, Recirculating ball bearings, drive system, and control system. CNC Lathe and Milling programming - Linear and circular interpolation, threading and drilling programs.

UNIT III **7 Hours**

ADDITIVE MANUFACTURING

Introduction - Impact of Additive Manufacturing (AM) and Tooling on Product Development - Distinction between AM and CNC Machining - The Generalized AM Process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing - AM Benefits - Classification of AM process

UNIT IV **8 Hours**

LIQUID AND SOLID MATERIAL BASED SYSTEMS

Stereo lithography Apparatus (SLA), Digital Light Processing (DLP), Fused Deposition Modelling (FDM) and Laminated Object Manufacturing (LOM) - Working Principle, Construction, Process, Materials and Applications

UNIT V **11 Hours**

POWDER BASED PROCESSES AND APPLICATIONS OF ADDITIVE MANUFACTURING

Selective Laser Sintering (SLS), Color Jet Printing (CJP), Electron Beam Melting (EBM) and Laser Engineered Net Shaping (LENS) - Working Principle, Construction, Process Variables, Materials and Applications. Reverse Engineering using 3D scanner. Application of Additive Manufacturing in Medical field, Manufacturing, Automotive industries, Aerospace and Electronics and Retail industries.

Total: 45 Hours

Reference(s)

1. Ibrahim Zeid, R.Sivasubramania, CAD/CAM Theory and Practice, Tata McGraw Hill, 2010.
2. M. Aditan, B.S. Pabala, CNC Machines, New age International, 2012.
3. C. K. Chua, K. F. Leong and C. S. Lim, Rapid prototyping: Principles and applications, Cambridge University Press, 2010.
4. D. T.Pham, S. S.Dimov, Rapid manufacturing, Springer-Verlag, London, 2001.
5. I. Gibson, D. W. Rosen, and B. Stucker, Additive Manufacturing Technologies 3D Printing, Rapid Prototyping and Direct Digital Manufacturing, Springer, 2015 http://www.springer.com/978-1-4939-2112-6

22OME02 INDUSTRIAL PROCESS ENGINEERING 3 0 0 3

Course Objectives

- To impart the knowledge on production planning methodologies and layout design
- To learn about production planning and its control methods
- To provide the knowledge of work study, process charts and ergonomic condition
- To impart the knowledge on inventory control and material handling
- To learn about system analysis and different types of maintenance processes

Course Outcomes (COs)

1. Select proper plant layout for the required production system
2. Plan the resources required for the production and to perform the control methods
3. Apply work study method, prepare charts to outline the process and develop ergonomic condition suitable for the processes.
4. Analyze the inventory required based on production needs and material handling
5. Perform system analysis and use different types of maintenance process for smooth operations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	1		1									2	
2	3	3	1		2						2			2	
3	1	3	3		2									2	
4	2	3	1		2									2	
5	2	3	1		2									2	

UNIT I **9 Hours**

INDUSTRIAL ENGINEERING AND PRODUCTION SYSTEM

Industrial engineering - Concept, History and development, Applications, Roles of Industrial engineer- Production management, Industrial engineering versus production management, operations management. Plant layout, Criteria for good layout, Types of layout - Process layout, Product layout, Combination layout and fixed position layout, Flow (material movement) pattern, Workstation Selection and design.

UNIT II **10 Hours**

PROCESS PLANNING AND PRODUCTION CONTROL

Introduction to Process planning-Definition, Procedure, Process selection, Machine capacity, Process sheet.Process analysis - Group technology, classification and coding system, formation of component family - Production planning, loading, scheduling. Production control -dispatching, routing - Progress control bar, curve, Gantt chart, route and schedule chart.

UNIT III **8 Hours**

WORK STUDY AND ERGONOMICS

Work study - Definition, Need, Advantages, objectives of method study and work measurement, method study procedure, Process chart - symbols, outline process chart, flow process chart, principles of motion economy, ergonomics- applications of ergonomic principles in the shop floor- work benches-seating arrangement, Industrial physiology.

UNIT IV **10 Hours**

INVENTORY MANAGEMENT

Inventory control, classification, management, objectives, functions. Economic order quantity, Economic batch quantity, inventory models,ABC analysis, Material Requirement Planning(MRPI), Manufacturing Resource Planning (MRPII), Operating cycle, lean manufacturing, Supply chain management - Material handling.

UNIT V **8 Hours**

SYSTEM ANALYSIS AND MAINTENANCE

System concept - system analysis, systems engineering, value engineering, value control, types of values. Plant maintenance - objectives, importance. Maintenance engineer - duties, functions and responsibilities. Types - breakdown, scheduled, preventive and predictive - Plant maintenance schedule, Condition monitoring.

Total: 45 Hours

Reference(s)

1. Khanna O.P., Industrial Engineering and management, Dhanpat Rai Publications.,2010
2. Martand T.Telsang, Industrial Engineering and Production Management, S Chand Publishers,2006
3. Panneerselvam R., Production and operations management, Heritage Publishers, 2006
4. Ravi Shankar, Industrial Engineering and Management, Golgotia Publications Pvt. Ltd., New Delhi, 2009

22OME03 MAINTENANCE ENGINEERING 3 0 0 3

Course Objectives

- To understand the principles, objectives and importance of maintenance adopted in industry for successful progress.
- To introduce different maintenance categories, its merits and types of lubrication.
- To expose the idea of condition monitoring, methods and instruments used for allied measurements.
- To learn about failure analysis and repair methods for few mechanical elements.
- To promote computerization in maintenance and inventory management.

Course Outcomes (COs)

1. Explain the principles, objectives and importance of maintenance adopted in industry.
2. Select the suitable maintenance category and lubrication type.
3. Apply the appropriate methods and instruments for condition monitoring.
4. Analyze the failures of mechanical systems and select suitable repair methods.
5. Utilize computers in maintenance and inventory management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2												2	
2	2	2												2	
3					2	2	1							2	
4	1	2	1		2	2	2							2	
5	2	2	2		1	1	1							2	

UNIT I **9 Hours**

PRINCIPLES OF MAINTENANCE PLANNING

Basic principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound maintenance systems - Maintenance organization - Maintenance economics.

UNIT II **9 Hours**

MAINTENANCE CATEGORIES AND LUBRICATION

Maintenance categories - Comparative merits of each category - Preventive maintenance, Maintenance schedules, Repair cycle - Total Productive Maintenance - Principles and methods of lubrication.

UNIT III **9 Hours**

CONDITION MONITORING

Condition based maintenance - Cost comparison with and without Condition Monitoring - Methods and instruments for condition monitoring - Noise, vibration, wear and temperature measurement.

UNIT IV **9 Hours**

FAILURE ANALYSIS AND REPAIR METHODS

Failure analysis - Failures and their development - Role of Non Destructive Testing in failure analysis - Repair methods for bearings, cylinder block, fuel pump, shaft.

UNIT V **9 Hours**

COMPUTER AIDED MAINTENANCE MANAGEMENT

Approach towards Computerization in maintenance - computer-aided maintenance management system (CAMMS) - Advantages of CAMMS - spare parts and inventory centre performance reporting.

Total: 45 Hours

Reference(s)

1. Srivastava S.K, Maintenance Engineering, S Chand and Company, 2010.
2. Mishra R.C, Pathak K, Maintenance Engineering and Management, Second edition, Prentice Hall India Learning Pvt. Ltd., 2012.
3. Keith Mobley R, Lindley R. Higgins and Darrin J. Wikoff, Maintenance Engineering Handbook, Seventh edition, McGraw-Hill Professional, 2008.
4. Davies A, Handbook of Condition Monitoring: Techniques and Methodology, Springer, 2012.
5. Otegui Jose Luis, Failure Analysis, Fundamentals and Applications in Mechanical Components, Nineteenth edition, Springer, 2014.

22OME04 SAFETY ENGINEERING 3 0 0 3

Course Objectives

- To study the principles of safety management system.
- To introduce the provisions contained in the industrial laws.
- To provide knowledge on safety requirements for engineering industry.
- To learn safety requirement for chemical industry.
- To study the various safety measures adopted in construction industries.

Course Outcomes (COs)

1. Explain safety management system of an industry.
2. Implement the provisions of acts and rules in industries.
3. Implement and review the safety performance followed in various industries
4. Evaluate safety appraisal in chemical industries.
5. Generate safety reports on construction industries.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1					2	1		1						2	
2					1			3					2	1	
3	2											3	1		
4	2	3							2				2		
5					2					3				3	

UNIT I **8 Hours**

SAFETY MANAGEMENT

Concepts - Evolution, International Labour Organization (ILO), National Safety Council, Techniques - Job Safety Analysis (JSA), Safety survey, Safety inspection, Safety Sampling, Accident Reporting and Investigation - Concept of an accident, Accident causation models, cost of accident, investigation, Safety Performance Monitoring - Safety indices.

UNIT II **10 Hours**

SAFETY AND LAW

Factory Act 1948-Safety and Health chapters, Tamil Nadu Factories Rules- Safety and Health chapters, Environment and Pollution Laws, ,Building and other construction works act 1996, Electricity Rules.

UNIT III **10 Hours**

SAFETY IN ENGINEERING INDUSTRIES

Safety in machine shop,- Principles of machine guarding - Personal protective equipment- Safety in handling industrial gases - Safety in cold forming and hot working of metals- Safety in finishing, inspection and testing, heat treatment, electro plating, leak test, radiography.

UNIT IV **9 Hours**

SAFETY IN CHEMICAL INDUSTRIES

Safety in process design, unit operations, pressure vessel, heat exchanger, safety valves -Plant commissioning and inspection, pressure vessel, Plant maintenance and emergency planning, management of maintenance HAZOP study.

UNIT V **8 Hours**

SAFETY IN CONSTRUCTION INDUSTRY

Construction regulations, contractual clauses, permit to work, - Education and training-Hazards of construction and prevention- excavation, scaffolding, dismantling, road works, construction of high rise buildings - Working at heights,-Working on fragile roofs, work permit systems-Construction machinery, cranes, chain pulley blocks, earth moving equipment, conveyors- Manual handling, Safety in demolition work, - Safety in confined spaces

Total: 45 Hours

Reference(s)

1. Blake R.B., Industrial Safety, Prentice Hall, Incorporated, New Jersey,1973.
2. National Safety Council, Accident Prevention Manual for Industrial Operations, Chicago, 1988
3. Subramanian V., The Factories Act, 1948, with Tamil Nadu Factories Rules , 1950, Madras
4. Environmental Pollution Control Act, 1986
5. BOCW Act,1996, Madras Book agency, Chennai-1
6. Explosive Act, 1884, Eastern Book Company, Lucknow -266 001.

22OBT01 BIOFUELS **3 0 0 3**

Course Objectives

- To understand and explore the scope of biofuels the most efficient renewable source of energy.
- To develop the expertise in the technology pertaining to their generation and employment in order to surrogate the existing conventional fuels and hence strives towards sustainable development
- To give way to the bolster green technology and incline towards more ecofriendly options.

Course Outcomes (COs)

1. Apply the bio resources that can be used for the production of biofuels.
2. Analyze the physical and chemical properties of the biodiesel.
3. Analyze the mechanisms of improvising the quality and performance of engines using biofuels
4. Analyze the bio-fuel conversion technologies and their environmental attributes
5. Evaluate the designing aspects of major unit processes/operations of an integrated bio-refinery

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1		2				3								
2	2						1								
3	1						3								
4	2						3								
5	1						1								

UNIT I **9 Hours**

CLASSIFICATION AND RESOURCES

Introduction, biofuel as a renewable energy, classification of biofuels - First, second, third and fourth generation biofuels, different plant sources as biofuel feed stocks, Biogases, physical and chemical characteristics of vegetable oils - iodine number, hydroxyl, acid values, rancidity, hydrogenolysis and hydrolysis, Food vs energy.

UNIT II **9 Hours**

BIODIESEL

Definition, basics and chemistry of biodiesel, vegetable oils in biodiesel production, Trans esterification: Chemical methods, enzymatic methods and types of catalysts, separation and purification, physical properties and characterization of biodiesel - Cloud point, pour point, cold filter plugging point, flash point, viscosity and cetane number.

9 Hours

UNIT III

QUALITY BIODIESEL AND ENVIRONMENT

Producing Quality Biodiesel, quality control, test methods, ASTM specifications. Oxidative andthermal stability, estimation of mono, di, triglycerides and free glycerol, engine performance test, blending of ethanol with biodiesel, blending of biodiesel with high speed diesel (HSD) and their combustion properties.

UNIT IV **9 Hours**

BIOETHANOL AND BIOGASES

Ethanol as a fuel, microbial and enzymatic production of ethanol from biomass - lignocellulose, sugarcane, sugar beet, corn, wheat starch, purification - wet and dry milling processes, saccharification- chemical and enzymatic. Production of bio methane and bio hydrogen.

UNIT V **9 Hours**

BIOREFINERIES

Definition and types of biorefineries, co-products of biorefineries-oil cake and glycerol, purificationof glycerol obtained in biodiesel plant; anaerobic and thermal gasification of biomass, economics of biorefineries.

Total: 45 Hours

Reference(s)

1. Caye Drapcho, John Nghiem and Terry Walker, Biofuels Engineering process technology, McGraw Hill Professional, 2008.
2. Mousdale, Biofuels, CRC Press, 2008
3. Ahindra Nag, Biofuels Refining and Performance, McGraw-Hill Professional, 2007.
4. Lisbeth Olsson, Biofuels (Advances in Biochemical Engineering/ Biotechnology), Springer, 2007

22OFD01 TRADITIONAL FOODS 3 0 0 3

Course Objectives

- Understand the importance of traditional foods and food habits
- Know the traditional processing of snack, sweet and dairy food products
- Infer the wide diversity and common features of traditional Indian foods and meal patterns.

Course Outcomes (COs)

1. Justify the processing methods of traditional foods in terms of its health benefits
2. Assess the production methods of traditional sweets, snacks and dairy products
3. Differentiate Traditional fermented foods products based on its raw material
4. Implement a large scale production of tradition foods for its increased consumption
5. Compare the health aspects of traditional foods with modern foods

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													
2		1												
3	2	1	1											
4								2						
5								2						

UNIT I **9 Hours**

TRADITIONAL METHODS OF FOOD PROCESSING

Introduction - food culture -geographical features and food. Traditional methods of milling grains - rice, wheat and corn - equipment and processes as compared to modern methods. Equipment and processes for edible oil extraction- comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation - sun-drying, osmotic drying, brining, pickling and smoking.

UNIT II **9 Hours**

TRADITIONAL SWEETS, SNACKS AND DAIRY PRODUCTS

Production, formulation, preparation and processing of Indian traditional sweet and snack food products:- Rasgolla, Gulab jamun; formulation and preparation of namkeen, potato chips, banana chips. Acid coagulated and fermented dairy products- paneer, dahi, shrikhand, lassi - processing conditions, defects etc. Fat rich products- Butter, ghee and its processing.

UNIT III **9 Hours**

TRADITIONAL FERMENTED FOOD PRODUCTS

Idli, Soya sauce, fish pickle, dry fish, meat and vegetable fermented products. Various alcohol based products. Ways to increase nutritional quality of food such as enrichment, fortification, fermentation and mutual supplementation. Best cooking and processing methods to retain nutrients

UNIT IV **10 Hours**

COMMERCIAL PRODUCTION OF TRADITIONAL FOODS

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods - types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods - ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters

UNIT V **8 Hours**

HEALTH ASPECTS OF TRADIONAL FOODS

Comparison of traditional foods with typical fast foods / junk foods - cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

Total: 45 Hours

Reference(s)

1. Sen and Colleen Taylor, Food Culture in India, Greenwood Press, 2005.
2. Davidar, Ruth N. "Indian Food Science: A Health and Nutrition Guide to Traditional Recipes:" East West Books, 2001.
3. Steinkrus.K.H. Handbook of Indigenous Fermented Foods, CRC press, 1995.
4. Aneja. R.P, Mathur.BN, R.C. Chandan,and Banerjee.A.K. Technology of Indian Milk Products. Dairy India Year Book, 2009.

22OFD02 FOOD LAWS AND REGULATIONS 3 0 0 3

Course Objectives

- Introduce the concept of food hygiene, importance of safe food and laws governing it
- Learn common causes of food borne illness - viz. physical, chemical and biological and identification through food analysis
- Understand food inspection procedures employed in maintaining food quality

Course Outcomes (COs)

1. Analyse the food safety strategies and nutritional quality of the food
2. Check the food regulatory mechanism and mandatory laws for food products
3. Determine the national and international regulatory agencies
4. Understand and apply the voluntary regulatory standards
5. Assess the implementation of food safety for a food processing industry

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1											
2		1				1	2	1						
3		1												
4	1	2												
5	1	2												

UNIT I **10 Hours**

INTRODUCTION

Introduction, concept of food safety and standards, food safety strategies. Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical hazards. Preventive food safety systems - monitoring of safety, wholesomeness and nutritional quality of food. Prevention and control of physical, chemical and microbiological hazards. Principles of food safety - Establishment: design and facilities - emergency preparedness - Maintenance cleaning and sanitation - personal hygiene - packaging and labelling - transportation - traceability - recall procedure - visitor policy. Adulteration: Intentional and unintentional - Preservatives - antioxidants, sweeteners, flavours, colours, vitamins, stabilizers - indirect additives - organic resides - inorganic residues and contaminants.

UNIT II **10 Hours**

FOOD LAWS

Indian and Food Regulatory Regime (Existing and new), PFA Act and Rules, Food Safety and Quality Requirements, Additives, Contaminants and Pesticide Residue. Food Safety and Standards Act, 2006, FSSAI roles and responsibilities, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR) WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.

UNIT III **10 Hours**

REGULATIONS

Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Role of Agricultural and Processed Food Products Export Development Authority (APEDA), Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK. Nutritional Labelling, Health claims.

UNIT IV **10 Hours**

STANDARDS

Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices ISO 9000, ISO 22000, ISO 14000, ISO 17025, PAS 22000, FSSC 22000, BRC, BRCIOP, IFS, SQF 1000, SQF 2000. Role of NABL, CFLS.

UNIT V **5 Hours**

IMPLEMENTATION AND RISK ASSESSMENT

Implementation of food safety for a desired food processing industry. Risk assessment studies: Risk management, risk characterization and communication.

Total: 45 Hours

Reference(s)

1. Singal RS (1997). Handbook of indices of food quality and authenticity. Woodhead Publ. Cambridge, UK.
2. Shapton DA (1994). Principles and practices of safe processing of foods. Butterworth Publication, London. Winton AL (1999) Techniques of food analysis, Allied Science Publications New Delhi.
3. Pomeranze Y (2004). Food analysis - Theory and Practice CBS Publications, New Delhi.
4. Jacob MB (1999). The chemical analysis of foods and food products. CBS Publ. New Delhi

22OFD03 POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES **3 0 0 3**

Course Objectives

- To understand the importance and different methods of post harvest handling and storage of fruits and vegetables.
- To gain knowledge on different preservation methods of fruits and vegetables
- To familiarize with the value added products from fruits and vegetables

Course Outcomes (COs)

1. Implement the different post harvest handling practices for the storage of fruits and vegetables
2. Analyze the suitable preservation method (sugar, salt or dehydration) to produce value added products from fruits and vegetables
3. Evaluate the requirement of low temperature and irradiation methods to preserve specific fruits and vegetables
4. Apply the concentration and fermentation methods to preserve fruits and vegetables
5. Implement the canning method to preserve fruits and vegetables

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	2	1			1							
2	1	1												
3	1	2												
4	1		1											
5	2	1	1											

UNIT I **9 Hours**

POST HARVEST PRACTICES AND PROCESSING

Maturity indices for harvesting; pathological spoilage's during storage, ripening and control measures, Post-harvest handling, sorting & grading, packaging, storage, transportation, Methods of pre-cooling, post-harvest treatments to hasten and delay ripening; Methods of storage at farm level - cold storage, controlled/modified atmosphere storage, Quality management, export requirements, Nutritive value, nutraceutical properties

UNIT II **9 Hours**

PRESERVATION AND VALUE ADDITION

General principles and methods of fruit and vegetable preservation. Preservation using sugar: Principle and Preparation of jam, jelly, marmalade, squash, RTS, carbonated beverages, crush, nectar, cordial, fruit bar, preserves, candies and carbonated fruit beverages. Processing using salt: Principle - Brining - Preparation of pickles, chutney and sauces, ketchup.

UNIT III **9 Hours**

PRESERVATION BY LOW TEMPERATURE AND IRRADIATION

Preservation by low temperature: definition, principle, methods - Refrigeration, freezing. Methods of freezing- changes during freezing. Preparation of frozen foods. Minimal Processing of Fruits and Vegetables - techniques involved - Preservation by irradiation: definition- principle, application, irradiation unit.

UNIT IV **9 Hours**

PRESERVATION BY DRYING

Machineries involved in processing of fruits and vegetables products. Drying and dehydration: definition, principle, Types of driers: Solar, cabinet, spray drier, drum drier, fluidized bed drier. Preparation of product for dehydration. Dehydration principles and equipment. Preparation of fruits - powder production. Problems related to storage of dehydrated products.

UNIT V **9 Hours**

PRESERVATION BY CANNING

Canning: principles, Types of cans, packing of canned products-preparation of canned products - general considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit- spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations.

Total: 45 Hours

Reference(s)

1. S.Ranganna, HandBook of Analysis and Quality Control for Fruit and Vegetable Products, McGraw Hill Education (India) Private Limited, Chennai, 2017
2. N.W. Desrosier, the Technology of Food Preservation, CBS Publisher & Distributions, New Delhi, 1987.
3. R.P. Srivastava and S. Kumar, Fruit and Vegetable Preservation: Principles and Practices, Second Edition, International Book Distribution Co., Lucknow, 1998.
4. G. Lal, G. Siddappa and G.L. Tondon, Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi, 1986.
5. Chakraverty, A.S. Mujumdar, G.S.V. Raghavan and H.S. Ramaswamy, Handbook of Post-harvest Technology, Marcel Dekker Press, USA, 2001.
6. D.K. Salunkhe, and S.S. Kadam, Handbook of Fruit Science and Technology: Production, Composition and Processing, Marcel Dekker, New York, 1995.

22OFD04 CEREAL, PULSES AND OILSEED TECHNOLOGY **3 0 0 3**

Course Objectives

- Understand the application of scientific principles in the processing technologies specific to the materials
- Understand the storage methods and handling techniques followed for cereals, pulses and oil seeds
- Develop the knowledge in the area of Cereals, pulses and oil seed processing and technology

Course Outcomes (COs)

1. Identify the specific processing technologies employed for cereals
2. Analyse the composition of millets and their nutritional importance
3. Relate the compositional changes and processing methods of pulses and legumes
4. Create the competence in processing of oilseeds technology
5. Relate the storage processing of food grains with quality aspects

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		2		2								
2	1	2		2		1								
3	2	2		1		2								
4	2	3		2		2								2
5	2	2		2		3								

UNIT I **9 Hours**

CEREALS

Cereal Grains- Basic agricultural aspects, structure and composition; Storage, Insect control; Processing: Wheat- milling, (Atta and maida), quality aspects of flour, wheat proteins and their function, rheology of flour; wheat based baked products - Bread, Biscuit, Cakes, Extruded products, Pizza, Chapatis, malting and malt products; Rice-Milling, Parboiling, Quick cooking rice, Traditional Indian Products- Puffed Rice, flaked rice, Idli/Dosa/vada mixes and other savouries; Corn- Wet and dry milling, Corn Products - Corn flakes, Corn starch, canned corn products, puffed product; Oats-Milling, Oat Products - Steel cut,rolled oats, quick cooking; Traditional and Fermented cereal products.

UNIT II **9 Hours**

OTHER CEREALS AND MILLETS

Sorghum, Pearl Millet, Finger millet, Foxtail Kodo Millet - Basic agricultural millet, aspects, structure and composition; storage, insect control; processing - pearling, Milling, Malting, Malt based foods, flaked and fermented products; Traditional and Nutritional products based on finger millet.

UNIT III **9 Hours**

PULSES AND LEGUMES

Basic agricultural aspects, structure, composition, storage, insect control, processing Milling/splitting, dhal milling, products - puffed, flakes, flour, legume-based traditional products, flour based Indian sweets and savouries, soya milk, soy protein Isolate, soya paneer

UNIT IV **9 Hours**

OILSEEDS AND NUTS

Basic agricultural aspects structure, composition, Storage, Insect control; processing: traditional and modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation; oil blends; applications of different oils and fats in food processing & products.

UNIT V **9 Hours**

STORAGE AND HANDLING

Bag Storage - Advantages and Disadvantages, Cover Plinth Storage Structures, CAP storage (Cover and Plinth Storage). Protection against Rodents, Fungi, Pests and Mites. Fumigation Processes for bag storage piles. Bulk Storage in silos and large Bins. Conveyors and Elevators for feeding and discharging.

Total: 45 Hours

Reference(s)

1. Chakraverty, A.: Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Co, Calcutta, 1995.
2. Delcour, Jan A. and R. Carl Hoseney., Principles of Cereal Science and Technology, 3rd Edition, American Association of Cereal Chemists, 2010.
3. Karl Kulp, Handbook of Cereal Science and Technology, 2nd Rev. Edition, CRC Press, 2000.
4. N.L.Kent and A.D.Evans, Technology of Cereals (4th Edition) Elsevier Science (Pergaman),Oxford, UK, 1994.
5. Matz, Samuel A., The Chemistry and Technology of Cereals as Food and Feed, 2nd Edition,CBS, 1996.
6. Morris, Peter C. and J.H. Bryce., Cereal Biotechnology, CRC/Wood head publishing, 2004.

22OFT01 FASHION CRAFTSMANSHIP 3 0 0 3

Course Objectives

- To impart theoretical and practical knowledge about various handi-craft techniques
- To enhance innovative skills on hand crafts.
- To build confidence on doing handicrafts.

Course Outcomes (COs)

1. Outline the classification, techniques and criteria for selecting raw materials for making various handicraft materials and produce textile based handicrafts. Produce various decorative and appealing products
2. Design and construct various wall hangings and fashion accessories.
3. Design and construct toys and accessories
4. Design and construct head accessories, home furnishings and paintings
5. Design and construct various decorative and appealing products for interiors

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	3				2		2	2		2	2	
2	3	2	3				1		2	3		2	2	
3	3	2	3				2		2	3		2	2	
4	3	2	3				2		2	3		2	2	
5	3	2	3				2		2	3		2	2	

UNIT I **9 Hours**

TECHNIQUES OF HANDICRAFT MATERIALS

Definition of Handicraft, Classification: Reusable, Non reusable, Raw materials used in various craft materials: printed, embroidered, stitched and handmade, Criteria for selection of raw materials: material types and end uses.

UNIT II **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - INTERIORS

Designing and Construction procedures for following various decorative and appealing products: Wall hangings - String Art on plywood, Pressed Flower Art frames.

UNIT III **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - ACCESSORIES

Designing and Construction procedures for following various decorative and appealing products: Handbags, Hats, footwear.

UNIT IV **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - ORNAMENTS

Designing and Construction procedures for following various decorative and appealing products: Stone necklace using Macrame Technique, Tribal Jewellery using woollen threads, Floral Jewellery using Resin Technique, Fabric Jewellery using Tie and Dye Technique.

UNIT V **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - FANCY ITEMS

Designing and Construction procedures for following various decorative and appealing products: Jewellery Box, Utility Holder, Gift items. Lampshade decors from cardboard, Driftwood Frames for pictures and Mirrors.

Total: 45 Hours

Reference(s)

1. Handmade in India: A Geographic Encyclopaedia of India Handicrafts. Abbeville press; 1 edition (October 20,2009)
2. Encyclopaedia of Card making Techniques (Crafts), Search Press Ltd, illustrated edition, 2007
3. All about Techniques in Illustration, Barron Educational Series, 2001
4. Printing by Hand: A Modern Guide to printing with Handmade stamps, Stencils and Silk Screens, STC Craft/A Melanie Falick Book, 2008
5. Materials & Techniques in the Decorative Arts: An Illustrated Dictionary, University of Chicago Press, 2000
6. https://www.marthastewart.com/274411/fashion-crafts

22OFT02 INTERIOR DESIGN IN FASHION 3 0 0 3

Course Objectives

- To impart knowledge on interior design.
- To improve the design skills, sustainable with socially-conscious designs

Course Outcomes (COs)

1. Interpret the elements of interior design concepts and resolve the personality requirements
2. Develop graphical representations of interior design concepts
3. Resolve the space planning requirements of residential home as per CPWD guidelines
4. Determine the aesthetic requirements of interior design components.
5. Appraise the roles and responsibilities of interior designer.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3		-	1							2	
2	3	2	3		2	3		2					3	
3	3	3	3		2	2		2					2	
4	3	3	3		2	3		2					2	
5	3	2			2			3					3	

UNIT I **9 Hours**

INTRODUCTION

Interior designing - definition, importance, requirements and types - Structural design, Decorative Design -Designing interiors, Good taste; Design themes, types and application. Personality of the Home - Art elements - Line: types, characteristics and importance; form: size and shape, characteristics; Colour - sources, qualities, emotional effects, colour wheel and schemes.

UNIT II **9 Hours**

GRAPHICAL PRESENTATIONS

3D composition; Isometric and Axonometric- Still life- Furniture Sketching- Object Drawing with color rendering - Interior elements, Lighting, plants. Perspective, Axonometric Isometric drawing. Orthographic Projection - Lifts and escalators.

UNIT III **9 Hours**

SPACE PLANNING

Space planning concepts- interiors, circulation. Definition, application of ergonomic principals in interiors. Residential house space planning case study- CPWD guidelines. Lighting for different locations and activities, measurement, ventilation and indoor air quality, noise control methods.

UNIT IV **9 Hours**

INTERIOR COMPONENTS

Application of colour in interiors; Texture - types and significance; Pattern: types and effects; Light - importance. Importance of Furniture Design for Interiors- Ancient Age / Middle Age / Contemporary. Doors, Windows, Staircase designs, False Ceiling, Partitions, Wall Panelling, Comics, Mosaic, Cladding- Flooring and Wall Cladding

UNIT V **9 Hours**

ROLES AND RESPONSIBILITIES OF INTERIOR DESIGNER

Role of an Interior Designer- Responsibility towards society and need of an Interior Designer to better the environment- Ethics and Code of Conduct- Responsibility towards client, contractor and supplier, Estimation. Professional Fees- Work of an Interior Designer- Making of portfolio, JD Annual Design Awards.

Total: 45 Hours

Reference(s)

1. Joanna Gaines, Homebody: A guide to creating spaces you never want to leave, Harper design, 2018.
2. Erin gates, Elements of Style: Designing a Home and a life, Simon and Schuster, 2014.
3. Simon Dodsworth, The Fundamentals of Interior Design, AVA publishing, 2009.
4. V. Mary. Knackstedt, The Interior Design Business Handbook: A Complete Guide to Profitability, Wiley, New Jersey; 2006.
5. M. G. Shah, C. M. Kale, and S.Y. Patki, Building Drawing with an Integrated Approach to Build Environment, Tata McGraw Hill, 2002.
6. Https://eclectictrends.com

22OFT03 SURFACE ORNAMENTATION 3 0 0 3

Course Objectives

- To familiarize the students about the various techniques of surface embellishment with relevance to garment embellishments.
- To aware of various types of embroidery and methods of producing it.
- To make the students confident about doing surface embellishment work

Course Outcomes (COs)

1. Analyze the raw material requirements for surface ornamentation and its application
2. Implement hand embroidery stitches on fabric and show the stitch development procedure in diagrammatic representations
3. Apply the machine and computerized embroidery stitches
4. Analyze the surface embellishment techniques and its application
5. Assess the quality maintenance parameters of all embroidered products and analyze the 6 traditional embroidery techniques

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2					1						
2	2	3	2						2				2	2
3	2	3	2		3								2	2
4	2	2	2						2				2	2
5	2	2	2						2					2

UNIT I **9 Hours**

INTRODUCTION TO SURFACE ORNAMENTATION

Introduction, Definition, Need, Types, Raw materials, Importance of surface ornamentation, Selection of needle, thread and fabric for hand embroidery and machine embroidery. various methods of surface embellishment- embroidery and surface ornamentation.

UNIT II **9 Hours**

HAND EMBROIDERY

General rules for hand embroidery. Types of hand embroidery stitches-Running, Couching, Button hole, Satin, Long & Short, Wheat, Chain, Stem, Herringbone, Cross stitch, Knotted stitches, Fish bone, Fly stitch, Braids, Back, Hem, Seed, Needle weaving, Whip stitches.

UNIT III **9 Hours**

MACHINE EMBROIDERY

General rules for machine embroidery. Types of frames and methods of transferring the designs. Attachments to sewing machines for embroidery, Types of machine embroidery stitches- Eyelet work, Cut work, patch work, Mirror work, Applique, Shaded embroidery, Shadow work, Bead and Sequins work, Vermicelli, Zigzag, Granite stitch. Computerized embroidery machine- Concept of design and development, software used in embroidery machines, process of designing, method and types of stitch application, punching and digitizing.

UNIT IV **9 Hours**

EMBELLISHMENT TECHNIQUES

Materials used and Applications. Types of embellishment techniques- fabric painting-hand, Stencil-dabbing and Spraying. Dyeing and printing-advanced tie and dye techniques, batik and block printing. Trimmings and decorations-Laces, Pompons, Fringes, Tassels, Tucks, Show buttons, Crocheting.

UNIT V **9 Hours**

TRADITIONAL EMBROIDERIES OF INDIA AND CARE

Care and maintenance of embroidered articles-care and maintenance methods for embroidered apparel, pressing. Traditional Embroideries of India-Phulkari, Kasuti, Kashmiri embroidery, Kutch work, Chikkankari, Kantha.

Total: 45 Hours

Reference(s)

1. Ruth Chandler, Modern Hand Stitching-Dozens of stitches with creative free-form variations,2014
2. Sophie Long, Mastering the Art of Embroidery: Traditional Techniques and Contemporary Applications for Hand and Machine Embroidery, Heritage Publishers, London, 2013
3. Christen Brown ,Embroidered & Embellished, C&T Publishing, 2013
4. Sheila Paine, Embroidered Textiles, Thames and Hudson Publisher, UK, 1990.
5. Gail Lawther, Inspirational Ideas for Embroidery on Clothes & Accessories, Search Press Ltd, UK, 1993.
6. http://www.needlenthread.com/tag/hand-embroidery-stitches

22OPH01 NANOMATERIALS SCIENCE 3 0 0 3

Course Objectives

- Impart knowledge on Nanoscience
- Explore different techniques of producing nanomaterials
- Create expertise on the applications of nanomaterials in various fields

Course Outcomes (COs)

1. Summarize the origin and advance of nanomaterials and its classification
2. Compare the different types of methods adopted for synthesizing nanomaterials
3. Analyze the characterization techniques for analyzing nanomaterials
4. Explain the physical properties exhibited by nanomaterials
5. Organize the nanomaterials developed for advanced technological applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1												
2	2	2												
3	3	1												
4	1	1												
5	2	3												

UNIT I **9 Hours**

NANO SCALE MATERIALS

Introduction-Feynman's vision-national nanotechnology initiative (NNI) - past, present, future - classification of nanostructures, nanoscale architecture - effects of the nanometer length scale - changes to the system total energy, and the system structures- effect of nanoscale dimensions on various properties - differences between bulk and nanomaterials and their physical properties.

UNIT II **9 Hours**

NANOMATERIALS SYNTHESIS METHODS

Top down processes - mechanical milling, nanolithography and types based on radiations - Bottom up process physical method: physical vapour deposition, RF sputtering, CVD- chemical method: colloidal and sol-gel methods - template based growth of nanomaterials - ordering of nanosystems, self-assembly and self-organization.

UNIT III **9 Hours**

CHARACTERIZATION TECHNIQUES

General classification of characterization methods - analytical and imaging techniques - microscopy techniques - electron microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy - diffraction techniques - X-ray spectroscopy - thermogravimetric analysis of nanomaterials.

UNIT IV **9 Hours**

SEMICONDUCTOR NANOSTRUCTURES

Quantum confinement in semiconductor nanostructures - quantum wells, quantum wires, quantum dots, super lattices-epitaxial growth of nanostructures-MBE, metal organic VPE, LPE - carbon nano tubes-structure, synthesis and electrical properties -applications- quantum well laser- quantum efficiency of semiconductor nanomaterials

UNIT V **9 Hours**

NANOMACHINES AND NANODEVICES

Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS)-fabrication, actuators-organic FET- principle, description, requirements, integrated circuits- single electron transistor - - organic photovoltaic cells- spintronics

Total: 45 Hours

Reference(s)

1. Willam A. Goddard, Donald W.Brenner, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, 2012
2. Charles P. Poole Jr and. Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2007
3. Guozhong Cao, Y. Wang, "Nanostructures and Nanomaterials-Synthesis, Properties & Applications", Imperials College Press, 2011.
4. T. Pradeep, "NANO: The Essentials Understanding Nanoscience and Nanotechnology", McGraw - Hill Education (India) Ltd, 2012
5. Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley and Sons Ltd, 2006
6. Viswanathan B, AuliceScibioh M, "Fuel cells: Principles and Applications", University Press, 2009.

22OPH02 SEMICONDUCTOR PHYSICS AND DEVICES 3 0 0 3

Course Objectives

- Impart knowledge in physical properties of semiconducting materials
- Analyze the factors affecting the operation of semiconductor devices
- Apply the physics of semiconductors to develop semiconductor devices

Course Outcomes (COs)

1. Exemplify the band gap, drift and diffusion current densities due to carrier transport in semiconductors
2. Analyze the energy band diagram in thermal equilibrium and space charge width of PN junction
3. Illustrate the operation of Bipolar Junction transistor at different modes and different configurations
4. Illustrate the operation of metal oxide field effect transistor and their memory devices
5. Represent the working mechanism of opto-electronic devices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	1												
4	2	1												
5	2	1												

UNIT I **9 Hours**

ENERGY BANDS AND CARRIER TRANSPORT PROPERTIES

Energy Bands: Formation of energy bands - doping effects - energy levels - electron and hole concept in semiconductor. Carrier transport: Carrier drift-drift current density - conductivity- diffusion current density - total current density

UNIT II **9 Hours**

P-N JUNCTION

Basic structure and fabrication process of p-n junction - current - voltage characteristics - energy band diagram - equilibrium Fermi levels - depletion region - junction breakdown phenomena - zener - avalanche breakdown.

UNIT III **9 Hours**

BIPOLAR JUNCTION TRANSISTOR

The basic transistor action - operation in the active mode - current gain - static characteristics - carrier distribution in emitter, base and collector region - modes of operation - current - voltage characteristics of common base and emitter configuration - frequency response and switching of bipolar transistor

UNIT IV **9 Hours**

MOSFET

The ideal MOS diode - basic fundamentals and characteristics - types - CMOS and BiCMOS - CMOS inverter - MOSFET on insulator - thin film transistor (TFT) - silicon on insulators (SOI) devices - MOS Memory structures - DRAM and SRAM

UNIT V **9 Hours**

PHOTONIC DEVICES

Radiative transitions and optical absorption-light emitting diodes-organic LED - infrared LED - semiconductor laser - temperature effect - photo detector - photo diode - silicon and compound semiconductor solar cells - efficiency

Total: 45 Hours

Reference(s)

1. Donald A Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, 2012
2. S. M. Sze and M. K. Lee, "Semiconductor Devices, Physics and Technology", John-Wiley & Sons, 2015
3. Ben. G. Streetman and S. K. Banerjee , "Solid State Electronic Devices", Pearson Education Ltd, 2015
4. C. Kittel, "Introduction to Solid State Physics", John-Wiley & Sons, 2012
5. J. Millman and C. Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, 2010
6. Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006

22OPH03 APPLIED LASER SCIENCE 3 0 0 3

Course Objectives

- Impart knowledge on laser science
- Explore different strategies for producing lasers
- Create expertise on the applications of lasers in various fields

Course Outcomes (COs)

1. Illustrate the transition mechanisms and the components of a laser system
2. Compare the different types of lasers based on pumping method, active medium and energy levels
3. Compute the rotation of earth, velocity and distance using lasers and apply the same for day today applications
4. Analyze the role of lasers in surgical and endoscopy applications
5. Apply the laser techniques in industrial applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	1												
4	2	1												
5	1	2												

UNIT I **9 Hours**

LASER FUNDAMENTALS

Introduction - principle - absorption and emission of light - thermal equilibrium - Einstein's prediction - Einstein's relations - A and B coefficients - condition for large stimulated emission - spontaneous and stimulated emission in optical region - light amplification - condition for light amplification - population inversion- Components of lasers - pumping methods - pumping mechanisms - optical resonator

UNIT II **9 Hours**

LASER BEAM CHARACTERISTICS AND TYPES

Characteristics of laser - Classification of lasers - principle, construction, working, energy level diagram and applications of molecular gas laser (CO2 laser) - liquid laser (dye laser) - excimer laser - Solid state laser (Nd:YAG laser) - semiconductor laser (homojunction laser).

UNIT III **9 Hours**

LASERS IN SCIENCE

Introduction - Harmonic generation (SHG) - Stimulated Raman emission - lasers in chemistry - laser in nuclear energy - lasers and gravitational waves - rotation of the earth - measurement of distance - Light detection And Ranging (LIDER) - velocity measurement - holography

UNIT IV **9 Hours**

LASERS IN MEDICINE AND SURGERY

Light induced biological hazards: Eye and skin - Eye laser surgery - photocoagulations - homeostasis - dentistry - laser angioplasty - different laser therapies - advantages & disadvantages - laser endoscopy.

UNIT V **9 Hours**

LASERS IN INDUSTRY

Applications in material processing: laser welding - hole drilling - laser cutting - Lasers in electronics industry: information storage - bar code scanner- Lasers in defence: laser based military weapons - laser walls.

Total: 45 Hours

Reference(s)

1. K. Thiyagarajan and A. K. Ghatak, "LASERS: Fundamentals and Applications", Springer, USA, 2015
2. M. N. Avadhanulu, "An Introduction to Lasers Theory and Applications", S. Chand Publisher, 2013
3. W. Koechner, M. Bass, "Solid State Lasers: a graduate text", Springer Verlag, New York, 2006
4. K. P. R. Nair, "Atoms, Molecules and Lasers", Narosa Publishing House, 2009
5. K. R. Nambiar, "Lasers: Principles Types and Applications", New Age International Publications, 2006
6. A. Sennaroglu, "Solid-State Lasers and Applications", CRC Press, 2006

22OPH04 BIO-PHOTONICS 3 0 0 3

Course Objective:

- To understand the light-matter interaction in biological cells or tissues by using the principles of optics and lasers.
- To apply the properties of biological cells or tissues in biomedical applications by various optical imaging, sensing and activation techniques.
- To analyze the concepts of Modern optical measurement techniques and devices in early detection of disease and cure them.

Course Outcomes (COs)

1. Infer the laws of optics and lasers to interpret the biological cells and tissues.
2. Identify the properties of different optical instruments in biological systems to represent their behavior in structure and design of detection engineering instruments.
3. Use laser tweezers techniques to infer the activities of cells (tissues) and explain the single molecule detection processes in medical diagnosis.
4. Outline the properties of ultra short laser pulses and tissue engineering to rectify the affecting factors in biological cells.
5. Compare the various types of bio-imaging methods to detect the infected cells and molecules in biological science.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	3	2												
3	3	2							3					
4	3	2							3					
5	3	2												

UNIT I **9 Hours**

INTRODUCTION TO BIOPHOTONICS

Light as Photon Particles – Coherence of light - lasers – classification of lasers – Mechanisms of Non- linear Optics (NLO) processes associated with Biophotonics - Light scattering mechanisms: Rayleigh scattering, Miescattering, Brillouin Scattering, Raman Scattering -Different light sources – Quantitative description of light: Radiometry

UNIT II **9 Hours**

PHOTOBIOLOGY

Interaction of light with cells and tissues – Light – Tissue Interaction Variables – Light –Tissue Interaction Theory: Radiative Transport Theory – Photo process in biopolymers – In Vivo Photoexcitation – photo-induced physical, chemical, thermal and mechanical effects in biological systems – Optical biopsy – Single molecule detection

UNIT III **9 Hours**

BIO-NANO-PHOTONICS

Laser Microtools, Semiconductor quantum dots for bioimaging, Metallic nanoparticles and nanorods for biosensing – Optical biosensors: Fibre-Optic, evanescent wave, surface Plasmon resonance (SPR) based biosensors – biomaterials for photonics – Principle and design of laser tweezers – laser trapping and dissection for biological manipulation.

UNIT IV **9 Hours**

TISSUE ENGINEERING WITH LIGHT

Basics of tissue optics: Light absorption and scattering in tissues, Wavelength effects and spectra– the therapeutic window, Light penetration in tissues – Absorbing agents in tissues and blood –Skinoptics, response to the UV radiation, Optical parameters of tissues – tissue welding – tissue contouring – tissue regeneration – Femto laser surgery – low level light therapy and photo dynamic therapy

UNIT V **9 Hours**

BIO-IMAGING TECHNIQUES AND ITS APPLICATIONS

An overview of optical imaging – Fluorescence Microscopy – Scanning Microscopy – In vivo Confocal Microscopy – Multi photon Microscopy – Optical Coherence Tomography (OCT) – Fluorescence Resonance Energy Transfer (FRET) imaging – fluorescence lifetime imaging Microscopy (FLIM) – Nonlinear optical imaging – Coherent Anti-stokes Raman Scattering –Bioimaging Applications.

Total: 45 Hours

Reference(s)

1. Introduction to Biophotonics, ParasN.Prasad, WileyInter-science, AJohnWiley & Sons, Inc., Publication (Class notes are developed mainly based on this book.)
2. Introduction to Biomedical Imaging, Andrew G.Webb, 2002, IEEE Press.
3. Biomedical Optics: Principles and Imaging, Lihong.V.Wang, Hsin.-I.Wu, 2007, Wiley Interscience 2007. & "An Introduction to Biomedical Optics", R.Splinterand B.A.Hooper, Taylor & Francis
4. Bioimaging Current Concepts in Light and Electron Microscopy, DouglasE.Chandler & Robert W.Roberson, Jones and Bartlett publishers.
5. Optical Imaging and Microscopy : Techniques and Advanced Systems, Peter Török and Fu-JenKao, 2004, Springer.

22OPH05 PHYSICS OF SOFT MATTER 3 0 0 3

Course Objectives

- To recognize the properties of soft matter and hard matter
- To understand the fundamental interactions of colloids and gels
- To explain the structure and phase behavior of liquid crystals and supramolecules
- To summarize the soft matter proprties of structures and components of life

Course Outcomes (COs)

1. Identify the salient features of soft matter and hard matter
2. Exemplify the fundamental interactions and stability of colloids and gels
3. Illustrate the structure and properties of liquid crystals
4. Outline the aggregation and phase behavior of surfactants, polymers, copolymers and block copolymers
5. Analyze the soft matter behavior of nucleic acids, proteins, polysaccharides and membranes

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	2												
4	2	2												
5	2	2												

UNIT I **9 Hours**

CONDENSED MATTER

Intermolecular forces-Condensation and freezing-mechanical response: Hookean solid-Newtonian liquid-viscoelasticity. Glasses: relaxation time-viscosity- glass forming liquids. Soft matter: length scales-fluctuations and Brownian motion

UNIT II **9 Hours**

COLLOIDAL DISPERSIONS & GELS

Forces between colloidal particles: vander Waals forces-electrostatic double layer forces-steric hindrance-depletion interactions. Stability and phase behaviour: Crystallisation-strong colloids-weak colloids.Physical and chemical gels-classical theory of gelation-elasticity of gels

UNIT III **9 Hours**

LIQUID CRYSTALS

Liquid crystal phases-distortions and topological defects-electrical and magnetic properties-polymer liquid crystals-Fredricks transition and liquid crystal displays

UNIT IV **9 Hours**

SUPRAMOLECULAR SELF ASSEMBLY

Aggragation and phase separation-types of micelles- bilayers and vesicles. Phase behaviour of concentrated surfactant solutions-phase separation in polymers, copolymers and block copolymers

UNIT V **9 Hours**

SOFT MATTER IN NATURE

Components and structures of life-Nucleic acids-proteins-interaction between proteins-polysaccharides-membranes

Total: 45 Hours

REFERENCES

1. Richard A L Jones, Soft Condensd Matter, Oxford University Press, UK, 2002
2. Masao Doi, Soft Matter Physics,Oxford University Press, UK, 2013.
3. Ian W. Hamley, Introduction to Soft Matter, John Wiley & Sons, 2007
4. A. Fernandez-Nieves, A M Puertas, Fluids, Colloids and Soft materials: An Introduction to Soft Matter Physics, John Wiley & Sons, 2016
5. Maurice Kleman, Oleg D. Lavrentovich, Soft Matter Physics: An Introduction, Springer-Verlag, New York, 2003.

22OCH01 **CORROSION SCIENCE AND ENGINEERING** **3 0 0 3**

Course Objectives

- Analyse the loss incurred due to corrosion in different sectors and terminologies related to corrosion
- Identify forms and types of corrosion with suitable mechanism
- Apply various methods of corrosion control, corrosion testing and monitoring

Course Outcomes (COs)

1. Explain if corrosion can occur under specific operating conditions in a given equipment or construction and indicate regions of immunity, corrosion and passivity of a metal
2. Compare different corrosion types on metals when exposed to air, water and at high temperatures (> 100 C)
3. Identify the corrosion mechanism on steel, iron, zinc and copper metal surfaces
4. Calculate the rate of corrosion on metals using electrochemical methods of testing
5. Propose the correct materials, design and operation conditions to reduce the likelihood of corrosion in new equipment and constructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

UNIT I **9 Hours**

CORROSION

Importance of corrosion - spontaneity of corrosion - units of corrosion rate (mdd and mpy) - direct and indirect damage by corrosion - importance of corrosion prevention in industries - Pilling Bedworth ratio and its significance - passivation - area relationship in both active and passive states of metals - Pourbaix digrams of Mg, Al and Fe and their advantages and disadvantages

UNIT II **7 Hours**

TYPES OF CORROSION

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion-Catastrophic oxidation corrosion

UNIT III **9 Hours**

MECHANISM OF CORROSION

Hydrogen embrittlement - corrosion fatigue - filiform corrosion - fretting damage and microbes induced corrosion. Corrosion mechanism on steel, iron, zinc and copper metal surfaces

UNIT IV **10 Hours**

CORROSION RATE AND ITS ESTIMATION

Rate of corrosion: Factors affecting corrosion. Electrochemical methods of polarization: Tafel extrapolation polarization and linear polarization. Weight loss method - testing for intergranular susceptibility and stress corrosion. Non destructive testing methods: Visual testing - liquid penetrant testing - magnetic particle testing - Ultrasonic monitoring, and eddy current testing

UNIT V **10 Hours**

CORROSION CONTROL METHODS

Fundamentals of cathodic protection - types of cathodic protection(sacrificial anodic and impressed current cathodic protection). Stray current corrosion, problems and its prevention. Protective coatings: Metal coatings: Hot dipping (galvanizing, tinning and metal cladding) - natural inhibitors. Selection of suitable design for corrosion control

Total: 45 Hours

Reference(s)

1. Mouafak A. Zaher, "Introduction to Corrosion Engineering", CreateSpace Independent Publishing Platform, 2016.
2. E.McCafferty, "Introduction to Corrosion Science", Springer; 2010 Edition, January 2010.
3. R. Winstone Revie and Herbert H. Uhlig, "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, John Wiley & Science, 2008.
4. Mars G. Fontana, "Corrosion Engineering", Tata McGraw Hill, Singapore, 2008
5. David E.J. Talbot (Author), James D.R. Talbot, "Corrosion Science and Technology", Second Edition (Materials Science & Technology), CRC Press; 2nd Edition, 2007.
6. http://corrosion-doctors.org/Corrosion-History/Eight.html

22OCH02 POLYMER SCIENCE 3 0 0 3

Course Objectives

- Explain the properties of different polymers with its mechanism
- Select the appropriate polymerization techniques to synthesize the polymers
- Identify suitable polymers for various industrial applications

Course Outcomes (COs)

1. Illustrate the types of mechanism of polymerization reactions and analyze the natural and synthetic polymers
2. Identify the suitable polymerization techniques to synthesize the high quality polymers
3. Identify the structure, thermal, and mechanical properties of polymers for different applications
4. Apply the polymer processing methods to design polymer products
5. Analyze the polymers used in electronic and biomedical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	2												
4	1	1	2											
5	1	3	2											

UNIT I **10 Hours**

POLYMERS AND ELASTOMERS

Classification of polymers - Mechanism: Addition polymerization - free radical, cationic, anionic and co-ordination (Ziegler-Natta) polymerization - copolymerization - condensation polymerization (nylon-6,6) - ring opening polymerization (nylon-6). Elastomers: Natural rubber and synthetic rubber: styrene - butadiene rubber (SBR), butyl, neoprene, thiocol rubbers. High performance polymers: polyethers, polyether ether ketone (PEEK), polysulphones and polyimides

UNIT II **8 Hours**

POLYMERIZATION TECHNIQUES

Homogeneous and heterogeneous polymerization - bulk polymerization (PMMA, PVC) - solution polymerization - polyacrylic acid, suspension polymerization (ion-exchange resins) - emulsion polymerization (SBR) - advantages and disadvantages of bulk and emulsion polymerization. Melt solution and interfacial poly-condensation

UNIT III **8 Hours**

CHARACTERIZATION AND TESTING

Characterization of polymers by Infrared Spectroscopy (IR) and Nuclear Magnetic Spectroscopy (NMR) - Thermal properties: TGA and DSC - Testing tensile strength - Izod impact - Compressive strength - Rockwell hardness - Vicot softening point - water absorption

UNIT IV **9 Hours**

POLYMER PROCESSING

Moulding: Compression - injection - extrusion and blow mouldings. Film casting - calendering. Thermoforming and vacuum formed polystyrene - foamed polyurethanes. Fibre spinning: melt, dry and wet spinning. Fibre reinforced plastics fabrication: hand-layup - filament winding and pultrusion

UNIT V **10 Hours**

SPECIALITY POLYMERS

Preparation and properties of heat resistant and flame retardant polymers. Polymers for electronic applications: liquid crystalline, conducting and photosensitive polymers – E waste management. Polymer for biomedical applications: artificial organs, controlled drug delivery, Scaffolds in tissue Engineering – waste management.

Total: 45 Hours

Reference(s)

1. V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International (P) Ltd., New Delhi, 2021
2. Joel R. Fried, "Polymer Science and Technology", Prentice Hall of India (P). Ltd., 2014
3. F. W. Billmeyer,"Text Book of Polymer Science", John Wiley & Sons, New York, 2008
4. Barbara H. Stuart, "Polymer Analysis", John Wiley & Sons, New York, 2008
5. George Odian , "Principles of Polymerization", John Wiley & Sons, New York, 2004
6. R. J. Young and P. A. Lovell, "Introduction to Polymers", CRC Press, New York, 2011
7. Common Biocompatible Polymeric Materials for Tissue Engineering and Regenerative Medicine (2019), Materials Chemistry and Physics https://doi.org/10.1016/j.

22OCH03 ENERGY STORING DEVICES 3 0 0 3

Course Objectives

- Compare the energy density of commercialized primary and secondary batteries.
- Classify the fuel cells and compare their efficiency in different environmental conditions.
- Demonstrate the various energy storage devices and fuel cells.

Course Outcomes (COs)

1. Find the parameters required for operation of a cell to evaluate the capacity of energy storage devices.
2. Identify the electrodes, electrolyte and cell reactions of different types of primary, secondary batteries and infer the selection criteria for commercial battery systems with respect to commercial applications.
3. Differentiate fuel cells based on its construction, production of current and applications.
4. Compare different methods of storing hydrogen fuel and its environmental applications.
5. Classify the solar cell based on the materials used in it.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1												
2	2	3					1							
3	3	1												
4	2	2					1							
5	3	3					1							

UNIT I **6 Hours**

BASICS OF CELLS AND BATTERIES

Components - classification - operation of a cell - theoretical cell voltage - capacity - specific energy - energy density of lithium and lead acid battery - charge efficiency- charge rate - charge retention - closed circuit voltage - open circuit voltage current density - cycle life - discharge rate-over charge-over discharge

UNIT II **10 Hours**

BATTERIES FOR PORTABLE DEVICES AND ELECTRIC VEHICLES

Primary batteries: zinc-carbon - magnesium,and mercuric oxide - recycling/safe disposal of used cells. Secondary batteries: lead acid - nickel-cadmium - lithium ion batteries - rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide - lithium anode cell - photogalvanic cells. Battery specifications for cars and automobiles. Extraction of metals from battery materials.

UNIT III **10 Hours**

TYPES OF FUEL CELLS

Importance and classification of fuel cells: Description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells - phosphoric acid - solid oxide - molten carbonate and direct methanol fuel cells

UNIT IV **10 Hours**

HYDROGEN AS A FUEL

Sources and production of hydrogen: Electrolysis and photocatalytic water splitting. Methods of hydrogen storage: High pressurized gas - liquid hydrogen type - metal hydride. Hydrogen as engine fuel - features, application of hydrogen technologies in the future – limitations.

UNIT V **9 Hours**

ENERGY AND ENVIRONMENT

Future prospects of renewable energy and efficiency of renewable fuels - economy of hydrogen energy. Solar Cells: First, second, third and fourth generation solar cell - photobiochemical conversion cell.

Total: 45 Hours

Reference(s)

1. N. Eliaz, E. Gileadi, Physical Electrochemistry, Fundamentals, Techniques and Applications, Wiley, 2019.
2. J. Garche, K. Brandt, Electrochemical Power sources: Fundamentals Systems and Applications, Elsevier, 2018
3. S.P. Jiang, Q. Li, Introduction to Fuel Cells, Springer, 2021.
4. A. Iulianelli, A. Basile, Advances in Hydrogen Production, Storage and Distribution, Elsevier, 2016.
5. M.M. Eboch, The Future of Energy, From Solar Cells to Flying Wind Farms, Capstone, 2020.

22OMA01 GRAPH THEORY AND COMBINATORICS 3 0 0 3

Course Objectives

- This course comprehends the graphs as a modeling and analysis tool in computer science & Engineering
- It introduces the structures such as graphs & trees and techniques of counting and combinations, which are needed in number theory based computing and network security studies in Computer Science.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Recognize the basic ideas of Graph and its characteristics.
2. Assess the characteristics of trees and its properties.
3. Predict the coloring of graphs and its applications in the respective areas of engineering.
4. Compute the permutations and combinations in the engineering field.
5. Demonstrate the types of generating functions and their applications in engineering.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2													
2	1	3													
3	2	3													
4	2	3													
5	3	3													

UNIT I **9 Hours**

INTRODUCTION

Graphs - Introduction - Isomorphism - Sub graphs - Walks, Paths, Circuits - Connectedness - Components - Euler graphs - Hamiltonian paths and circuits - Trees - Properties of trees - Distance and centers in tree - Rooted and binary trees.

UNIT II **9 Hours**

TREES, CONNECTIVITY

Spanning trees - Fundamental circuits - Spanning trees in a weighted graph - cut sets - Properties of cut set - All cut sets - Fundamental circuits and cut sets - Connectivity and separability - Network flows - 1-Isomorphism - 2-Isomorphism - Combinational and geometric graphs - Planer graphs - Different representation of a planer graph.

UNIT III **9 Hours**

MATRICES, COLOURING AND DIRECTED GRAPH

Chromatic number - Chromatic partitioning - Chromatic polynomial - Matching - Covering - Four color problem - Directed graphs - Types of directed graphs - Digraphs and binary relations - Directed paths and connectedness - Euler graphs.

UNIT IV **9 Hours**

PERMUTATIONS

Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.

UNIT V **9 Hours**

GENERATING FUNCTIONS

Generating functions - Partitions of integers - Exponential generating function - Summation operator - Recurrence relations - First order and second order - Non-homogeneous recurrence relations - Method of generating functions.

Total: 45 Hours

Reference(s)

1. Narsingh Deo, Graph Theory: With Application to Engineering and Computer Science, Prentice Hall of India, 2003
2. Grimaldi R.P., Discrete and Combinatorial Mathematics: An Applied Introduction, Addison Wesley, 1994.
3. Rosen K.H., Discrete Mathematics And Its Applications, McGraw Hil, 2007
4. Clark J. & Holton D.A., A First Look at Graph Theory, Allied Publishers, 1995.
5. Mott J.L., Kandel A. & Baker T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India, 1996.
6. Liu C.L., Elements of Discrete Mathematics, McGraw Hill, 1985.

22OGE01 PRINCIPLES OF MANAGEMENT 3 0 0 3

Course Objectives

- To develop cognizance about importance of management principles.
- Extract the functions and responsibilities of managers.
- To Study and understand the various HR related activities.
- Learn the application of the theories in an organization.
- Analyze the position of self and company goals towards business.

Course Outcomes (COs)

1. Students will be able to understand the basic concepts of Management.
2. Have some basic knowledge on planning process and its Tools & Techniques.
3. Ability to understand management concept of organizing and staffing.
4. Ability to understand management concept of directing.
5. Ability to understand management concept of controlling.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1									2		3				
2									2		2				
3									2		2				
4									3		2				
5									2		2				

UNIT I **9 Hours**

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management Science or Art Manager Vs Entrepreneur-types of managers - Managerial roles and skills Evolution of Management Scientific, Human Relations, System and Contingency approaches Types of Business organization - Sole proprietorship, partnership, Company - public and private sector enterprises - Organization culture and Environment Current Trends and issues in Management.

UNIT II **9 Hours**

PLANNING

Nature and purpose of planning - Planning process - Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III **9 Hours**

ORGANISING

Nature and purpose – Formal and informal organization - Organization chart - Organization Structure Types - Line and staff authority – Departmentalization - Delegation of authority - Centralization and decentralization - Job Design - Human Resource – Management - HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career planning and management

UNIT IV **9 Hours**

DIRECTING

Foundations of individual and group behaviour – Motivation - Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership - types and theories of leadership – Communication - Process of communication - Barrier in communication Effective communication - Communication and IT.

UNIT V **9 Hours**

CONTROLLING

System and process of controlling - Budgetary and non - Budgetary control techniques - Use of Computers and IT in Management control - Productivity problems and management - Control and Performance-Direct and preventive control - Reporting.

Total: 45 Hours

Reference(s)

1. Robbins S, Management, (13th ed.), Pearson Education, New Delhi, 2017.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management, Pearson Education, 7th Edition, 2011.
3. Robert Kreitner and Mamata Mohapatra, Management, Biztantra, 2008.
4. L. M. Prasad, Principles and Practice of Management. 7th Edition, Sultan Chand & Sons, 2007.
5. P. C. Tripathi and P. N. Reddy, Principles of Management, Fourth Edition, Tata McGraw Hill, 2008.

22OGE02 ENTREPRENEURSHIP DEVELOPMENT I 3 0 0 3

Course Objectives

- Learn the basics and scope of the Entrepreneurship
- Understand the generation of ideas of the Entrepreneurship
- Evolve the legal aspects of the business
- Learn to analyze the various business finance
- Learn the basics of the Operations Management

Course Outcomes (COs)

1. Analyze the role of entrepreneurship in economic development.
2. Explain the types of ideas that to be used for entrepreneurship development.
3. Examine the legal aspects of business and its association.
4. Examine the sources of business and its analysis.
5. Analyse the different modes of operation management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1						1	2		2						
2						1	2		2						
3						1	2		2						
4						1	2		2						
5						1	2		2						

UNIT I **9 Hours**

BASICS OF ENTREPRENEURSHIP

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurship process. Role of entrepreneurship in economic development

UNIT II **9 Hours**

GENERATION OF IDEAS

Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractional, Reversal Method, Brain Storming, Analogies

UNIT III **9 Hours**

LEGAL ASPECTS OF BUSINESS

Contract act - Indian contract act, Essential elements of valid contract, classification of contracts, sale of goods act- Formation of contract of sale, negotiable instruments - promissory note, bills and cheques, partnership, limited liability partnership (LLP), companies act-kinds, formation, memorandum of association, articles of association.

UNIT IV **9 Hours**

BUSINESS FINANCE

Project evaluation and investment criteria (cases), sources of finance, financial statements, break even analysis, cash flow analysis.

UNIT V **9 Hours**

OPERATIONS MANAGEMENT

Importance - functions - deciding on the production system - facility decisions: plant location, plant layout (cases), capacity requirement planning - inventory management (cases) - lean manufacturing, Six sigma.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business

22OGE03 ENTREPRENEURSHIP DEVELOPMENT II 3 0 0 3

Course Objectives

- Evolve the marketing mix for promotion the product / services
- Handle the human resources and taxation
- Learn to analyze the taxation
- Understand the Government industrial policies and supports
- Preparation of a business plan

Course Outcomes (COs)

1. Examine the strategies and plans in marketing management.
2. Analyse the cases involved in human resource management.
3. Classify the direct and indirect taxes in business.
4. Analyze the supports given by government for improving the business.
5. Examine the various steps involved in preparing the business plan.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1						1	2		2						
2						1	2		2						
3						1	2		2						
4						1	2		2						
5						1	2		2						

UNIT I **9 Hours**

MARKETING MANAGEMENT

Marketing environment, Segmentation, Targeting and positioning, Formulating marketing strategies, Marketing research, marketing plan, marketing mix (cases)

UNIT II **9 Hours**

HUMAN RESOURCE MANAGEMENT

Human Resource Planning (Cases), Recruitment, Selection, Training and Development, HRIS, Factories Act 1948 (an over view)

UNIT III **9 Hours**

BUSINESS TAXATION

Direct taxation, Income tax, Corporate tax, MAT, Tax holidays, Wealth tax, Professional tax (Cases). Indirect taxation, Excise duty, Customs, Sales and Service tax, VAT, Octroi, GST (Cases

UNIT IV **9 Hours**

GOVERNMENT SUPPORT

Industrial policy of Central and State Government, National Institute-NIESBUD, IIE, EDI. State Level Institutions - TIIC, CED, MSME, Financial Institutions

UNIT V **9 Hours**

BUSINESS PLAN PREPARATION

Purpose of writing a business plan, Capital outlay, Technical feasibility, Production plan, HR plan, Market survey and Marketing plan, Financial plan and Viability, Government approvals, SWOT analysis.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Philip Kotler., Marketing Management, Prentice Hall of India, New Delhi: 2003
3. Aswathappa K, Human Resource and Personnel Management - Text and Cases, Tata McGraw Hill: 2007.
4. Jain P C., Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi: 2002.
5. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006.
6. http://niesbud.nic.in/agencies.html

22OGE04 NATION BUILDING, LEADERSHIP AND SOCIAL RESPONSIBILITY **3 0 0 3**

Course Objectives

- To understand the importance of National Integration, Patriotism and Communal Harmony
- To outline the basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality
- To analyze the different types of responsibility role of play for the improvement of society

Course Outcomes (COs)

1. Understand religo-cultural diversity of the country and its impact on the lives of the people and their beliefs
2. Acquire a sense of responsibility, smartness in appearance and improve self confidence
3. Develop the sense of self-less social service for better social & community life
4. Apply the importance of Physical and Mental health and structure of communication organization and various mode of communication
5. Acquire awareness about the various types of weapon systems in the Armed Forces.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2		1				1					3			
2	2		2				2					2			
3	2		1				1					2			
4	2		3				3					3			
5	2		1				1					2			

UNIT I **9 Hours**

NATIONAL INTEGRATION

Importance & Necessity, Factors Affecting National Integration, Unity in Diversity. Threats to National Security. Water Conservation and Rain Harvesting, Waste Management and Energy Conservation. Leadership Capsule-Traits-Indicators-Motivation-Moral Values-Honor Code-Case Studies: Shivaji, Jhansiki Rani, Case Studies–APJ Abdul kalam, Deepa Malik, Maharana Pratap, N Narayan Murthy Ratan Tata Rabindra Nath Tagore, role of NCC cadets in 1965 war.

UNIT II **9 Hours**

PERSONALITY DEVELOPMENT AND LEADERSHIP

Intra & Interpersonal skills - Self-Awareness- &Analysis, Empathy, Critical & creative thinking, Decision making and problem solving, Communication skills, Group Discussion – copping with stress and emotions, changing mindset, Public Speaking, Time Management, Social skills, Career counseling, SSB procedure and Interview skills.

UNIT III **9 Hours**

SOCIAL SERVICE, COMMUNITY DEVELOPMENT AND ENVIRONMENTAL AWARENESS

Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare. Protection of children & women safety, Road/ Rail Travel Safety, New initiatives, Cyber and mobile security awareness.

Disaster management Capsule-Organization-Types of Disasters-Essential Services-Assistance-Civil Defence Organization

UNIT IV **9 Hours**

HEALTH, HYGIENE AND COMMUNICATION

Sanitation, First Aid in Common Medical Emergencies. Health, Treatment and Care of Wounds. Yoga-Introduction, Definition, Purpose, Benefits. Asanas-Padamsana, Siddhasana, Gyan Mudra, Surya Namaskar, Shavasana, Vajrasana, Dhanurasana, Chakrasana, Sarvaangasana, Halasanaetc.

Obstacle Training Contact: Obstacle training - Intro, Safety measures, Benefits, Straight balance, Clear Jump, Gate Vault, ZigZagBalance, High Wall etc.

COMMUNICATION: Basic Radio Telephony (RT) Procedure-Introduction, Advantages, Disadvantages, Need for standard- Procedures-Types of Radio Telephony Communication-Radio telephony procedure, Documentation.

UNIT V **9 Hours**

ARMED FORCES AND NCC GENERAL

Introduction to Digital Signal Processors- Basic Classification-Features TMS320C6713 Architecture-Functional Unit-Pipelining- Addressing Modes -Instruction set Simple Assembly Language Program.

Total: 45 Hours

Reference(s)

1. Director General NCC Website: https://indiancc.nic.in/ncc-general-elective-subject-course-design/
2. Grooming Tomorrow's Leaders, published by DG, NCC. https://indiancc.nic.in/
3. Youth in Action, published by DG, NCC. https://indiancc.nic.in/
4. The Cadet, Annual Journal of the NCC. https://indiancc.nic.in/
5. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material. https://indiancc.nic.in/

22OBM01 OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES

3 0 0 3

Course Objectives

- Students will be able to know about Occupational safety and health (OSH)
- Students will be able to discuss about risks faced by emergency responders during disease outbreaks and other emergencies
- Students will be able to create awareness on necessary strategies for managing OSH in emergency situations

Course Outcomes (COs)

1. Practice the occupational safety measures by the scientific knowledge to overcome the risks faced by emergency responders
2. Apply appropriate strategies and tools in Occupational safety and healthcare
3. Analyse common risks for safety and health in emergencies
4. Adapt appropriate occupational safety practices in chemical accidents
5. Guide Occupational safety measures in radiation incidents

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		3	2	1				1				2		2	
2		2	2	2				1				2		2	
3		3	2	2				1				2		2	
4		2	2	2				1				2		2	
5		3	2	2				1				2		2	

UNIT I **9 Hours**

MANAGEMENT ASPECTS

Management system approach to occupational safety and health hazards and risks – rights, duties and responsibilities of employers and workers during outbreaks and emergencies – Emergency responders health monitoring and surveillance

UNIT II **9 Hours**

STRATEGIES AND TOOLS

International Health Regulations, 2005 – Incident command system for managing outbreaks and emergencies – Occupational safety and health controls – Strategies for infection prevention and control

UNIT III **9 Hours**

COMMON RISKS FOR SAFETY AND HEALTH IN EMERGENCIES

Vector-borne diseases, water and food-borne diseases, Vaccine-preventable diseases – Heat stress - Slips, trips and falls - Road traffic injuries – Ergonomic hazards - Violence – Psychological stress during outbreaks and injuries

UNIT IV **9 Hours**

OCCUPATIONAL SAFETY AND HEALTH IN CHEMICAL INCIDENTS

Emergencies caused by chemical incidents – occupational safety and health hazards and risks of chemicals – Personal Protective Equipment – Decontamination of emergency response personnel – medical surveillance of emergency responders

UNIT V **9 Hours**

OCCUPATIONAL SAFETY AND HEALTH IN RADIATION INCIDENTS

Sources and scenarios of radiation incidents – guidance for protection of emergency responders - Occupational health surveillance of persons occupationally exposed to radiation in emergencies

Total: 45 Hours

Reference(s)

1. Emergency responder health monitoring and surveillance. National Response Team technical assistance document. Atlanta (GA): National Institute for Occupational Safety andHealth; 2012.
2. Emergency response framework (ERF). Geneva: World Health Organization; 2013
3. Guidelines on occupational safety and health management systems, second edition.Geneva: International Labour Organization; 2009.
4. OSH management system: a tool for continual improvement. Geneva: International Labour Organization; 2011
5. OECD Environmental Outlook to 2050: the consequences of inaction. Paris: Organization for Economic Co-operation and Development; 2012.

22OBM02 AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT 3 0 0 3

Course Objectives

- Understand the ambulance & transport management and allied services.
- Compare the ambulance design and equipment, transportation and corporate Profit.
- Carry-out various acts governing transport management.

Course Outcomes (COs)

1. Identify ambulance services, types and allied services
2. Formulate minimum ambulance rescue equipment and developing a transportation Strategy.
3. Understand the Emergency response team, Transportation interfaces, Transportation Service Characteristics& regulatory reforms involved.
4. Identify ambulance services, types and allied services
5. Formulate minimum ambulance rescue equipment and developing a transportation Strategy.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2												2	
2	2													3	
3		2												2	
4	2	2													
5	2												2		

UNIT I **9 Hours**

INTRODUCTION

Introduction-transportation ambulance types-Advanced Life Support Ambulance-Basic Life Support Ambulance-Patient Transport Ambulance-Emergency services-Ambulances-Allied services-telephone management

UNIT II **9 Hours**

AMBULANCE DESIGN AND EQUIPMENT

Design and Equipment of Ambulances -Minimum Ambulance Rescue Equipment-Emergency drugs medicines Recruitment validation Training to handle in house Ambulance emergency procedures Checklist measures Roles of paramedics, midwives, community nurses, hospice workers in emergency handling via ambulance

UNIT III **9 Hours**

TRANSPORTATION REGULATION FOR EMERGENCY MEDICAL SERVICE

Crisis Management-Anxiety & Stress Management-the Emergency response team-police assistance-Information handling & processing-Establishing customer service levels - Developing and Reporting customer service standards - Impediments to an Effective customer Service strategy - Improving customer Service Performance Transportation

UNIT IV **9 Hours**

AMBULANCE PREVENTIVE MAINTENANCE

Legal obligationsSwitch Console Front, Main Electrical, Patient Compartment Climate Oxygen system On board Suction system 110/12 VOLT system, Modular Body, Medical Equipment - Cot & Stretcher, safety belts-driver(s), passenger, Patients-child restraint device- incubator

UNIT V **9 Hours**

THE MOTOR VEHICLE ACT

The Motor Vehicle Act, 1988- Rules of the road Regulations 1989- Overall Dimensions of Motor Vehicles (Prescription of conditions for exemption) Rules 1991-Use of Red light on the top front of the vehicle

Total: 45 Hours

Reference(s)

1. Fawcett,"Supply Chain Management", Pearson Education India, 01-Sep-2008 - 600 pages.
2. B. Feroz, A. Mehmood, H. Maryam, S. Zeadally, C. Maple and M. A. Shah, "Vehicle-Life Interaction in Fog-Enabled Smart Connected and Autonomous Vehicles," in IEEE Access, vol. 9, pp. 7402-7420, 2021, doi: 10.1109/ACCESS.2020.3049110.
3. R. Jin, T. Xia, X. Liu, T. Murata and K. -S. Kim, "Predicting Emergency Medical Service Demand With Bipartite Graph Convolutional Networks," in IEEE Access, vol. 9, pp. 9903-9915, 2021, doi: 10.1109/ACCESS.2021.3050607.
4. Les Pringle,"Call the Ambulance",Transworld Publishers, 2010.
5. Edward J. Bardi, John Joseph Coyle, Robert A. Novack"Management of Transportation", Thomson/South-Western, 2006

22OBM03 **HOSPITAL AUTOMATION** **3 0 0 3**

Course Objectives

- Introduce the concepts of hospital systems and need for central monitoring
- Exemplify the power generation, utility and protection systems.
- Apply the distributed and central monitoring functions in hospital environment

Course Outcomes (COs)

1. Identify the factors in central power generating and monitoring systems
2. Analyze the sensors and actuators for the automation systems
3. Classify the equipment types and its applications.
4. Apply software tools and digital computer for monitoring of parameters and medical data handling
5. Design central monitoring station for hospitals for control and surveillance applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2													2	
2		2												2	
3		2											3		
4		2												2	
5	3													2	

UNIT I **9 Hours**

AUTOMATION IN HEALTHCARE

Introduction to automation Role of automation in healthcare Remote Patient Monitoring Maximizing resources on patient care Reducing variability, Automating clinician and patient interactions through products.

UNIT II **9 Hours**

POWER GENERATION AND MEDICAL GAS PRODUCTION

Power generator, Battery : Maintenance and troubleshooting, energy conservation and monitoring system - Automation in dryer, compressor, air conditioning, lighting, heating systems.

UNIT III **9 Hours**
AUTOMATION IN PIPING

Monitoring of flow and pressure of medical gas System components Vacuum control units Automatic changeover system - Types of Outlets - Leakage test- Prevention and safety automation.

UNIT IV **9 Hours**
INSTRUMENTATION SYSTEMS

Optical sensors , Pressure Sensors - Ultrasonic Sensors - Tactile Sensors - Thermal sensors -Biosensor - Linear Actuators, Central monitoring station - Alarm system - Regulation and standards.

UNIT V
APPLICATIONS **9 Hours**

Business intelligence & executive dashboards - Radio-Frequency Identification (RFID)- based patient and asset tracking solutions - Tablet-based applications for bed side access to doctors/nurses - Healthcare CRM for patient relationship management - Patient kiosk, tele-health – HIS integration.

Total: 45 Hours

Reference(s)

1. Khandpur RS, Handbook of Biomedical Instrumentation, Prentice Hall of India, New Delhi, 3 rd edition, 2014.
2. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education India, Delhi, 4 th edition 2008
3. Curtis Johnson D Process Control Instrumentation Technology, Prentice Hall of India, 8th edition 2006
4. John V. Grimaldi and Rollin H. Simonds., Safety Management, All India Travelers Book seller, New Delhi, 1989
5. N.V. Krishnan, Safety in Industry, Jaico Publisher House, 1996.

22AGO01 RAINWATER HARVESTING TECHNIQUES 3 0 0 3

Course Objectives

- To enhance the awareness about water resources management and conservation
- To acquire knowledge about water harvesting techniques and their implementation
- To practice the design aspects of sustainable rainwater harvesting solutions for communities

Course Outcomes (COs)

- Assess the sources, availability and challenges in water resources management
- Assess various water harvesting systems in practice
- Execute design considerations for comparing surface runoff harvesting methods
- Compare the characteristics and impacts of flood water harvesting techniques
- Evaluate various rainwater harvesting methods for groundwater recharging

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	O3
1	1						3							1	
2	2	1												2	
3	1	1	3				2							1	
4	1	2	3				2							1	
5	1	1	3				2							1	

Unit I **8 Hours**

WATER RESOURCES AND CONSERVATION CHALLENGES

Global water distribution – primary and secondary sources of water – technical, social and cultural aspects; Global challenges in water and climate – water scarcity – water pollution – Indian scenario; Water resources management – public participation – integrated approach; Water governance – water sharing plans – policy, schemes and concerns

Unit II **10 Hours**

WATER RESOURCES AND CONSERVATION CHALLENGES

Principles of water harvesting for rural and urban – collection at micro and macro levels, flow control, storage and uses; Rainwater harvesting systems – traditional and contemporary – groundwater recharge; Water resources inventory – site analysis – database collection – water allocation principles based on demand and supply; Traditional water harvesting systems – practices in India – references in old texts – reasons for their deterioration – way forward; Watershed-based approach – project planning at micro and macro levels – community participation – rain centres.

Unit III **9 Hours**

SURFACE RUNOFF HARVESTING

Short-term and micro-level harvesting techniques for runoff – terracing and bunding – rock and ground catchments; Long-term and macro-level harvesting techniques for runoff – farm ponds – percolation ponds and nala bunds; Design considerations – site selection – selection of runoff coefficients – computation of rainwater runoff volume – hydrograph analysis – cost estimation; Design of storage structures – storage capacity – selection of component – methods of construction

Unit IV **9 Hours**

FLOOD WATER HARVESTING

Floods – causes of urban floods and droughts – characteristics of water spread – impacts; Flood water harvesting – permeable rock dams – water spreading bunds – flood control reservoir; Design considerations – computation of flood water quantity; Trenching and Diversion Structures – types – site selection – design criteria – most economic section – design consideration of ditch system

UNIT V **9 Hours**

GROUNDWATER HARVESTING

Rooftop rainwater harvesting – recharge pit – recharge trench – tube well – recharge well; artificial recharge – gully plug – dug well – percolation tank – nala bunds – recharge shaft; Groundwater harvesting – aquifer characteristics – subsurface techniques – infiltration wells – recharge wells – groundwater dams; Design of drainage system – types – design criteria – filter design – causes of failures

Total **45 Hours**

References

1. Theib YO, Dieter P, Ahmed YH, Rainwater Harvesting for Agriculture in the Dry Areas, CRC Press, Taylor and Francis Group, London, 2012.
2. Lancaster, Brad. Rainwater Harvesting for Drylands and Beyond, Volume 1, 3rd edition, Rainsource Press. 2019.
3. Das M, Open Channel Flow, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
4. Michael AM, Ojha TP, Principles of Agricultural Engineering, Volume II, 4th Edition, Jain Brothers, New Delhi, 2003.
5. Suresh R, Soil and Water Conservation Engineering, Standard Publisher Distributors, New Delhi, 2014.
6. Singh G, Venkataramanan C, Sastry G, Joshi BP, Manual of Soil and Water Conservation Practices, CSWCR&TI, Dehradun, 1990

Online resources

1. https://onlinecourses.swayam2.ac.in/cec21_ge14/preview
2. https://archive.nptel.ac.in/content/storage2/courses/105101010/downloads/Lecture10.pdf

22OEE01 **VALUE ENGINEERING** **3 0 0 3**

Course Objectives

- To understand the concept of value engineering in order to reduce cost of product or process or service.
- To implement creative and innovative techniques using FAST diagram.
- To study benefits of Value Engineering for various industries.

Course Outcomes (COs)

The students will be able to

- Apply the concepts of value and value engineering to prepare a job plan
- Analyse the cost and worth of a product/service using the principles of economics
- Evaluate the value of a product/service to take managerial decisions
- Apply the soft skills in understanding team building, team work and report writing
- Asses the functions and values of product/services in industries using case studies

Articulation Matrix

CO. No.	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1											3	1	1	
2										1	3	1	1	
3											3	1	3	
4										1	3	2		1
5										2	3	1		2

Unit I **INTRODUCTION TO VALUE ENGINEERING** **8 Hours**

Historical perspective of Value Engineering, Aims and objectives of Value Engineering , Concept of Value, Value Engineering concerned with Economic Value , Value Engineering Job plan.

Unit II
FUNCTIONAL ANALYSIS **9 Hours**

Function-Cost-Worth analysis: Function Analysis System Technique (FAST); Review of principles of engineering economics

Unit III
EVALUATION OF VALUE ENGINEERING **10 Hours**

Evaluation of function, Problem setting system, problem solving system, setting and solving management - decision - type and services problem, evaluation of value

Unit IV **HUMAN ASPECTS IN VALUE ENGINEERING** **9 Hours**

Team building; Life cycle costing; Managing Value Engineering Study; Value Engineering Report writing; Presentation Skill - Individual and Team Presentations; Implementation and follow-up.

UNIT V **BENEFITS OF VALUE ENGINEERING** **9 Hours**

Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe Value Engineering Case studies in the Industries like Manufacturing; Construction; Health Care; Process.

Total 45 Hours

References

1. Anil Kumar Mukhopadhyaya, Value Engineering Mastermind - From Concepts to Certification, Response. Business Books from SAGE, Los Angeles / London / New Delhi / Singapore / Washington DC, 2014.
2. Anil Kumar Mukhopadhyaya, Value Engineering -Concepts, Techniques and Applications, Response Books, A Division of SAGE Publications, New Delhi / Thousand Oaks / London, 2003
3. R. D. Miles, Techniques of Value analysis & Engineering, McGraw Hill, 2000.
4. E. Midge Arthur, Value Engineering -A Systematic Approach, McGraw Hill Book Co., New York, 2000.
5. Zimmerman, Value Engineering - A Practical Approach, CBS Publishers & Distributors, New Delhi, 2000.

Online Resources:

1. https://www.investopedia.com/terms/v/value-engineering.asp#:~:text=Value%20engineering%20promotes%20the%20substitution,is%20also%20called%20value%20analysis.
2. https://cleartax.in/glossary/value-engineering/

22OEE02 **ELECTRICAL SAFETY** **3 0 0 3**

Course Objectives

- To provide knowledge on basics of electrical fire and statutory requirements for electrical safety
- To understand the causes of accidents due to electrical hazards
- To know the various protection systems in Industries from electrical hazards
- To know the importance of earthing
- To distinguish the various hazardous zones and applicable fire proof electrical devices

Course Outcomes (COs)

The students will be able to

- Analyze the basic concepts in electrical circuit and hazards involved in it.
- Analyze the electrical hazards in the workplace and its impacts.
- Examine the operation of various protection systems from electrical hazards.
- Explore the different hazardous zones in Industries and their safety measures.
- Analyze the various safety procedures involved in the industries.

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1				2	1						2	
2	1	1				1	2	2					1	2
3	1	1				2		2	1				2	1
4	1	1				2	1						1	
5	1	1				2	1	2	1				2	1

UNIT I INTRODUCTION **9 Hours**

Objectives of safety and security measures - Hazards associated with electric current and voltage - principles of electrical safety - working principles of major electrical equipment - Typical supply situation - Indian electricity act and rules - statutory requirements from electrical inspectorate-International standards on electrical safety.

UNIT II ELECTRICAL HAZARDS9 Hours

Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity- Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges- over current and short circuit current-heating effects of current- Lightning, hazards, lightning arrestor, - national electrical safety code ANSI.

UNIT III ELECTRICAL SAFETY EQUIPMENT **9 Hours**

Fuse, circuit breakers and overload relays - safe distance from lines - capacity and protection of conductor joints and connections, overload and short circuit protection - earth fault protection. FRLS insulation - insulation and continuity test - system grounding - equipment grounding - earth leakage circuit breaker

(ELCB) - ground fault circuit interrupter - electrical guards - Personal protective equipment.

UNIT IV ELECTRICAL SAFETY OPERATION AND MAINTENANCE **9 Hours**

Role of environment in selection - protection and interlock - discharge rod and earthing devices - safety in the use of portable tools - preventive maintenance - installation – earthing, specifications, earth resistance, earth pit maintenance - Fire Extinguishers - CO2 and Dry Powder schemes.

UNIT V HAZARDOUS AREAS **9 Hours**

Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies – electrical safety standards. (IS, API and OSHA standards)

Total **45 Hours**

References

1. Fordham Cooper, W., "Electrical Safety Engineering, Butterworth and Company", London, Third Edition, 2013.
2. "Indian Electricity Act and Rules", Government of India.
3. "Power Engineers", Handbook of TNEB, Chennai, 2010.
4. "Accident prevention manual for industrial operations", N.S.C., Chicago, 1982.
5. John Cadick, P.E., Mary Capelli-Schellpfeffer, Dennis K. Neitzel, Al Winfield, "Electrical Safety Handbook", Fourth Edition, Tata Mcgraw Hill, 2014.

Online Resources:

1. https://egyankosh.ac.in/handle/123456789/59158
2. https://tnebes.org/archive/2019/May19/safetymanual%20.pdf
3. https://electricalsafety.lbl.gov/resources/standards/

22OCB01 INTERNATIONAL BUSINESS MANAGEMENT 3 0 0 3

Course Objectives

- To enable the students to understand the fundamentals of international business
- To provide competence to the students on making international business decisions
- To enable the students to understand the financial and promotional assistance available for exporters

Course Outcomes (COs)

1. Demonstrate the role and importance of digital marketing in today's rapidly changing business environment.
2. Discover the techniques to help organizations to utilize social media for digital marketing.
3. Analyze the key elements and campaign effectiveness of E-Mail marketing and mobile marketing.
4. Evaluate the effectiveness of a digital marketing campaign using Google Analytics.
5. Apply advanced practical skills to plan, predict and manage digital marketing campaign

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3						2		2					1
2	3						3		2					1
3	3						3		2					2
4	3						2		2					2
5	3						2		2					1

UNIT I **9 Hours**

INTRODUCTION

Definition, Drivers of International Business, Domestic Vs. International Business, Trade and Investment Theories: Interventionist Theories, Free Trade Theories, Theories Explaining Trade Patterns: PLC Theory, The Porter Diamond, Factor Mobility Theory.

UNIT II **9 Hours**

GLOBALIZATION

Globalization: Implications, Challenges - Protectionism: Tariff Barriers, Non-Tariff Barriers- Forms of Integration, Role of WTO and IMF in International Business, Economic, Political, Cultural and Technological Environments.

UNIT III **9 Hours**

INTERNATIONAL BUSINESS STRATEGIES

Market Entry Strategies, Multinational Strategy, Production Strategy, Marketing Strategy, Human Resource Strategy.

UNIT IV **9 Hours**

FOREIGN EXCHANGE

Foreign Exchange Market – Functions, Theories of Exchange Rate Determination, Exchange Rate Forecasting, Convertibility of Currency, Risks associated with Foreign Exchange.

UNIT V **9 Hours**

EXPORTS AND ETHICS IN INTERNATIONAL BUSINESS

Exports – Risks, Management of Exports, Regulatory frameworks, Export financing, Countertrade, Ethics – Issues, Dilemma and Theory.

Total: 45 Hours

References:

1. John D Daniels, Lee H.Radebaugh, and Sullivan, “International Business”, New Delhi: Pearson Education, 2018.
2. Charles W L Hill and Arun Kumar Jain, “International Business”, New Delhi: Tata McGraw Hill, 2017.
3. Francis Cherunilam, “International Business”, New Delhi: Prentice Hall of India, 2020.
4. Simon Collinson, Rajneesh Narula, Alan M. Rugman, “International Business”, New Delhi: Pearson Education, 2020.
5. K.Aswathappa, “International Business”, New Delhi: Tata McGraw Hill, 2020.

2IT0XA SWIFT FOR IOS DEVELOPMENT 1 0 0 1

Course Objectives

1. Learn how to use Xcode IDE for iOS app development
2. Understand the concept of Auto Layout and how to use it to create responsive UIs
3. Learn how to publish your app to the App Store.

Course Outcomes (COs)

1. Develop basic iOS applications using Swift programming language, including user interface and data persistence.
2. Use Xcode IDE to build and debug iOS applications.
3. Publish an iOS application to the App Store.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2				2			1		1	1	
2		1	2	2		1		1					1	

iOS Development- Introduction to XCode IDE, Views and View Controllers- Storyboard and Interface Builder - Creating the first iOS application- iOS UI Controls-iOS Container Views - iOS Content Views-iOS View Controllers-Tab Bar Interface- Navigation Interface - Architecture Pattern - Install Libraries - Web Request & Parsing -iOS UserDefaults -CoreData & Database-Multithreading in Swift - Misc

Total: 15 Hours

Reference(s)

1. Apple's official Swift documentation: https://docs.swift.org/swift-book/
2. Apple's official iOS app development documentation: https://developer.apple.com/documentation/
3. Stanford University's iOS app development course on iTunes U: https://itunes.apple.com/us/course/developing-ios-11-apps-with-swift/id1309275316
4. "Swift Programming: The Big Nerd Ranch Guide" by Matthew Mathias and John Gallagher "iOS Apprentice" by Matthijs Hollemans
5. "Swift for Beginners: Develop and Design" by Boisy G. Pitre and Jaimee Newberry
6. "Learning Swift: Building Apps for macOS, iOS, and Beyond" by Jonathon Manning and Paris Buttfield-Addison

22IT0XB CONTAINERS AUTOMATION 1 0 0 1

Course Objectives

- To understand the concept of container Automation and its importance in distributed systems.
- To configure and manage container Automation to distribute traffic across instances.

Course Outcomes (Cos)

1. Understand the fundamentals of distributed systems.
2. Apply various types of Containers Automation
3. Able to configure Container Automation to distribute traffic across instances.

Articulation Matrix

CO N	PC	PC	PC	PC	PC	PC	PC	PC	PC	PO1	PO1	PO1	PSC	PSC
1	1	2	2				2			1		1	1	
2		1	2	2		1		1					1	
3		1	2	2		1		1					1	

UNIT 1 **15 Hours**

Containers Automation

Introduction to Container Automation - Run multiple containers - CRUD Operations - Introduction to Continuous Integration (CI) - Jenkins - Understand image layers - Orchestrate applications - Docker Networking - Docker Swarm

Total: 15 Hours

Reference:

1. Filip Covic ,"Container Handling in Automated Yard Blocks",2019

2. Francisco Javier Ramírez Urea," Containers for Developers Handbook",2023

22IT0XC AWS Load balancing Technique 1 0 0 1

Course Objectives

- To understand the concept of load balancing and its importance in distributed systems.
- To compare and contrast different types of AWS load balancers.
- To configure and manage AWS load balancers to distribute traffic across instances.
- To implement health checks and troubleshoot load balancing issues.
- To apply best practices for load balancing in AWS environments.

Course Outcomes (COs)

1. Understand the fundamentals of distributed system
2. Able to configure and manage AWS load balancers to distribute traffic across instances.
3. Able to implement health checks and troubleshoot load balancing issues

Articulation Matrix

CO N	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
1	1	2	2				2			1		1	1	
2		1	2	2		1		1					1	
3		1	2	2		1		1					1	

UNIT 1 **15 Hours**

AWS Load balancing Technique

Introduction to Load Balancing - Basics of load balancing and types - Creating and configuring - classic load balancer Application load balancer - Networking load balancer - Creating and implementing advance load balancing - Common load balancing issues - troubleshooting, Strategies - maintaining high availability - fault tolerance - Load balancing micro services - containerized applications.

Total: 15 Hours

Reference:

1. Server Load Balancing by Tony Bourke

22IT0XD ETHICAL HACKING ESSENTIAL:WEB PENTESTING 1 0 0 1

Course Objectives

- Assess various modern tools & Techniques.
- Demonstrate the different Cyber Attacks.
- Implement Web Penetration Testing.

Course Outcomes (COs)

1. Assess the Vulnerability of the websites using pentesting tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2	2									2	

UNIT 1 **15 Hours**

Ethical hacking Essential:Web Pentesting

Kali linux networking commands - Steganography- Information Gathering- Information gathering tool- XAMPP-NGROK- L3MON- BWAPP-COOKIES- Burp Suite -Cross Site Scripting (XSS)- File Upload vulnerability- Dirb Tools - HTML Injection- SQL injection- TOR- TERMUX

Total: 15 Hours

Reference(s)

1. Andy Gill," Breaking into Information Security: Learning the Ropes 101",2022
2. Phillip L. Wylie , Kim Crawley ," Pentester BluePrint: Starting a Career as an Ethical Hacker",2021
3. Zaid Sabih," Learn Ethical Hacking from Scratch: Your stepping stone to penetration testing",2018

22IT0XE GENERATIVE AI WITH LARGE LANGUAGE MODELS 1 0 0 1

Course Objectives

- Understand how to integrate large language models into your generative AI projects and the latest advancements in the field
- Learn the basics of transfer learning and transformer training to optimize AI models in NLP applications.

Course Outcomes:

- Apply generative AI for domain-specific tasks like video summarization, automated research, and conversational data insights.
- Apply various NLP techniques, such as text classification, named entity recognition, question answering, text summarization, and sentiment analysis, using large language models.

Articulation Matrix

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2				2			1		1	1	
2	1	1	2	2		1		1					1	

UNIT 1 **15 Hours**

Introduction to AI generative models -Types of AI generative models- Variational autoencoders - Generative adversarial networks (GAN)- Auto regressive models- Flow based models-Transformer based model-Generative AI use cases- Introduction to large language models- Calling OpenAI APIs, including GPT-4- Training and deploying LLMs- The Hugging Face Transformers Library-Open source pretrained LLMs-Fine tuning and evaluating LLMs-LLM deployment considerations

Total: 15 Hours

References

1. Generative AI : For Entrepreneurs in a Hurry by Mohak Agarwal
2. Quick start guide to large language models by Sinan Ozdemir
3. GPT-3 Building Innovative NLP Products Using Large Language Models by Sandra Kublik, Shubham Saboo
4. Introduction to Transformers for NLP by Shashank Mohan Jain · 2022

22IT0XF DEEP LEARNING USING COMPUTER VISION 1 0 0 1

COURSE OBJECTIVES

- To understand the fundamental concepts of neural networks , deep learning and their applications in computer vision.
- To analyze and apply algorithms for object detection and recognition.

COURSE OUTCOMES (COs)

1. Develop the ability to conceptualize and solve complex computer vision problems using neural networks.
2. Implement and fine-tune neural network models for specific tasks using appropriate architectures and techniques.

ARTICULATION MATRIX

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2				2			1		1	1	
2		1	2	2		1		1					1	

UNIT 1 15 Hours

Neural Networks - Fully Connected & Deep NNs - Activation Functions - Regularization - Bias - Variance - Loss Function - Optimization- Introduction to CNNs - Convolution Layers - Convolution NN Models - Alexnet - VCG16 - ResNets - RCNN - YOLO - Intersection of Union in YOLO - Bounding Box Regression in YOLO - Vehicle Identification - Number Plate Recognition

Total: 15 Hours

Reference(s)

1. "Deep Learning for Vision Systems" , Mohamed Elgendy,Manning Publisher,2020.
2. "Deep Learning for Computer Vision" ,Rajalingappaa Shanmugamani, Packt Publishing,2018.
3. “Deep Learning" ,Ian Goodfellow, Yoshua Bengio, and Aaron Courville,MIT Press, 2016.
4. “Computer Vision: Algorithms and Applications" ,Richard Szeliski, Springer, 2010.

22IT0XG FEATURE ENGINEERING FOR NLP 1 0 0 1

COURSE OBJECTIVES

● To Understand the importance of feature engineering in Natural Language Processing. ● To Learn the different techniques for text cleaning and preprocessing and apply them on natural language applications.

COURSE OUTCOMES (COs)

1. Apply different techniques for text cleaning and preprocessing
2.Implement feature engineering techniques to real-world NLP problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3		2	2	1								2
2		1	2	2		1		1					1	

UNIT I **15 Hours**

Introduction to natural language processing - Text Corpus - Exploratory Data Analysis - Word Embedding - Feature Scaling and Normalization - Feature Encoding - Nominal vs Ordinal Encoding - One Hot Encoding - Mean Encoding - Target Guided Ordinal Encoding - Label Encoding - Feature Selection - Chi Square Test - Information Gain - Forward Selection - Backward Elimination - LASSO regression - Ridge Regression.

Total: 15 Hours

Reference(s)

1. Steven Bird, Ewan Klein, and Edward Loper, “Natural Language Processing with Python”, O’Reilly, 2009
2. Q. Ethan Mccallum, “Bad Data Handbook: Cleaning Up The Data So You Can Get Back To Work” ,O’Reilly, 2012.
3. Jalaj Thanaki, “Python Natural Language Processing: Advanced machine learning and deep learning techniques for natural language processing, Ingram Short, 2017. 4. Alice Zheng, Amanda Casari, Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists, O’Reilly, 2018.

L	T	P	C
1	0	0	1

22IT0XH **TABLEAU**

Course Objectives

- To provide a foundational understanding of Tableau with practical use case
- To learn about core Tableau concepts

Course Outcomes (COs)

The students will be able to

- Understand visualization concepts and importance of visualization
- Identify an appropriate solution using various Tableau techniques with various use cases.

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1									1	1	
2		1	2	2		1							1	

Introduction to Tableau - Different Products by Tableau (Tableau Server, Tableau Desktop, Tableau Reader, Tableau Online, Tableau Public, Tableau Mobile), - Advantages of Tableau - Introduction to Data Visualization - Tableau's Popularity – An example with Magic Quadrant for Analytics and Business Intelligence Platform - Applications of Tableau - Companies using Tableau - Features of Tableau - Tableau Terminologies - Navigations - Design Flow - How to Connect to a File Source - Data Types in Tableau - Changing Data Types - Tableau Operators - String Functions in Tableau - Date Functions in Tableau - Logical Statements in Tableau (CASE, IF, IFNULL, IIF) - Aggregate Functions - Joins in Tableau - Data Blending - Field Operator - How to Apply Filter - Changing Data Type of a Field from Data Pane - Worksheet - Charts - Tableau Forecasting - Calculated Fields - Dashboard - Story - Tableau Case Studies

Total ***15*** **Hours**

References

1. Tableau for Dummies by Molly Monsey and Paul Sochan
2. Visual Data Storytelling with Tableau by Lindy Ryan

22IT0XI WEB DEVELOPMENT USING CMS: A COMPARITIVE STUDY

L	T	P	C
1	0	0	1

Course Objectives

- To discover the characteristics of website development applications including the major system components and architectures of the systems
- To analyze the strengths and limitations of the tools and devices for website development using Joomla platform.
- To explore the characteristics of different types of website development on the performance metrics

Course Outcomes (COs)

The students will be able to

- Understand the fundamental elements of Content Management Systems.
- Learn the design process of Joomla and WordPress website development Environments and its solutions.
- Familiarize hardware, software and the aspects involved in Joomla & WordPress website - development.

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		1								2	
2	1				2						1		2	
3	1		2		3						2		2	

EXPLORING JOOMLA AND WORDPRESS

Different types of servers – Website development platforms – XAMPP, WAMP, LAMP – Basic blocks in website development and CMS – Overview of WordPress – Introduction and features - Overview of Joomla – Introduction and features. Advantages and Disadvantages of CMS – Comparison of Joomla, WordPress with other CMS- Joomla and its benefits – Installation of Joomla, set up and Process – Administrator Menus – Administrator Modules – Global Configurations – Preparing the content – Planning, creating and organizing content – Category Manager Overview – Copying, Moving Categories – Create Content – Create Articles – Article Parameters – Permissions – Menus – Menu Manager – Menu Item Parameters – Menu Module–Split Menus- Overview of WordPress – Understanding the dashboard – Understanding themes – Understanding Plug-ins – Creating Menus – Changing Menu Page – Installing Plugins – Page Creation – About Us, Support Us and Contact Us – Gallery – Posts – Widgets – Sliders – Logo Creation – Customization Options – Updating Settings.

Total ***20*** **Hours**

References

1 Ron Saverdia, Kenneth Crowder, “Building Powerful and Efficient Websites Using Joomla”, O’Reilly, 2019
2 Lis Sabin, Wilson, “WordPress for Dummies”, 6th edition, A Wiley Brand, 2023

L	T	P	C
1	0	0	1

22IT0XJ DATA VISUALIZATION AND REPORTING USING POWERBI

Course Objectives

- Focused on introducing users to the fundamentals of Power BI and DAX in a hands-on and interactive environment.
- Throughout the course, users will be guided through an end-to-end analytics scenario using a combination of lectures, demos, and hands-on labs to reinforce understanding of the data analysis process.
- Learn Power BI skills that will get you started with self-service business analytics and sharing discovered insights.

Course Outcomes (COs)

The students will be able to,

- Understand the fundamental elements of using PowerBI.
- Learn the design process of PowerBI development Environments and its solutions.
- Familiarize the concepts used in business analysis and integrate in any business.

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		1								2	
2	1				2						1		2	
3	1		2		3						2		2	

CREATING TABLE RELATIONSHIPS & DATA MODELS IN POWER BI

Introduction to Microsoft PowerBI Desktops – Downloading and Adjusting Settings – Regional Settings – Exploring the Interface and Workflow – PowerBI resources – Connecting & Shaping Data with Power BI Desktop – The Power BI Query Editor – Power BI Demo & Solution- Principles of Normalization – Data Tables Vs Lookup Tables – Table Relationships Vs Merged Tables – Snowflake Schemes in Power BI – Active Vs Inactive Relationships – Understanding Relationship Cardinality – Connecting Multiple Data Tables – PowerBI Desktop Model View – Analyzing data with DAX Calculations in Power BI – Implicit Vs Explicit DAX Measures- Inserting Basic charts and Visuals in Power BI – Adding Simple Objects to the Power BI Report Canvas – Exploring the Reports View in Power BI Desktop – Power BI Report Filtering – Power BI Report Formatting – Demos & Previews. AI Visuals and Demos

Total *20* Hours

References

1 Brian Larson, “Data Analysis with Microsoft Power BI”, McGraw-Hill. O’Reill, ISBN: 9781260458626, 2020.

2 Greg Deckler, Brett Powell, “Microsoft Power BI Cookbook”, Second Edition, ISBN: 1801813043

		L	T	P	C
22IT0XK	**CLOUD MULTI-TENANCY AND SECURITY**	**1**	**0**	**0**	**1**

Course Objectives

- Understand the fundamental concepts of cloud multi-tenancy and its significance in modern cloud computing.
- Evaluate the benefits and challenges associated with implementing multi-tenancy in cloud environments.

Course Outcomes (COs)

The students will be able to

- Grasp multi-tenancy's significance role in optimizing resource usage and cost-effectiveness.
- Evaluate the benefits of multi-tenancy, recognizing cost savings and flexible resource allocation.

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		3	2	3	3	3		1	3	2	3	2	
2	2		3	3	2	3	3		1	2	2	2	2	

Introduction to Cloud Multi-Tenancy-Architectural Models for Multi-Tenancy-Security Threats and Vulnerabilities -Security Measures and Best Practices- Access Control and Authentication in Multi-Tenancy- Regulatory Compliance Considerations-Monitoring, Auditing, and Incident Response

Total ***15*** **Hours**

References

1 "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" by Tim Mather, Subra Kumaraswamy, and Shahed Latif
2 "Architecting the Cloud: Design Decisions for Cloud Computing Service Models" by Michael J. Kavis

L	T	P	C
1	0	0	1

22IT0XL CLOUD INFRASTRUCTURE MODERNIZATION

Course Objectives

- Gain insight into the evolutionary journey of cloud computing and the imperative for infrastructure modernization.
- Evaluate the impediments inherent in legacy infrastructure and identify opportunities for enhancement

Course Outcomes (COs)

The students will be able to

- Grasp multi-tenancy's significance role in optimizing resource usage and cost-effectiveness.
- Evaluate the benefits of multi-tenancy, recognizing cost savings and flexible resource allocation.

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		3	2	3	3	3		1	3	2	3	2	
2	2		3	3	2	3	3		1	2	2	2	2	

Introduction to Modernizing Cloud Infrastructure-Challenges of Legacy Infrastructure-Strategies for Modernization-Migration Strategies - Optimizing Cloud Infrastructure-Automation and Infrastructure as Code (IaC)-Managing Modern Cloud Infrastructure-Case Studies and Best Practices

Total ***15*** **Hours**

References

1 "Cloud Computing: Principles, Systems and Applications" by Rajkumar Buyya, Chee Shin Yeo, and Srikumar Venugopal
2 "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Zaigham Mahmood, and Ricardo Jimenez
3 "Cloud Computing: Theory and Practice" by Qing Li

22IT0XM **CYBER RISK MITIGATION**

L	T	P	C
1	0	0	1

Course Objectives

- To Assess various modern tools & Techniques.
- To Demonstrate the different Cyber Attacks on real time.
- To Implement data hiding techniques for cyber risk management.

Course Outcomes (COs)

The students will be able to

- Understand the importance of Cyber security.
- Apply data hiding techniques for cyber risk management.

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2		1								2	
2	2		2		2								2	

Cyberspace - Overview of Computer and Web-technology-Concept of cyber security - Issues and challenges of cyber security – Legal perspective of cybercrime - IT Act 2000 and its amendments - Cybercrime and offenses - Kali Linux Installation in Virtual Machine - Basic Linux commands - Networking Commands - Network configuration - DoS - DDoS - Spyware - Keylogger - Email spoofing - Phishing - SQL injection – Cross-site scripting - Password Cracking.

Total ***15*** **Hours**

References

1 Introduction to Cyber Security available at http://uou.ac.in/foundation-course
2 Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17
3 Cyber Security Techniques http://uou.ac.in/progdetail?pid=CEGCS-17

L	T	P	C
1	0	0	1

22IT0XN BUILDING API WITH DJANGO FRAMEWORK

Course Objectives

- To learn the core concepts of Django and Django Rest Framework.
- To analyze advanced querying techniques using Django ORM

Course Outcomes (COs)

The students will be able to

- Implement the simple API with Django frameworks.
- Apply the advanced querying techniques using Django ORM

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
1	3	3	1	3	2				2				2	1
2	3	3		2	2				2				2	2

Overview of Django and Django Rest Framework (DRF)- Setting up a Django project and integrating DRF, A simple API with pure Django, A simple API with pure Django, Views and Generic Views, Access Control-Authentication scheme setup, Advanced Querying and Filtering, Testing and Continuous Integration.

Total *20* Hours

References

1 Building APIs with Django and Django Rest Framework - by Agiliq -2021
2 Django for APIs –build web API with python & Django- William S Vincent-2021
3 https://www.django-rest-framework.org/

L	T	P	C
1	0	0	1

22IT0XO REAL TIME INTERNET OF ROBOTICS THINGS(RIoT)

Course Objectives

- To enhance the capabilities of IOT Sensors and Actuator of Internet of Things
- To understand various applications in robotic systems within the IOT framework and techniques.

Course Outcomes (COs)

The students will be able to

- Identify functionalities and components of IOT.
- Implement the techniques for robotic localization and mapping.

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	3	2				2				2	1
2	3	3		2	2				2				2	2

IoT Foundations: Logical design of IoT – IoT functional blocks, Integration of Sensors and Actuators with Arduino, Sensors for IoT: Water Quality sensors, Sensor applications, Actuator for IoT: maintenance of actuators, smart material actuators, Applications of IoT in Robotics: IoT applications and Sensors, Space robotics for science and space exploration, Satellite based Internetworking, Tele operators, Space component systems like rover mobility, locomotion and guidance.

Total ***20*** **Hours**

References

1 Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), 1st Edition, VPT, 2014.
2 Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies,Platforms, and Use Cases", CRC Press, 2017.
3 Lewin A.R.W. Edwards, “Open source robotics and process control cookbook”, Elsevier Publications, 2005.

L	T	P	C
1	0	0	1

22IT0XP **WEB PENTESTING**

Course Objectives

- To Assess various modern tools & Techniques for cybersecurity.
- To Demonstrate the different Cyber Attacks.
- To Implement Web Penetration Testing.

Course Outcomes (COs)

The students will be able to

- Assess the Vulnerability of the websites using pentesting tools.
- Analyse the Web App tools

Articulation Matrix

COs. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1		2				2				2	
2	3	3			2				2				2	

Kali Linux networking commands - Metasploit- MSFconsole -Steganography -XAMPP- NGROK- BWAPP- Vega Tool- Zaproxy tool- SSL Scanning Tools- COOKIES-Cross Site Scripting (CSS)- File Upload vulnerability- HTML Injection- SQL injection-Information Gathering- Information gathering tool- dnsmap-dnsrecon-dmirtry tools- netdiscover- recon-ng Tools- TOR- TERMUX

Total **15 Hours**

References

1 Introduction to Cyber Security available at http://uou.ac.in/foundation-course
2 Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17
3 Cyber Security Techniques http://uou.ac.in/progdetail?pid=CEGCS-17

CANDIDATES ADMITTED DURING ACADEMIC YEAR: 2022 - 2023

DEPARTMENT OF INFORMATION TECHNOLOGY

Minimum Credits to be Earned: 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
22PH102	ENGINEERING PHYSICS	2	0	2	3	4	50	50	100	BS
22CH103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
22GE001	FUNDAMENTALS OF COMPUTING	3	0	0	3	3	40	60	100	ES
22HS001	FOUNDATIONAL ENGLISH	1	0	2	2	3	100	0	100	HSS
22GE004	BASICS OF ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
22HS002	STARTUP MANAGEMENT	1	0	2	2	3	100	0	100	EEC
22IT108	COMPREHENSIVE WORK	0	0	2	1	2	100	0	100	EEC
Total		**14**	**1**	**12**	**21**	**27**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
22PH202	ELECTROMAGNETISM AND MODERN PHYSICS	2	0	2	3	4	50	50	100	BS
22CH203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
22GE002	COMPUTATIONAL PROBLEM SOLVING	3	0	0	3	3	40	60	100	ES
22GE003	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES
22IT206	DIGITAL COMPUTER ELECTRONICS	3	0	2	4	5	50	50	100	ES
	LANGUAGE ELECTIVE	1	0	2	2	3	100	0	100	HSS
*22HS003	தமிழர் மரபு HERITAGE OF TAMILS	1	0	0	1	1	100	0	100	HSS
Total		**17**	**1**	**10**	**23**	**28**	-	-	-	-

* The lateral entry students have to complete this course during IV semester.

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT301	PROBABILITY, STATISTICS AND QUEUING THEORY	3	1	0	4	4	40	60	100	ES
22IT302	DATA STRUCTURES I	3	0	2	4	5	50	50	100	ES
22IT303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3	3	40	60	100	PC
22IT304	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	2	4	5	50	50	100	PC
22IT305	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
22HS004	HUMAN VALUES AND ETHICS	2	0	0	2	2	100	0	100	HSS
22HS005	SOFT SKILLS AND EFFECTIVE COMMUNICATION	0	0	2	1	2	100	0	100	HSS
22HS006	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY	1	0	0	1	1	100	0	100	HSS
Total		**18**	**1**	**6**	**22**	**25**	-	-	-	-
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT401	DISCRETE MATHEMATICS	3	1	0	4	4	40	60	100	ES
22IT402	DATA STRUCTURES II	3	0	2	4	5	50	50	100	PC
22IT403	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
22IT404	WEB TECHNOLOGY AND FRAMEWORKS	2	0	2	3	4	50	50	100	PC
22IT405	DATABASE MANAGEMENT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I				3		-	-	100	PE
22HS007	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
22HS008	ADVANCED ENGLISH AND TECHNICAL EXPRESSION	0	0	2	1	2	100	0	100	EEC
Total		-	-	-	**23**	-				-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours / Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT501	PRINCIPLES OF COMMUNICATION	3	0	0	3	3	40	60	100	PC
22IT502	COMPUTER NETWORKS	3	0	2	4	5	50	50	100	PC
22IT503	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
22IT504	INTERNET OF THINGS	2	0	2	3	4	50	50	100	PC
	PROFESSIONAL ELECTIVE II	-	-	-	3	-	-	-	100	PE
	OPEN ELECTIVE	-	-	-	3	-	-	-	100	OE
22IT507	MINI PROJECT I	0	0	2	1	2	60	40	100	EEC
Total		-	-	-	**21**	-	-	-	-	-
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							C IA	**SEE**	**Total**	
22IT601	DATA MINING AND WAREHOUSING	3	0	2	4	5	50	50	100	PC
22IT602	PRINCIPLES OF COMPILER DESIGN	3	1	0	4	4	40	60	100	PC
22IT603	CLOUD COMPUTING	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE III	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IV	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE V	-	-	-	3	-	-	-	100	PE
22IT607	MINI PROJECT II	0	0	2	1	2	60	40	100	EEC
Total		-	-	-	**22**	-	-	-	-	-

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT701	CRYPTOGRAPHY AND INFORMATION SECURITY	3	0	0	3	3	40	60	100	PC
22IT702	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE VI	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VIII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IX	-	-	-	3	-	-	-	100	PE
22IT707	PROJECT WORK I	0	0	4	2	4	60	40	100	EEC
Total		-	-	-	**21**	-	-	-	-	-
VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT801	PROJECT WORK II	0	0	20	10	20	60	40	100	EEC
Total		**0**	**0**	**20**	**10**	**20**	-	-	-	**-**

ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
LANGUAGE ELECTIVES										
22HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
22HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
22HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
22HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
22HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
DISCIPLINE ELECTIVES										
VERTICAL 1 - DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
22IT007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IT010	APP DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT012	DevOps	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
22IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE

22IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
22IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	4	50	50	100	PE
22IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
22IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
22IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
22IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
22IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
22IT023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
22IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
22IT025	MULTIMEDIA AND ANIMATION	2	0	2	3	4	50	50	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT026	AUGMENTED REALITY AND VIRTUAL REALITY	2	0	2	3	4	50	50	100	PE
22IT027	GAME DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT028	VIDEO CREATION AND EDITING	2	0	2	3	4	50	50	100	PE
22IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
22IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
22IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	3	50	50	100	PE
22IT033	IoT ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT034	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE

VERTICAL VII- DIVERSIFIED COURSES										
22IT035	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE
22IT036	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT037	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT038	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
22IT039	HUMAN COMPUTER INTERACTION	3	0	0	3	3	40	60	100	PE
22IT040	E-COMMERCE	3	0	0	3	3	40	60	100	PE
22IT041	C# and .NET	3	0	0	3	3	40	60	100	PE
22IT042	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	3	40	60	100	PE
HONOUR VERTICAL- DATA SCIENCE										
22ITH01	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22ITH02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22ITH03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22ITH04	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22ITH05	NATURAL LANGUAGE PROCESSING	2	0	2	3	3	50	50	100	PE
22ITH06	COMPUTER VISION	2	0	2	3	3	50	50	100	PE
MINOR VERTICAL - SOFTWARE APPLICATION DEVELOPMENT										
22ITM43	PROBLEM SOLVING USING C	2	0	2	3	3	50	50	100	PE
22ITM44	DATA STRUCTURES USING C++	2	0	2	3	3	50	50	100	PE
22ITM45	DATABASE PROGRAMMING USING SQL	2	0	2	3	3	50	50	100	PE
22ITM46	RPA AUTOMATION TECHNIQUES	2	0	2	3	3	50	50	100	PE
22ITM47	FRONT END DESIGN USING HTML, CSS	2	0	2	3	3	50	50	100	PE
22ITM48	DATA ANALYSIS USING PYTHON	2	0	2	3	3	50	50	100	PE
22ITM49	SOFTWARE ENGINEERING METHODOLOGIES	2	0	2	3	3	50	50	100	PE
OPEN ELECTIVES										
22OIT01	DATA STRUCTURES	3	0	0	3	3	40	60	100	OE
22OIT02	C++ PROGRAMMING	2	0	0	2	3	50	60	100	OE
22OIT03	PROGRAMMING USING JAVA	2	0	0	2	3	50	60	100	OE

22OIT04	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	2	0	0	2	3	50	50	100	OE
22OCE01	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OEC02	MICROCONTROLLER PROGRAMMING	3	0	0	3	3	40	60	100	OE
22OEI01	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	3	40	60	100	OE
22OEI02	SENSOR TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OEI03	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OEI04	OPTOELECTRONICS AND LASER INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OME01	DIGITAL MANUFACTURING	3	0	0	3	3	40	60	100	OE
22OME02	INDUSTRIAL PROCESS ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME03	MAINTENANCE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME04	SAFETY ENGINEERING	3	0	0	3	3	40	60	100	OE
22OBT01	BIOFUELS	3	0	0	3	3	40	60	100	OE
22OFD01	TRADITIONAL FOODS	3	0	0	3	3	40	60	100	OE
22OFD02	FOOD LAWS AND REGULATIONS	3	0	0	3	3	40	60	100	OE
22OFD03	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	3	0	0	3	3	40	60	100	OE
22OFD04	CEREAL, PULSES AND OIL SEED TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OFT01	FASHION CRAFTSMANSHIP	3	0	0	3	3	40	60	100	OE
22OFT02	INTERIOR DESIGN IN FASHION	3	0	0	3	3	40	60	100	OE
22OFT03	SURFACE ORNAMENTATION	3	0	0	3	3	40	60	100	OE
22OPH01	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH02	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	OE
22OPH03	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH04	BIOPHOTONICS	3	0	0	3	3	40	60	100	OE
22OPH05	PHYSICS OF SOFT MATTER	3	0	0	3	3	40	60	100	OE
22OCH01	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	OE
22OCH02	POLYMER SCIENCE	3	0	0	3	3	40	60	100	OE
22OCH03	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	OE
22OGE01	PRINCIPLES OF MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OGE02	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	40	60	100	OE
22OGE03	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	40	60	100	OE
22OGE04	NATION BUILDING, LEADERSHIP AND SOCIAL RESPONSIBILITY	3	0	0	3	3	40	60	100	OE
22OBM01	OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES	3	0	0	3	3	40	60	100	OE
22OBM02	AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT	3	0	0	3	3	40	60	100	OE

22OBM03	HOSPITAL AUTOMATION	3	0	0	3	3	40	60	100	OE
22OAG01	RAIN WATER HARVESTING TECHNIQUES	3	0	0	3	3	40	60	100	OE
22OEE01	VALUE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OEE02	ELECTRICAL SAFETY	3	0	0	3	3	40	60	100	OE
22OCB01	INTERNATIONAL BUSINESS MANAGEMENT	3	0	0	3	3	40	60	100	OE

ONE CREDIT COURSES										
22IT0XA	SWIFT FOR IOS DEVELOPMENT	1	0	0	1	-	100	0	100	EEC
22IT0XB	CONTAINERS AUTOMATION	1	0	0	1	-	100	0	100	EEC
22IT0XC	AWS LOAD BALANCING TECHNIQUE	1	0	0	1	-	100	0	100	EEC
22IT0XD	ETHICAL HACKING ESSENTIAL: WEB PENTESTING	1	0	0	1	-	100	0	100	EEC
22IT0XE	GENERATIVE AI WITH LARGE LANGUAGE MODELS	1	0	0	1	-	100	0	100	EEC
22IT0XF	DEEP LEARNING USING COMPUTER VISION	1	0	0	1	-	100	0	100	EEC
22IT0XG	FEATURE ENGINEERING FOR NLP	1	0	0	1	-	100	0	100	EEC
22IT0XH	TABLEAU	1	0	0	1	-	100	0	100	EEC
22IT0XI	WEB DEVELOPMENT USING CMS: A COMPARATIVE STUDY	1	0	0	1	-	100	0	100	EEC
22IT0XJ	DATA VISUALIZATION AND REPORTING USING POWERBI	1	0	0	1	-	100	0	100	EEC
22IT0XK	CLOUD MULTI-TENANCY AND SECURITY	1	0	0	1	-	100	0	100	EEC
22IT0XL	CLOUD INFRASTRUCTURE MODERNIZATION	1	0	0	1	-	100	0	100	EEC
22IT0XM	CYBER RISK MITIGATION	1	0	0	1	-	100	0	100	EEC
22IT0XN	BUILDING APIS WITH DJANGO FRAMEWORK	1	0	0	1	-	100	0	100	EEC
22IT0XO	REAL TIME INTERNET OF ROBOTICS THINGS (RIoT)	1	0	0	1	-	100	0	100	EEC
22IT0XP	WEB PENTESTING	1	0	0	1	-	100	0	100	EEC

CANDIDATES ADMITTED DURING ACADEMIC YEAR: 2023 - 2024

DEPARTMENT OF INFORMATION TECHNOLOGY
Minimum Credits to be Earned : 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
22PH102	ENGINEERING PHYSICS	2	0	2	3	4	50	50	100	BS
22CH103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
22GE001	FUNDAMENTALS OF COMPUTING	3	0	0	3	3	40	60	100	ES
22HS001	FOUNDATIONAL ENGLISH	1	0	2	2	3	100	0	100	HSS
22GE004	BASICS OF ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
22HS002	STARTUP MANAGEMENT	1	0	2	2	3	100	0	100	EEC
*22HS003	தமிழர் மரபு HERITAGE OF TAMILS	1	0	0	1	1	100	0	100	HSS
Total		**15**	**1**	**10**	**21**	**26**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
22PH202	ELECTROMAGNETISM AND MODERN PHYSICS	2	0	2	3	4	50	50	100	BS
22CH203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
22GE002	COMPUTATIONAL PROBLEM SOLVING	3	0	0	3	3	40	60	100	ES
22GE003	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES
22IT206	DIGITAL COMPUTER ELECTRONICS	3	0	2	4	5	50	50	100	ES
	LANGUAGE ELECTIVE	1	0	2	2	3	100	0	100	HSS
*22HS006	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY	1	0	0	1	1	100	0	100	HSS
Total		**17**	**1**	**10**	**23**	**28**	-	-	-	-

* The lateral entry students have to complete these courses during III and IV semester.

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT301	PROBABILITY, STATISTICS AND QUEUING THEORY	3	1	0	4	4	40	60	100	ES
22IT302	DATA STRUCTURES I	3	0	2	4	5	50	50	100	ES
22IT303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	1	0	4	4	40	60	100	PC
22IT304	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	2	4	5	50	50	100	PC
22IT305	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
22HS004	HUMAN VALUES AND ETHICS	2	0	0	2	2	40	60	100	HSS
22HS005	SOFT SKILLS AND EFFECTIVE COMMUNICATION	0	0	2	1	2	60	40	100	HSS
Total		**17**	**2**	**6**	**22**	**25**	-	-	-	-
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT401	DISCRETE MATHEMATICS	3	1	0	4	4	40	60	100	ES
22IT402	DATA STRUCTURES II	3	0	2	4	5	50	50	100	PC
22IT403	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
22IT404	WEB TECHNOLOGY AND FRAMEWORKS	2	0	2	3	4	50	50	100	PC
22IT405	DATABASE MANAGEMENT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	-	-	-	3	-	-	-	100	PE
22HS007	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
22HS008	ADVANCED ENGLISH AND TECHNICAL EXPRESSION	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**23**	**-**	-	-	-	-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT501	PRINCIPLES OF COMMUNICATION	3	0	0	3	3	40	60	100	PC
22IT502	COMPUTER NETWORKS	3	0	2	4	5	50	50	100	PC
22IT503	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
22IT504	INTERNET OF THINGS	2	0	2	3	4	50	50	100	PC
	PROFESSIONAL ELECTIVE II	-	-	-	3	-	-	-	100	PE
	OPEN ELECTIVE	-	-	-	3	-	-	-	100	OE
22IT507	MINI PROJECT I	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	**-**	**-**	**-**	**-**

VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT601	DATA MINING AND WAREHOUSING	3	0	2	4	5	50	50	100	PC
22IT602	PRINCIPLES OF COMPILER DESIGN	3	1	0	4	4	40	60	100	PC
22IT603	CLOUD COMPUTING	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE III	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IV	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE V	-	-	-	3	-	-	-	100	PE
22IT607	MINI PROJECT II	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**22**	**-**	**-**	**-**	**-**	**-**

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours / Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT701	CRYPTOGRAPHY AND INFORMATION SECURITY	3	0	0	3	3	40	60	100	PC
22IT702	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE VI	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VIII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IX	-	-	-	3	-	-	-	100	PE
22IT707	PROJECT WORK I	0	0	4	2	4	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	-	-	-	-

VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours / Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT801	PROJECT WORK II	0	0	20	10	20	60	40	100	EEC
Total		**0**	**0**	**20**	**10**	**20**	-	-	-	**-**

ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
LANGUAGE ELECTIVES										
22HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
22HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
22HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
22HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
22HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
DISCIPLINE ELECTIVES										
VERTICAL 1 - DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
22IT007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IT010	APP DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT012	DevOps	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
22IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE

22IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
22IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	4	50	50	100	PE
22IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
22IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
22IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
22IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
22IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
22IT023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
22IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
22IT025	MULTIMEDIA AND ANIMATION	2	0	2	3	4	50	50	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT026	AUGMENTED REALITY AND VIRTUAL REALITY	2	0	2	3	4	50	50	100	PE
22IT027	GAME DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT028	VIDEO CREATION AND EDITING	2	0	2	3	4	50	50	100	PE
22IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
22IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
22IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT033	IoT ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT034	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE

VERTICAL VII- DIVERSIFIED COURSES										
22IT035	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE
22IT036	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT037	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT038	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
22IT039	HUMAN COMPUTER INTERACTION	3	0	0	3	3	40	60	100	PE
22IT040	E-COMMERCE	3	0	0	3	3	40	60	100	PE
22IT041	C# AND .NET	3	0	0	3	3	40	60	100	PE
22IT042	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	3	40	60	100	PE
HONOUR VERTICAL-DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
MINOR VERTICAL - SOFTWARE APPLICATION DEVELOPMENT										
22ITM43	PROBLEM SOLVING USING C	2	0	2	3	3	50	50	100	PE
22ITM44	DATA STRUCTURES USING C++	2	0	2	3	3	50	50	100	PE
22ITM45	DATABASE PROGRAMMING USING SQL	2	0	2	3	3	50	50	100	PE
22ITM46	RPA AUTOMATION TECHNIQUES	2	0	2	3	3	50	50	100	PE
22ITM47	FRONT END DESIGN USING HTML, CSS	2	0	2	3	3	50	50	100	PE
22ITM48	DATA ANALYSIS USING PYTHON	2	0	2	3	3	50	50	100	PE
22ITM49	SOFTWARE ENGINEERING METHODOLOGIES	2	0	2	3	3	50	50	100	PE
OPEN ELECTIVES										
22OIT01	DATA STRUCTURES	3	0	0	3	3	40	60	100	OE
22OIT02	C++ PROGRAMMING	2	0	0	2	3	50	60	100	OE
22OIT03	PROGRAMMING USING JAVA	2	0	0	2	3	50	60	100	OE
22OIT04	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	2	0	0	2	3	50	50	100	OE
22OCE01	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OEC02	MICROCONTROLLER PROGRAMMING	3	0	0	3	3	40	60	100	OE

22OEI01	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	3	40	60	100	OE
22OEI02	SENSOR TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OEI03	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OEI04	OPTOELECTRONICS AND LASER INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
		3	0	0	3	3	40	60	100	OE
22OME01	DIGITAL MANUFACTURING	3	0	0	3	3	40	60	100	OE
22OME02	INDUSTRIAL PROCESS ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME03	MAINTENANCE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME04	SAFETY ENGINEERING	3	0	0	3	3	40	60	100	OE
22OBT01	BIOFUELS	3	0	0	3	3	40	60	100	OE
22OFD01	TRADITIONAL FOODS	3	0	0	3	3	40	60	100	OE
22OFD02	FOOD LAWS AND REGULATIONS	3	0	0	3	3	40	60	100	OE
22OFD03	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	3	0	0	3	3	40	60	100	OE
22OFD04	CEREAL, PULSES AND OIL SEED TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OFT01	FASHION CRAFTSMANSHIP	3	0	0	3	3	40	60	100	OE
22OFT02	INTERIOR DESIGN IN FASHION	3	0	0	3	3	40	60	100	OE
22OFT03	SURFACE ORNAMENTATION	3	0	0	3	3	40	60	100	OE
22OPH01	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH02	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	OE
22OPH03	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH04	BIOPHOTONICS	3	0	0	3	3	40	60	100	OE
22OPH05	PHYSICS OF SOFT MATTER	3	0	0	3	3	40	60	100	OE
22OCH01	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	OE
22OCH02	POLYMER SCIENCE	3	0	0	3	3	40	60	100	OE
22OCH03	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	OE
22OGE01	PRINCIPLES OF MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OGE02	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	40	60	100	OE
22OGE03	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	40	60	100	OE
22OGE04	NATION BUILDING, LEADERSHIP AND SOCIAL RESPONSIBILITY	3	0	0	3	3	40	60	100	OE
22OBM01	OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES	3	0	0	3	3	40	60	100	OE
22OBM02	AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT	3	0	0	3	3	40	60	100	OE

22OBM03	HOSPITAL AUTOMATION	3	0	0	3	3	40	60	100	OE
22OAG01	RAIN WATER HARVESTING TECHNIQUES	3	0	0	3	3	40	60	100	OE
22OEE01	VALUE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OEE02	ELECTRICAL SAFETY	3	0	0	3	3	40	60	100	OE
22OCB01	INTERNATIONAL BUSINESS MANAGEMENT	3	0	0	3	3	40	60	100	OE
ONE CREDIT COURSES										
22IT0XA	SWIFT FOR IOS DEVELOPMENT	1	0	0	1	-	100	0	100	EEC
22IT0XB	CONTAINERS AUTOMATION	1	0	0	1	-	100	0	100	EEC
22IT0XC	AWS LOAD BALANCING TECHNIQUE	1	0	0	1	-	100	0	100	EEC
22IT0XD	ETHICAL HACKING ESSENTIAL: WEB PENTESTING	1	0	0	1	-	100	0	100	EEC
22IT0XE	GENERATIVE AI WITH LARGE LANGUAGE MODELS	1	0	0	1	-	100	0	100	EEC
22IT0XF	DEEP LEARNING USING COMPUTER VISION	1	0	0	1	-	100	0	100	EEC
22IT0XG	FEATURE ENGINEERING FOR NLP	1	0	0	1	-	100	0	100	EEC
22IT0XH	TABLEAU	1	0	0	1	-	100	0	100	EEC
22IT0XI	WEB DEVELOPMENT USING CMS: A COMPARATIVE STUDY	1	0	0	1	-	100	0	100	EEC
22IT0XJ	DATA VISUALIZATION AND REPORTING USING POWERBI	1	0	0	1	-	100	0	100	EEC
22IT0XK	CLOUD MULTI-TENANCY AND SECURITY	1	0	0	1	-	100	0	100	EEC
22IT0XL	CLOUD INFRASTRUCTURE MODERNIZATION	1	0	0	1	-	100	0	100	EEC
22IT0XM	CYBER RISK MITIGATION	1	0	0	1	-	100	0	100	EEC
22IT0XN	BUILDING APIs WITH DJANGO FRAMEWORK	1	0	0	1	-	100	0	100	EEC
22IT0XO	REAL TIME INTERNET OF ROBOTICS THINGS (RIoT)	1	0	0	1	-	100	0	100	EEC
22IT0XP	WEB PENTESTING	1	0	0	1	-	100	0	100	EEC

CANDIDATES ADMITTED DURING ACADEMIC YEAR :2024 - 2028

DEPARTMENT OF INFORMATION TECHNOLOGY
Minimum Credits to be Earned : 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
22PH102	ENGINEERING PHYSICS	2	0	2	3	4	50	50	100	BS
22CH103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
22GE001	FUNDAMENTALS OF COMPUTING	3	0	0	3	3	40	60	100	ES
22HS001	FOUNDATIONAL ENGLISH	1	0	2	2	3	50	50	100	HSS
22GE004	BASICS OF ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
22HS002	STARTUP MANAGEMENT	1	0	2	2	3	50	50	100	EEC
*22HS003	தமிழர் மரபு HERITAGE OF TAMILS	1	0	0	1	1	40	60	100	HSS
Total		**15**	**1**	**10**	**21**	**26**	-	-	-	-

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CIA	SEE	Total	
22MA201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
22PH202	ELECTROMAGNETISM AND MODERN PHYSICS	2	0	2	3	4	50	50	100	BS
22CH203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
22GE002	COMPUTATIONAL PROBLEM SOLVING	3	0	0	3	3	40	60	100	ES
22GE003	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES
22IT206	DIGITAL COMPUTER ELECTRONICS	3	0	2	4	5	50	50	100	ES
	LANGUAGE ELECTIVE	1	0	2	2	3	50	50	100	HSS
*22HS006	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY	1	0	0	1	1	40	60	100	HSS
22HS009	CO-CURRICULAR OR EXTRACURRICULAR ACTIVITIES	0	0	2	-	2	100	-	100	HSS
Total		**17**	**1**	**12**	**23**	**30**	-	-	-	-

* The lateral entry students have to complete these courses during III and IV semester.

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT301	PROBABILITY, STATISTICS AND QUEUING THEORY	3	1	0	4	4	40	60	100	ES
22IT302	DATA STRUCTURES I	3	0	2	4	5	50	50	100	ES
22IT303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	1	0	4	4	40	60	100	PC
22IT304	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	2	4	5	50	50	100	PC
22IT305	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
22HS004	HUMAN VALUES AND ETHICS	2	0	0	2	2	40	60	100	HSS
22HS005	SOFT SKILLS AND EFFECTIVE COMMUNICATION	0	0	2	1	2	60	40	100	HSS
Total		**17**	**2**	**6**	**22**	**25**	-	-	-	-
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT401	DISCRETE MATHEMATICS	3	1	0	4	4	40	60	100	ES
22IT402	DATA STRUCTURES II	3	0	2	4	5	50	50	100	PC
22IT403	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
22IT404	WEB TECHNOLOGY AND FRAMEWORKS	2	0	2	3	4	50	50	100	PC
22IT405	DATABASE MANAGEMENT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	-	-	-	3	-	-	-	100	PE
22HS007	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
22HS008	ADVANCED ENGLISH AND TECHNICAL EXPRESSION	0	0	2	1	2	60	40	100	EEC
22HS010	SOCIALLY RELEVANT PROJECTS	0	0	2	-	2	100	-	100	HSS
Total		**-**	**-**	**-**	**23**	**-**	-	-	-	-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT501	PRINCIPLES OF COMMUNICATION	3	0	0	3	3	40	60	100	PC
22IT502	COMPUTER NETWORKS	3	0	2	4	5	50	50	100	PC
22IT503	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
22IT504	INTERNET OF THINGS	2	0	2	3	4	50	50	100	PC
	PROFESSIONAL ELECTIVE II	-	-	-	3	-	-	-	100	PE
	OPEN ELECTIVE	-	-	-	3	-	-	-	100	OE
22IT507	MINI PROJECT I	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	**-**	**-**	**-**	**-**
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT601	DATA MINING AND WAREHOUSING	3	0	2	4	5	50	50	100	PC
22IT602	PRINCIPLES OF COMPILER DESIGN	3	1	0	4	4	40	60	100	PC
22IT603	CLOUD COMPUTING	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE III	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IV	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE V	-	-	-	3	-	-	-	100	PE
22IT607	MINI PROJECT II	0	0	2	1	2	60	40	100	EEC
Total		**-**	**-**	**-**	**22**	**-**	**-**	**-**	**-**	**-**

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT701	CRYPTOGRAPHY AND INFORMATION SECURITY	3	0	0	3	3	40	60	100	PC
22IT702	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE VI	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VIII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IX	-	-	-	3	-	-	-	100	PE
22IT707	PROJECT WORK I	0	0	4	2	4	60	40	100	EEC
Total		**-**	**-**	**-**	**21**	**-**	-	-	-	**-**

VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
22IT801	Project Work II	0	0	20	10	20	60	40	100	EEC
Total		**0**	**0**	**20**	**10**	**20**	-	-	-	**-**

ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CIA	**SEE**	**Total**	
LANGUAGE ELECTIVES										
22HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
22HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
22HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
22HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
22HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
DISCIPLINE ELECTIVES										
VERTICAL 1 - DATA SCIENCE										
22IT001	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
22IT002	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
22IT003	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT004	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT006	COMPUTER VISION	2	0	2	3	4	50	50	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
22IT007	AGILE SOFTWARE DEVELOPMENT	3	0	0	3	3	40	60	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
22IT010	APP DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT012	DevOps	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
22IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
22IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE

22IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
22IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
22IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	4	50	50	100	PE
22IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
22IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
22IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
22IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
22IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
22IT023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
22IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
22IT025	MULTIMEDIA AND ANIMATION	2	0	2	3	4	50	50	100	PE
22IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
22IT026	AUGMENTED REALITY AND VIRTUAL REALITY	2	0	2	3	4	50	50	100	PE
22IT027	GAME DEVELOPMENT	2	0	2	3	4	50	50	100	PE
22IT028	VIDEO CREATION AND EDITING	2	0	2	3	4	50	50	100	PE
22IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
22IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
22IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
22IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
22IT005	NATURAL LANGUAGE PROCESSING	2	0	2	3	4	50	50	100	PE
22IT033	IoT ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT034	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE

VERTICAL VII- DIVERSIFIED COURSES										
22IT035	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE
22IT036	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT037	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
22IT038	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
22IT039	HUMAN COMPUTER INTERACTION	3	0	0	3	3	40	60	100	PE
22IT040	E-COMMERCE	3	0	0	3	3	40	60	100	PE
22IT041	C# and .NET	3	0	0	3	3	40	60	100	PE
22IT042	MANAGEMENT INFORMATION SYSTEMS	3	0	0	3	3	40	60	100	PE
MINOR VERTICAL - SOFTWARE APPLICATION DEVELOPMENT										
22ITM43	PROBLEM SOLVING USING C	2	0	2	3	3	50	50	100	PE
22ITM44	DATA STRUCTURES USING C++	2	0	2	3	3	50	50	100	PE
22ITM45	DATABASE PROGRAMMING USING SQL	2	0	2	3	3	50	50	100	PE
22ITM46	RPA AUTOMATION TECHNIQUES	2	0	2	3	3	50	50	100	PE
22ITM47	FRONT END DESIGN USING HTML, CSS	2	0	2	3	3	50	50	100	PE
22ITM48	DATA ANALYSIS USING PYTHON	2	0	2	3	3	50	50	100	PE
22ITM49	SOFTWARE ENGINEERING METHODOLOGIES	2	0	2	3	3	50	50	100	PE
OPEN ELECTIVES										
22OIT01	DATA STRUCTURES	3	0	0	3	3	40	60	100	OE
22OIT02	C++ PROGRAMMING	2	0	0	2	3	50	60	100	OE
22OIT03	PROGRAMMING USING JAVA	2	0	0	2	3	50	60	100	OE
22OIT04	FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS	2	0	0	2	3	50	50	100	OE
22OCE01	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OEC02	MICROCONTROLLER PROGRAMMING	3	0	0	3	3	40	60	100	OE
22OEI01	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	3	40	60	100	OE
22OEI02	SENSOR TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OEI03	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OEI04	OPTOELECTRONICS AND LASER INSTRUMENTATION	3	0	0	3	3	40	60	100	OE
22OME01	DIGITAL MANUFACTURING	3	0	0	3	3	40	60	100	OE

22OME02	INDUSTRIAL PROCESS ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME03	MAINTENANCE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OME04	SAFETY ENGINEERING	3	0	0	3	3	40	60	100	OE
22OBT01	BIOFUELS	3	0	0	3	3	40	60	100	OE
22OFD01	TRADITIONAL FOODS	3	0	0	3	3	40	60	100	OE
22OFD02	FOOD LAWS AND REGULATIONS	3	0	0	3	3	40	60	100	OE
22OFD03	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	3	0	0	3	3	40	60	100	OE
22OFD04	CEREAL, PULSES AND OIL SEED TECHNOLOGY	3	0	0	3	3	40	60	100	OE
22OFT01	FASHION CRAFTSMANSHIP	3	0	0	3	3	40	60	100	OE
22OFT02	INTERIOR DESIGN IN FASHION	3	0	0	3	3	40	60	100	OE
22OFT03	SURFACE ORNAMENTATION	3	0	0	3	3	40	60	100	OE
22OPH01	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH02	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	OE
22OPH03	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	OE
22OPH04	BIO-PHOTONICS	3	0	0	3	3	40	60	100	OE
22OPH05	PHYSICS OF SOFT MATTER	3	0	0	3	3	40	60	100	OE
22OCH01	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	OE
22OCH02	POLYMER SCIENCE	3	0	0	3	3	40	60	100	OE
22OCH03	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	OE
22OMA01	GRAPH THEORY AND COMBINATORICS	3	0	0	3	3	40	60	100	OE
22OGE01	PRINCIPLES OF MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OGE02	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	40	60	100	OE
22OGE03	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	40	60	100	OE
22OGE04	NATION BUILDING: LEADERSHIP AND SOCIAL RESPONSIBILITY	3	0	0	3	3	40	60	100	OE
22OBM01	OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES	3	0	0	3	3	40	60	100	OE
22OBM02	AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT	3	0	0	3	3	40	60	100	OE
22OBM03	HOSPITAL AUTOMATION	3	0	0	3	3	40	60	100	OE
22OAG01	RAIN WATER HARVESTING TECHNIQUES	3	0	0	3	3	40	60	100	OE
22OEE01	VALUE ENGINEERING	3	0	0	3	3	40	60	100	OE
22OEE02	ELECTRICAL SAFETY	3	0	0	3	3	40	60	100	OE
22OCB01	INTERNATIONAL BUSINESS MANAGEMENT	3	0	0	3	3	40	60	100	OE

ONE CREDIT COURSES										
22IT0XA	SWIFT FOR IOS DEVELOPMENT	1	0	0	1	-	100	0	100	EEC
22IT0XB	CONTAINERS AUTOMATION	1	0	0	1	-	100	0	100	EEC
22IT0XC	AWS LOAD BALANCING TECHNIQUE	1	0	0	1	-	100	0	100	EEC
22IT0XD	ETHICAL HACKING ESSENTIAL: WEB PENTESTING	1	0	0	1	-	100	0	100	EEC
22IT0XE	GENERATIVE AI WITH LARGE LANGUAGE MODELS	1	0	0	1	-	100	0	100	EEC
22IT0XF	DEEP LEARNING USING COMPUTER VISION	1	0	0	1	-	100	0	100	EEC
22IT0XG	FEATURE ENGINEERING FOR NLP	1	0	0	1	-	100	0	100	EEC
22IT0XH	TABLEAU	1	0	0	1	-	100	0	100	EEC
22IT0XI	WEB DEVELOPMENT USING CMS: A COMPARATIVE STUDY	1	0	0	1	-	100	0	100	EEC
22IT0XJ	DATA VISUALIZATION AND REPORTING USING POWERBI	1	0	0	1	-	100	0	100	EEC
22IT0XK	CLOUD MULTI-TENANCY AND SECURITY	1	0	0	1	-	100	0	100	EEC
22IT0XL	CLOUD INFRASTRUCTURE MODERNIZATION	1	0	0	1	-	100	0	100	EEC
22IT0XM	CYBER RISK MITIGATION	1	0	0	1	-	100	0	100	EEC
22IT0XN	BUILDING APIS WITH DJANGO FRAMEWORK	1	0	0	1	-	100	0	100	EEC
22IT0XO	REAL TIME INTERNET OF ROBOTICS THINGS (RIoT)	1	0	0	1	-	100	0	100	EEC
22IT0XP	WEB PENTESTING	1	0	0	1	-	100	0	100	EEC

22MA101 ENGINEERING MATHEMATICS I 3 1 0 4

Course Objectives

- To impart mathematical modeling to describe and explore real-world phenomena and data.
- To provide basic understanding on Linear, quadratic, power and polynomial, exponential, and multi variable models
- Summarize and apply the methodologies involved in framing the real-world problems related to fundamental principles of polynomial equations

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications. PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement the concepts of mathematical modeling based on linear functions in Engineering.
2. Formulate the real-world problems as a quadratic function model
3. Demonstrate the real-world phenomena and data into Power and Polynomial functions
4. Apply the concept of mathematical modeling of exponential functions in Engineering
5. Develop the identification of multivariable functions in the physical dynamical problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												1
2	2	2												
3	2	1												
4	2	2											1	
5	1	2												2

UNIT I **9 Hours**

MATHEMATICS MODELING OF LINEAR FUNCTIONS

The geometry of linear equations - Formation of linear equations: Method of least squares and method of regression - Vector spaces: Basic concepts with examples - Linear combination - Eigen values and vectors

UNIT II **9 Hours**

MATHEMATICAL MODELING OF QUADRATIC FUNCTIONS

General form of a quadratic function - Basic relationships between the equation and graph of a quadratic function - Sum of squares error and the quadratic function of best fit - Quadratic forms: Matrix form - Orhtogonality - Canonical form and its nature

UNIT III **9 Hours**

MATHEMATICAL MODELING OF POWER AND POLYNOMIAL FUNCTIONS

Characteristics of the graphs of power and polynomial functions - Fitting of power and polynomial functions using the method of least squares - Local maxima and local minima of power and polynomial functions - Power series of functions with real variables, Taylors series, radius and interval of convergence- Tests of convergence for series of positive terms - comparison test, ratio test

UNIT IV **9 Hours**

MATHEMATICAL MODELING OF EXPONENTIAL FUNCTIONS

Concept of exponential growth - Graphs of exponential functions - Relationship between the growth factor and exponential growth or decline - Exponential equations have a variable as an exponent and take the form $y= ab^x$ through least square approximation - Calculus of exponential functions - Exponential series - Characteristics

UNIT V **9 Hours**

MATHEMATICAL MODELING OF MULTIVARIABLE FUNCTIONS

Graphing of functions of two variables -Partial derivatives - Total derivatives - Jacobians - Optimization of multivariable functions with constraints - Optimization of multivariable functions without constraints

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2016
2. B. S. Grewal, Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB, Khanna, 2014
3. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons2020
4. Thomas and Finney, Calculus and analytic Geometry, Fourteenth Edition, By Pearson Paperback, 2018

22PH102 ENGINEERING PHYSICS 2 0 2 3

Course Objectives

- Understand the concept and principle of energy possessed by mechanical system
- Exemplify the propagation and exchange of energy
- Identify the properties of materials based on the energy possession

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PSO1.Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Illustrate the concept and principles of energy to understand mechanical systems
2. Exemplify the types of mechanical oscillations based on vibrational energy
3. Infer the concept of propagation of energy as transverse and longitudinal waves
4. Analyze the exchange of energy and work between the systems using thermodynamic principles
5. Apply the concept of energy and entropy to understand the mechanical properties of materials

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1					2			1		
2	3	2	1	2					2			1	1	
3	3	2	2	1					2			1		
4	3	2	2	1					2			1	2	
5	3	2	2	1					2			1		

UNIT I **6 Hours**

CONSERVATION OF ENERGY

Concept of energy - types of energy-conservation of energy. Mechanical energy: - translation - rotation - vibration - Kinetic and potential energies - conservation - work and energy - laws of motion - minimization of potential energy - equilibrium - dissipative systems - friction

UNIT II **5 Hours**

VIBRATIONAL ENERGY

Periodic Motion - Simple Harmonic Motion - Energy of the SHM - Pendulum types - Damped oscillations - forced oscillations - natural frequency - resonance

UNIT III **6 Hours**

PROPAGATION OF ENERGY

Transfer of energy - material medium - Transverse wave - Longitudinal wave - standing wave – interference - Doppler effect. Sound waves and its types - characteristics - human voicere - reflection - refraction-beats

UNIT IV **7 Hours**

EXCHANGE OF ENERGY

Energy in transit - heat - Temperature - measurement - specific heat capacity and water - thermal expansion- Heat transfer processes Thermodynamics: Thermodynamic systems and processes - Laws of thermodynamics - Entropy - entropy on a microscopic scale -maximization of entropy

UNIT V **6 Hours**

ENERGY IN MATERIALS

Elastic energy - Structure and bonding - Stress - strain - Tension and compression - elastic limit - Elastic Modulus - Stress - strain diagram - ductility - brittleness - rubber elasticity and entropy

EXPERIMENT 1 — 5 Hours

Assess the physical parameters of different materials for engineering applications like radius, thickness and diameter to design the electrical wires, bridges and clothes.

EXPERIMENT 2 — 5 Hours

Evaluate the elastic nature of different solid materials for modern industrial applications like shock absorbers of vehicle

EXPERIMENT 3 — 5 Hours

Analyze the photonic behavior of thin materials for advanced optoelectronic applications like adjusting a patient’s head, chest and neck positions as a medical tool.

EXPERIMENT 4 — 5 Hours

Investigate the phonon behavior of poor conductors for thermionic applications like polymer materials and textile materials.

EXPERIMENT 5 — 5 Hours

Assess the elongation of different solid materials for industrial applications like buildings, bridges and vehicles.

EXPERIMENT 6 — 5 Hours

Measure the compressibility of different liquids for modern industrial applications like navigation, medicine and imaging.

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part I: Classical Mechanics and Thermodynamics, Cognella Academic Publishing, 2019.
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

22CH103 ENGINEERING CHEMISTRY I 2 0 2 3

Course Objectives

- Understand the origin of elements from the universe
- Outline the properties of elements in the periodic table
- Analyse the different types of bond formed during chemical reactions and its reaction thermodynamics
- Summarize different states of matter based on atomic arrangement

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand nuclear transmutation reactions that lead to the formation of elements in the universe
2. Illustrate atomic structure of elements in the periodic table and interpret the periodic trends in properties of elements with its anomaly
3. Apply the conditions for the formation of different types of chemical bonds and predict the minimum energy required for a reaction to occur
4. Analyse endothermic and exothermic processes and exchange of energy during chemical reactions
5. Analyse whether the given matter is a solid, liquid, gas, or plasma and interpret the arrangement of atoms

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1											1	
3	2	1												
4	2	1											1	
5	2	1												

UNIT I **6 Hours**

ORIGIN OF ELEMENTS

Hydrogen - Elements and Sun - fusion - hypernova - supernova - dying stars - man-made elements

UNIT II **6 Hours**

ATOMIC STRUCTURE AND PERIODICITY

Atomic Structure - Electronic configuration - Periodic Table - Periodic trends in properties of elements - Anomalous behaviour in periodicity

UNIT III **6 Hours**

CHEMICAL BONDING

Octet rule & its limitations - types of chemical bonds - bond energy - bond cleavage - activation energy of reactions

UNIT IV **6 Hours**

REACTION THERMODYNAMICS

Conservation of energy - Endothermic reactions & exothermic reactions - Exchange of energy involved in chemical reactions

UNIT V **6 Hours**

STATES OF MATTER

Solid - liquid - gas - plasma - arrangement of atoms/ions/molecules in different phase

EXPERIMENT 1 **5 Hours**

Evaluate the recommended dissolved oxygen (DO) content in effluent samples collected from sewage treatment plants in BIT. Ensure the suitability of outlet water for the growth of aquatic animals (fishes).

EXPERIMENT 2 **5 Hours**

Investigate the amount of Iron (Fe) in a mild steel alloy sample using a spectrophotometer.

EXPERIMENT 3 **4 Hours**

Estimate the amount of chromium present in industry effluent samples and bottled beverages.

EXPERIMENT 4 **5 Hours**

Ensure the suitability of drinking water in the RO water supply in BIT based on the presence of chloride ions.

EXPERIMENT 5 **3 Hours**

Assess the acidic nature of effluent water from industries using the conductometric titration method.

EXPERIMENT 6 **4 Hours**

Measure the stain removal efficiency of the prepared soaps from stained clothes.

EXPERIMENT 7 **4 Hours**

Assess the purity of commercially available active pharmaceutical ingredients(aspirin) as per the government-prescribed standards

Total: 60 Hours

Reference(s)

1 Rose Marie Gallagher and Author Paul Ingram, Complete Chemistry Cambridge IGCSE, 2nd Edition, Oxford university press, 2020.
2 Peter Atkins, Julio D Paula and James Keeler, Atkins' Physical Chemistry, 12th Edition, Oxford university press, 2019.
3 Gareth Price, Thermodynamics of chemical processes, 2nd Edition, Oxford university press, 2019.
4 D Tabor, Gases, liquids and solids and other states of matter, 3rd Edition, Oxford University press, 2018.
5 P L Soni, Text book of inorganic chemistry, Chand publishers, New Delhi, 2017.
6 J.D. Lee, Concise inorganic chemistry, 5th edition (Reprint), Blackman Science Ltd, France, Wiley-India, 2016.

22GE001 FUNDAMENTALS OF COMPUTING 3 0 0 3

Course Objectives

- Understand the fundamental digital logics behind computations of computer systems.
- Develop simple assembly language programs with respect to arithmetic operations.
- Understand the program execution process and basics of software development methodologies.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Infer the hidden languages and inner structures of computer hardware and software through codes and combinations.
2. Interpret the organizational and architectural issues of a digital computer with concepts of various data transfer techniques in digital computers and the I/O interfaces.
3. Analyze programming problems and apply assembly instructions to solve simple problems.
4. Infer the fundamentals of operating system and System programs basics.
5. Apply the software development methodologies to various real life scenarios.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1										
2	3	3	3	1									1	
3	2	2	2	1										
4	2	2	2	1										
5	2	2	2	1									2	

UNIT I **8 Hours**

CODES AND COMBINATIONS

Communication using Mores and Braille binary codes - Digitizing letters, numbers and objects using binary codes - Performing simple operations: addition through binary codes.

UNIT II **9 Hours**

COMPUTATION USING COMPUTER

Communication to computing devices through various input sources - Computational operation - its flow, functions and control - communication to output devices - Basic communication protocol.

UNIT III **11 Hours**

ASSEMBLY LANGUAGE PROGRAMMING

Little Man Computing (LMC) Model - Instruction Set - Labels - Calculation -Branching - Input- Output - Loops - Simple programs.

UNIT IV **9 Hours**

OPERATING SYSTEM AND APPLICATION GENERATION

BIOS - Device Drivers - Resources - Scheduler - Applications Generation and Creation - Stages of Compilation - Linkers, Loaders and Libraries.

UNIT V **8 Hours**

SOFTWARE DEVELOPMENT

Phases of application life cycle management - Software Development Methodologies - Web Page development.

Total: 45 Hours

Reference(s)

1. Charles Petzold, "Code: The Hidden Language of Computer Hardware and Software", Microsoft Press books, 2009.
2. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
3. Andrew Eliaz, "Little Man Computer Programming: For The Perplexed From The Ground Up", The Internet Technical Bookshop; 1st edition, 2016.
4. Abraham Silberschatz, "Peter Baer Galvin and Greg Gagne, Operating System Concepts", 9th Edition, John Wiley & Sons Pvt. Ltd, 2015.
5. Roger S.Pressman, "Software Engineering: A Practitioner"s Approach", McGraw Hill International edition, Seventh edition, 2010

22HS001 FOUNDATIONAL ENGLISH 1 0 2 2

Course Objectives

- Heighten awareness of grammar in oral and written expression
- Improve speaking potential in formal and informal contexts
- Prowess and develop abilities as critical readers and writers in interpreting complex texts.

Programme Outcomes (POs)

PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO12 Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (Cos)

1. Express themselves in a professional manner using error-free language
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3		2	2	
2									2	3		2	2	
3									2	3		2	2	
4									2	3		2	2	
5									2	3		2	2	

UNIT I **15 Hours**

SELF-EXPRESSION

Self-Introduction-Recreating Interview Scenarios (with a focus on verbal communication)-Subject Verb Concord - Tenses - Common Errors in verbal communication Be-verbs Self-Introduction- Recreating interview scenarios-Haptics-Gestures-Proxemics-Facial expressions- Paralinguistic / Vocalic- Body Language- Appearance-Eye Contact-Artefacts Self-Introduction-Powerful openings and closings at the interview-Effective stock phrases - Modified for spontaneity and individuality-Question tags, framing questions including WH- questions- Prepositions-Listening to Ted talks-Listening for specific information

UNIT II **15 Hours**

CREATIVE EXPRESSION

Descriptive Expression-Picture Description and Blog Writing -Vocabulary-One-word substitution-Adjectives-Similes, Metaphors, Imagery & Idioms -Link words - Inclusive language Narrative Expression- Travelogue and Minutes of Meeting -Verbal Analogy-Sequence & Time order words - Jumbled paragraph, sentences, Sequencing-Text & Paragraph Completion-Past tense -Using quotation marks

UNIT III **15 Hours**

FORMAL EXPRESSION

Formal Letters and Emails-Writing: E-mails and Letters of apology, Requisition and Explanation, and Letters to newspapers-Speaking: Tendering verbal apologies, and explanations, persuading a listener/ audience-Hierarchy in Business correspondence- Subject of a mail, Header, Body (Salutation) and Footer of a mail-Conjunctional clause Punctuation-Formal Idioms-Phrases-Articles - Definite & Indefinite-Types of sentences-Modal verbs Precision in comprehension, Summary writing, Selective summary-Reading: Active reading- short paragraphs, excerpts, articles and editorials-Skimming and Scanning Reading comprehension & analysis- Tenses, QP/ PQ approach. Identifying the central themes/ crux-Interpreting tone - formal/informal/semi-formal-Note-taking-Listening: Listening for data, for specific information, for opinion-Active and passive Listening-Transcription-Paraphrasing and summarizing information-Agreeing & disagreeing-Note-taking-Writing: Summary writing, selective summary, paraphrasing, note-making, opinion pieces-Finding synonyms in the context Paraphrasing- Sentence Transformation - simple, compound, complex. Sentence Substitution-Sentence completion- Interpreting paragraphs

Total: 45 Hours

Reference(s)

1 Sasikumar, V, et.al. A Course in Listening & Speaking Foundation Books, 2005.
2 Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3 Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010
4 Reynolds, John. Cambridge IGCSEA, First Language English. 2018th ed., Hodder Education, 2018.
5 Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

22GE004 BASICS OF ELECTRONICS ENGINEERING 2 0 2 3

Course Objectives

- To Understand the concept of energy transmission through mechanical, electrical and electromagnetic form.
- To Analyze the use of PN Junction Diode and BJT for signal conditioning.
- To apply the working principle of PN Junction Diode and BJT for the design of basic Digital Logic.
- To analyze the working and characteristics of Special Purpose Semiconductor Electronic Devices.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Understand the need for electrical and electromagnetic signal transmission.
2 Analyze the working principle and characteristics of PN junction diode.
3 Analyze the working principle and characteristics of Bipolar Junction Transistor.
4 Apply the working principle of PN Junction diode and BJT for designing basic Digital Logic functions.
5 Analyze the energy conversion needs and working principle of Special purpose electronic devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1										
2	3	3	3	2										
3	3	3	3	2									1	
4	3	3	3	2										
5	3	3	3	1									1	

UNIT I **6 Hours**

ENERGY TRANSFER AND SIGNALS

Energy Transmission through Mechanical, Electrical and Electromagnetic means, Signal as Energy Transmission, Complexity in signal transmission (Volume of Information, Distance and Time taken), Limitations of Mechanical Energy Transmission, Electrical and Electromagnetic Signal Transmission, Need for Conversion between Electrical and Mechanical Signals.

UNIT II **8 Hours**

SIGNAL CONDITIONING USING DIODE

Need for Vacuum Tubes in the Evolution of Electronics, Overview of Vacuum Tubes, Diode and Triode, Limitations of Vacuum Tubes. Semiconductor Group in Periodic Table, Overview of Semiconductor Materials, Flow of electrical energy through PN Junction Diode, Signal Clipping, Signal Clamping and Signal Multiplication using PN Junction Diode, Limitations of PN Junction Diode.

UNIT III **6 Hours**

SIGNAL CONDITIONING USING TRANSISTOR

Need for controlling electrical signals, Principle of Bipolar Junction Transistor operation, Signal Switching and Amplification using BJT, Limitations of BJT, Principle of Field Effect Transistor operation.

UNIT IV **6 Hours**

LOGIC SYNTHESIS USING DIODE AND TRANSISTORS

Overview of Logic Gates, PN Junction and BJT as electronic switches, Digital Logic Synthesis using Diode and Transistor: Diode Logic, Resistor Transistor Logic, Diode Transistor Logic, Transistor Logic.

UNIT V **4 Hours**

DEVICES FOR SPECIAL REQUIREMENTS

Voltage Regulation using Zener Diode, Variable Capacitance using Varactor Diode, Electrical Energy to Light Energy conversion using Light Emitting Diode, Light to Energy to Electrical Energy conversion using Solar Cell.

EXPERIMENT 1 **6 Hours**

Design a voltage multiplier to convert the low voltage from the mains power supply to the high voltage to operate the microwave oven.

EXPERIMENT 2 **6 Hours**

Design and construct regulated DC power supply for Mobile phone charger

EXPERIMENT 3 **6 Hours**

Design and construct an audio amplifier circuit for amplifying the volume to play the mobile sound in a huge speaker.

EXPERIMENT 4 **6 Hours**

Design and construct Switching circuit for the Pump to control over flow and drain condition for overhead tank using PN junction diode.

EXPERIMENT 5 **6 Hours**

Design and construct BJT based circuit to implement two-way connection for staircase light application.

Total: 60 Hours

Reference(s)

1. Thomas L. Floyd ,Electronic Devices: Electron Flow Version, Ninth Edition, Prentice Hall, 2012.
2. J Millman, C. Halkias & Satyabrata JIT, Electronic Devices and Circuits, Tata McGraw-Hill, 2007.
3. L Robert Boylestead, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education 2006.
4. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 2003.
5. Adel S. Sedra & Kenneth C. Smith, Micro Electronic Circuits Theory and Applications, Sixth Edition, Oxford University Press, 2013.
6. Behzad Razavi, Microelectronics, Wiley India Pvt. Ltd.; 2nd edition (2018)

22HS002 STARTUP MANAGEMENT **1 0 2 2**

Course Objectives

- Promote entrepreneurial spirit and motivate to build startups
- Provide insights on markets and the dynamics of buyer behaviour
- Train to develop prototypes and refine them to a viable market offering
- Support in developing marketing strategies and financial outlay
- Enable to scale up the porotypes to commercial market offering

Programme Outcomes (POs)

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Generate valid and feasible business ideas
2. Create Business Model Canvas and formulate positioning statement
3. Invent prototypes that fulfills an unmet market need
4. Formulate business strategies and create pitch decks
5. Choose appropriate strategies for commercialization

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1							1	2	1		1			
2							2	2	1	1	2		1	
3							3	3	1	2	2			
4							1	3	1	2	2			
5							2	3	2	2	2		1	

UNIT I **3 Hours**

BUSINESS MODELS AND IDEATION

Startups: Introduction, Types of Business Modes for Startups. Ideation: Sources of Ideas, Assessing Ideas, Validating Ideas, Tools for validating ideas, Role of Innovation and Design Thinking

UNIT II **3 Hours**

UNDERSTANDING CUSTOMERS

Buyer Decision Process, Buyer Behaviour, Building Buyer Personas, Segmenting, Targeting and Positioning, Value Proposition (Business Model Canvas), Information Sourcing on Markets, Customer Validation

UNIT III **3 Hours**

DEVELOPING PROTOTYPES

Prototyping: Methods-Paper and Digital, Customer Involvement in Prototyping, Product Design Sprints, Refining Prototypes

UNIT IV **3 Hours**

BUSINESS STRATEGIES AND PITCHING

Design of Marketing Strategies and Campaigns, Go-To-Market Strategy, Financial KPIs Financial Planning and Budgeting, Assessing Funding Alternatives, Pitching, Preparing Pitch Decks

UNIT V **3 Hours**

COMMERCIALIZATION

Implementation: Prototype to Commercialization, Test Markets, Institutional Support, Registration Process, IP Laws and Protection, Legal Requirements, Type of Ownership, Building and Managing Teams, Defining role of investors

EXPERIMENT 1 **1 Hour**

Analysis of various business sectors

EXPERIMENT 2 **2 Hours**

Developing a Design Thinking Output Chart

EXPERIMENT 3 **1 Hour**

Creating Buyer Personas

EXPERIMENT 4 **3 Hours**

Undertake Market Study to understand market needs and assess market potential

EXPERIMENT 5 **2 Hours**

Preparation of Business Model Canvas

EXPERIMENT 6 **15 Hours**

Developing Prototypes

EXPERIMENT 7 **2 Hours**

Organizing Product Design Sprints

EXPERIMENT 8 **2 Hours**

Preparation of Business Plans

EXPERIMENT 9 **2 Hours**

Preparation of Pitch Decks

Total: 15+30=45 Hours

Reference(s)

1. Rashmi Bansal, Connect the Dots, Westland and Tranquebar Press, 2012
2. Pavan Soni, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Penguin Random House India, 2020
3. Ronnie Screwvala, Dream with Your Eyes Open: An Entrepreneurial Journey, Rupa Publications, 2015
4. Stephen Carter, The Seed Tree: Money Management and Wealth Building Lessons for Teens, Seed Tree Group, 2021
5. Kotler Philip, Marketing Management, Pearson Education India, 15th Edition
6. Elizabeth Verkey and Jithin Saji Isaac, Intellectual Property, Eastern Book Company, 2nd Edition, 2021

22HS003 HERITAGE OF TAMILS 1 0 0 1

Course Objectives

- Describe the linguistic diversity in India, highlighting Dravidian languages and their features.
- Summarize the evolution of art, highlighting key transitions from rock art to modern sculptures.
- Examine the role of sports and games in promoting cultural values and community bonding.
- Discuss the education and literacy systems during the Sangam Age and their impact.
- Outline the importance of inscriptions, manuscripts, and the print history of Tamil books in preserving knowledge and culture.

Programme Outcomes (POs)

PO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the concept of language families in India, with a focus on Dravidian languages.
2. Trace the evolution of art from ancient rock art to modern sculptures in Tamil heritage.
3. Identify and differentiate various forms of folk and martial arts in Tamil heritage.
4. Understand the concepts of Flora and Fauna in Tamil culture and literature.
5. Evaluate the contributions of Tamils to the Indian Freedom Struggle.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				2
2									2	3				2
3									2	3				2
4									2	3				2
5									2	3				2

UNIT I **3 Hours**

LANGUAGE AND LITERATURE

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II **3 Hours**

HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III **3 Hours**

FOLK AND MARTIAL ARTS

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV **3 Hours**

THINAI CONCEPT OF TAMILS

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V **3 Hours**

CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total: 15 Hours

Reference(s)

1. Dr.K.K.Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL.
2. Dr.S.Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr.M.Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies.
5. Keeladi, Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr.K.K.Pillay, Studies in the History of India with Special Reference to Tamil Nadu.
7. Porunai Civilization, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
8. R Balakrishnan, Journey of Civilization Indus to Vaigai, RMRL.

22HS003 **தமிழர் மரபு** **1 0 0 1**

பாடத்திட்டத்தின் நோக்கம்

- இந்திய மொழிக்குடும்பத்துள் திராவிட மொழிகள் தனித்து இயங்கும் தன்மையை அதன் சிறப்புகள் வழி அறிதல்.
- தொன்றுதொட்டு தமிழர், கலையில் அடைந்த வளர்ச்சியை இயம்புதல்.
- சங்ககால தமிழரின் கற்றல் திறத்தை இலக்கியங்கள் வழி ஆராய்தல்.

கற்றலின் விளைவு

1 இந்திய மொழிக்குடும்பத்துள் திராவிட மொழிகள் தனித்து இயங்கும் தன்மையை அதன் சிறப்புகள் வழி அறிதல்.
2 தொன்றுதொட்டு தமிழர், கலையில் அடைந்த வளர்ச்சியை இயம்புதல்.
3 சங்ககால தமிழரின் கற்றல் திறத்தை இலக்கியங்கள் வழி ஆராய்தல்.
4 தமிழ் மொழியின் சிறப்புகளை அதன் படைப்பிலக்கியங்கள் மூலம் அறிந்து கொள்ளுதல்.
5 கற்காலம் தொடங்கி, இக்காலம் வரை சிற்பக்கலை அடைந்த வளர்ச்சியை கண்டுகொள்ளல் .
6 தமிழர் தம் வாழ்வில் எங்கனம் இயற்கையை வணங்கி போற்றினர் என்பதை திணை கோட்பாட்டின் வழி தெளிதல்.
7 இந்திய விடுதலை போரில் தமிழர் ஆற்றிய பங்கினை தெரிந்து கொள்ளுதல்.

அலகு I மொழி மற்றும் இலக்கியம்: **3**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22MA201 ENGINEERING MATHEMATICS II 3 1 0 4

Course Objectives

- To impart and analyze the concepts of differential equations to describe in real-world phenomena
- To provide basic understanding on differential equation models and vector field models
- Summarize and apply the methodologies involved in framing the real-world problems related to fundamental principles of complex functions

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Interpret the concept of differential equations through mathematical modeling and analyze its applications in engineering
2. Formulate the real-world problems as second order linear differential equations and give solutions for the same
3. Demonstrate the real-world phenomena with magnitude and direction in the form of vector functions
4. Apply the concept of vector fields and line integrals through mathematical modeling in engineering
5. Determine complex functions and apply them to formulate problems arising in engineering

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	2	2											1	
3	2	2												
4	2	1												2
5	1	2												

UNIT I **9 Hours**

FIRST ORDER LINEAR DIFFERENTIAL EQUATIONS

Formation of differential equations- Solutions of first order linear ODE: Leibnitzs and method of separation of variables- Cooling/Heating of an object - A falling object- Modeling of electric circuits: RL and RC circuits - Modeling of population dynamics: Exponential growth and decay - Logistic growth model

UNIT II **9 Hours**

SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS

Methods of solving second order linear ordinary differential equations -Models for linear oscillators: Simple harmonic motion - Mechanical vibrations with and without damping - Electric circuit system: RLC circuits

UNIT III **9 Hours**

VECTOR DIFFERENTIAL CALCULUS

Vector and scalar functions - Fields - Derivative of vector function and geometrical interpretation- Velocity and acceleration - Gradient and its properties- Tangent and normal vectors - Directional derivative- Divergence of a vector field - Curl of a vector field - Projectile motion

UNIT IV **9 Hours**

VECTOR INTEGRAL CALCULUS

Line integrals of vector point functions - Surface integral of vector point functions - Applications of line and surface integrals - Greens theorem in a plane - Stokes theorem - Gauss divergence theorem

UNIT V **9 Hours**

COMPLEX FUNCTIONS

Basic concepts of Complex numbers Geometrical representation of complex number - Analytic functions and its properties - Construction of Analytic functions: Fluid flow Electric flow - Mapping of complex functions

Tutorial: 15 Hours
Total: 60 Hours

Reference(s):

1. Richard E. Williamson, Introduction to Differential Equations and Dynamical Systems, McGraw Hill Companies. Inc, 1997
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass Thomas Calculus, 13/e, Pearson Publishers, 2013
4. Erwin Kreyszig, Advanced Engineering Mathematics Wiley, 10th editi5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017on ,2015
5. J. Stewart, Essential Calculus, Cengage, 2nd edition, 2017

22PH202 ELECTROMAGNETISM AND MODERN PHYSICS

2 0 2 3

Course Objectives

- Understand the principles and mechanisms of electricity and magnetism
- Infer the classification of electromagnetic waves
- Analyze the theory of relativity and energy bands

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the principles and mechanism of electrostatics and current
2. Illustrate the principles and mechanism of magneto statics
3. Classify electromagnetic waves and infer the characteristics of visible light
4. Outline the importance of theory of relativity and analyze the wave nature of particles
5. Exemplify the electrical properties of semiconductor based on the band theory

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1					2			1	1	
2	3	2	1	2					2			1		
3	3	2	2	1					2			1		
4	3	2	2	1					2			1		
5	3	2	2	1					2			1	1	

UNIT I **6 Hours**

ELECTRICITY

Electric monopoles - Electric field- Electric flux - Electric potential - electrical energy- capacitor- conductors and insulators-Electric dipole and polarization - electric current -voltage sources- resistance

UNIT II **6 Hours**

MAGNETISM

Sources of magnetism- monopoles-magnetic field and force-magnetic field and current distribution-magnetic dipole-magnetic potential energy-inductor- electric and magnetic field comparison

UNIT III **6 Hours**

ELECTROMAGNETIC WAVES AND LIGHT

Electromagnetism: basic laws-electromagnetic energy-radiation. Electromagnetic waves: origin, nature and spectrum-visible light Principle of least time- geometrical optics-Human eye - Diffraction - Interference - polarization-LASER

UNIT IV **6 Hours**

MODERN PHYSICS

Special theory of relativity - simultaneity and time dilation - length contraction - relativistic mass variation. Matter waves - de-Broglie hypothesis - wave nature of particles.

UNIT V **6 Hours**

ENERGY BANDS IN SOLIDS

Band theory of solids - classification of materials - semiconductors - direct and indirect semiconductor - fermi energy -Intrinsic and extrinsic semiconductor - carrier concentration - electrical conductivity

EXPERIMENT 1 **5 Hours**

Analysis of I-V characteristics of a solar cell for domestic applications

EXPERIMENT 2 **5 Hours**

Investigate the photonic behavior of laser source for photo copier device

EXPERIMENT 3 **5 Hours**

Implement the principle of stimulated emission of laser for grain size distribution in sediment samples

EXPERIMENT 4 **5 Hours**

Assess the variation of refractive index of glass and water for optical communication

EXPERIMENT 5 **5 Hours**

Evaluate the band gap energy of semiconducting materials for display device applications

EXPERIMENT 6 **5 Hours**

Determine the carrier concentration of charge carriers in semiconductors for automotive applications

Total: 60 Hours

Reference(s)

1. C J Fischer, The energy of Physics Part II: Electricity and Magnetism, Cognella Academic Publishing, 2019
2. P G Hewitt, Conceptual Physics, Pearson education, 2017
3. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2019
4. J Walker, D Halliday and R Resnick, Principles of Physics, John Wiley and Sons, Inc, 2018
5. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017

22CH203 ENGINEERING CHEMISTRY II 2 0 2 3

Course Objectives

- Understand the concept of electrochemistry for determination of electrode potential, pH and applications as energy storage devices
- Outline the chemistry of metal corrosion and analyze the methods of corrosion control
- Understand how catalyst increases the reaction rate
- Summarize the variation in properties and reactivity of isotopes

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO7 Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications

Course Outcomes (COs)

1. Apply the electrochemical principles to determine the electrode potential of a metal
2. Analyze the construction, cell reactions and working of energy storage devices
3. Analyze the specific operating conditions under which corrosion occurs and suggest a method to control corrosion
4. Illustrate reaction mechanisms and assess the role of catalyst in a chemical reaction
5. Analyze various types of nuclear transmutation including decay reactions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1											1	
2	2	1												
3	2	1					1							
4	2	1												
5	2	1											1	

UNIT I **6 Hours**

ELECTROCHEMISTRY

Origin of potential - electromotive force - electrical double layer - transport of charge within the cell - cell description - prediction of cell potentials

UNIT II **6 Hours**

ENERGY STORING DEVICES

Relation between electrical energy and energy content of a cell - reversible and irreversible cell - charging and discharging reactions in a reversible cell - current challenges in energy storage technologies

UNIT III **6 Hours**

METAL CORROSION AND ITS PREVENTION

Oxidation of metals: Electrochemical origin of corrosion - electromigration - electron transfer in the presence and absence of moisture - galvanic series. Strategies for corrosion control: Galvanic anode and impressed current.

UNIT IV **6 Hours**

CATALYSIS

Energy profile diagram for a chemical reaction - activation energy - role of catalyst - homogeneous and heterogeneous catalysis - types

UNIT V **6 Hours**

NUCLEAR REACTIONS

Radioactive and stable isotopes - variation in properties between isotopes - radioactive decay (alpha, beta and gamma) - half-life period - nuclear reactions - radiocarbondating

EXPERIMENT 1 **4 Hours**

Measure industrial effluent water pH and assess water quality against allowed standards

EXPERIMENT 2 **4 Hours**

Iron (Fe2+) in Bhavani River water: Potentiometric Analysis & Pollution Assessment (CPCB Standards).

EXPERIMENT 3 **4 Hours**

Construct a Zn-Cu electrochemical cell and validate the output by connecting the LED light.

EXPERIMENT 4 **5 Hours**

Evaluate the corrosion percentage in concrete TMT bars

EXPERIMENT 5 **4 Hours**

Determination of the percentage of corrosion inhibition in plain-carbon steel using natural inhibitors using natural inhibitors

EXPERIMENT 6 **4 Hours**

Electroplating of copper metal on iron vessels for domestic application.

EXPERIMENT 7 **5 Hours**

Determination of acid-catalyzed hydrolysis kinetics in locally sourced fruit extracts

Total: 60 Hours

Reference(s)

1. U. Hanefeld, L. Lefferts, Catalysis: An Integrated Textbook for Students, 2nd Edition, Wiley- VCH, 2017.
2. S. Vairam, Engineering Chemistry, 1st Edition, John Wiley & Sons, 2014.
3. Jain and Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2013.
4. P.H. Rieger, Electrochemistry, Second Edition (Reprint), Springer, Netherland, 2012.
5. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th Edition (revised), New Age International Publishers, 2011.
6. E. McCafferty, Introduction to Corrosion Science, 1st Edition, Springer, 2010.

22GE002 COMPUTATIONAL PROBLEM SOLVING 3 0 0 3

Course Objectives

- Analyze the algorithm design techniques and development principles in solving the real-life problems.
- Illustrate the different ways of organizing and storing the data in computing systems.
- Understand the basic network configuration and setup connections among different device systems.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze a problem and formulate algorithms, pseudocodes and flowcharts.
2. Develop algorithmic solutions to simple computational problems and explore algorithmic approaches to problem solving.
3. Design and apply appropriate data structures for solving computing problems.
4. Compare the various storage devices used in a computer system.
5. Analyze the requirements for a given organizational structure and establish the connection between two or more computers to form a network.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2									3	
2	3	3	3	3									3	
3	2	2	2	3									3	
4	2	2	2	2										3
5	2	2	2	2									1	2

UNIT I **6 Hours**

VISUAL PROCESS MODELING

Scenario decomposition - logical sequencing - drawing flowchart - preparing visual process model.

UNIT II **12 Hours**

ALGORITHMIC DESIGN THINKING

Analysis - Verification - Brute force - Divide and conquer - Greedy - Backtracking.

UNIT III **12 Hours**

DATA ORGANIZATION

Elementary Data Organization - Abstract Data Types - Fundamentals of Linear and Non Linear Data Structures.

UNIT IV **7 Hours**

DATA STORAGE

Flat File and Relational database- Data Read & Write in Local Storage, Server Storage and Cloud storage - Database Query Methods.

UNIT V **8 Hours**

NETWORKING ESSENTIALS

Networking Components and Services - IP Addressing - Configuring and Managing the Campus Network - Network Security - Firewalls.

Total: 45 Hours

Reference(s)

1. David D. Riley, Kennya. Hunt, "Computational thinking for the modern problem Solver", CRC Press Taylor & Francis Group, 2014.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2011.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,2016.
4. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill, 2015.
5. Behrouz A.Forouzan, "Data Communication and Networking", 5th Edition, Tata McGraw-Hill, 2014.

22GE003 BASICS OF ELECTRICAL ENGINEERING 2 0 2 3

Course Objectives

- To understand the basic concepts of electrical charge and its properties
- To interpret the formation of electric field due to electric charges
- To illustrate the concept of magnetic fields due to revolving electron
- To illustrate the force on moving charges in electric and magnetic field
- To understand the energy transfer in electro mechanical conversion

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

P04: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Interpret the behavior of electric charges in different medium using coulombs law.
2. Analyse the electric field due to different charge distributions.
3. Analyse the magnetic field intensity due to long conductor, solenoid, toroid and magnetic dipoles.
4. Analyze the force on conductors due to the moving charges.
5. Interpret the energy conversion concepts in electromagnetic fields.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		1									1	
2	3	2		1										
3	1	1	3											1
4	2	1		3									1	
5	3	2		1										

UNIT I **5 Hours**

ELECTRIC CHARGE

Properties of charge, additivity of charges, quantization of charge, conservation of charge, Forces between multiple charges, Electric charge in conductors, Drift of Electrons, Charges in Clouds.

UNIT II **7 Hours**

ELECTRIC FIELD

Electric field due to system of charges, Significance of Electric field line. Electric Dipole and its significance, Continuous charge distribution, Field in infinite long uniform straight conductors, field in uniform charged uniform infinite plane sheet, field due to uniform thin spherical sheet.

UNIT III **7 Hours**

MAGNETIC FIELDS

Concept of magnetic field, magnetic fields in infinitely long straight wire, straight and toroidal solenoids, Magnetic dipole moment of a revolving electron, Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to axis, Induced Electric field due to changing Magnetic Field.

UNIT IV **6 Hours**

FORCE ON CHARGES

Force on a moving charge in uniform magnetic and electric fields, Force on a current carrying conductor in a uniform magnetic field, Force between two parallel current carrying conductors.

UNIT V **5 Hours**

ELECTRO MECHANICAL ENERGY CONVERSION

Energy transfer in electromagnetic fields, Energy storage in magnetic field, Electromagnetic induction, induced emf, Eddy currents. Self and mutual inductance Linear Momentum and Angular Momentum carried by Electromagnetic Fields.

EXPERIMENT 1 **7 Hours**

Analysis the behavior of a Fixed Resistor in an Electric Heater

EXPERIMENT 2 **7 Hours**

Construct an Electrical Wiring layout for a basic Household Applications

EXPERIMENT 3 **8 Hours**

Analysis the self and Mutual Induction in a Domestic Fan

EXPERIMENT 4 **8 Hours**

Design A Transistor-Based Electronic Switch

Total: 60 Hours

Reference(s)

1. Mathew N. O. Sadiku, Principles of Electromagnetics, 6th Edition, Oxford University 2020
2. William H. Hayt and John A. Buck, Engineering Electromagnetics, McGraw Hill 2020
3. Kraus and Fleisch, Electromagnetics with Applications, McGraw Hill International Editions, 2017
4. S.P.Ghosh, Lipika Datta, Electromagnetic Field Theory, First Edition, McGraw Hill Education(India) Private Limited 2017

22IT206 DIGITAL COMPUTER ELECTRONICS 3 0 2 4

Course Objectives

- Understand the operation of Arithmetic Logic unit in Microprocessors
- Interpret Data retrieval from Memory by Microprocessors
- Analyze the role of Control Unit in Microprocessors
- Analyze Instruction execution in Microprocessors

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes

1. Analyze the Design of Arithmetic and Logic Unit in Microprocessors
2. Analyze the Data Storage and Retrieval from Random Access Memory
3. Analyze the working mechanism of Control Unit in Microprocessors
4. Analyze the execution of Arithmetic and Logical Instructions
5. Analyze the execution of Jump and Memory related Instructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2											
2	2	2	2											
3	2	2	2											
4	2	2											1	
5	2	2											1	

UNIT I **9 Hours**

BINARY SYSTEM AND DESIGN OF ALU

Conversion of Decimal, Hexadecimal, Octal and Binary Numbers - Representation of Negative Numbers in Binary - Design of Binary Arithmetic Logic Modules - Magnitude Comparator - Encoder - Decoder - Multiplexer - Demultiplexer - Design of Arithmetic and Logic Unit (ALU)

UNIT 2 **9 Hours**

SYNCHRONOUS CIRCUIT AND DESIGN OF RAM

Latches and Flip Flops - Clock - Registers - Counters - Shift Registers - Storage and Retrieval of Binary Numbers from Registers - Design of Random Access Memory (RAM) - Encoding and Decoding of Memory address locations

UNIT 3 **9 Hours**

DESIGN OF CONTROL UNIT

Design of Control Unit - Mechanism of Instruction Read, Data Read, Instruction Decode, Instruction Execute and Data Write

UNIT 4 **9 Hours**

BASIC INSTRUCTION EXECUTION

Arithmetic Instructions - Increments, Decrements and Rotate Instructions - Logic Instructions - Arithmetic and Logic instructions

UNIT 5 **9 Hours**

ADVANCED INSTRUCTION EXECUTION

Memory Reference instructions - Register Instructions - Jump and Call Instructions - Concept of Flag - Extended Register Instructions - Indirect Instructions - Stack instructions

EXPERIMENT 1 **5 Hours**

Buzzer Alarm System: Logic Circuit for Intruder Detection

EXPERIMENT 2 **5 Hours**

Binary Calculator: Design and Simulation of a Basic Arithmetic Unit.

EXPERIMENT 3 **5 Hours**

Binary Comparator: Designing a Circuit to Compare Binary Numbers

EXPERIMENT 4 **5 Hours**

Digital Lock System: With the combination of Flip-Flops and Logic Gates.

EXPERIMENT 5 **5 Hours**

Digital Alarm Clock: Timekeeping with Counters and Decoders

EXPERIMENT 6 **5 Hours**

Elevator Control System: Implementing Logic for Floor Selection

Total: 75 Hours

Reference(s)

1. Digital Logic & Computer Design , Morris Mano Pearson Education India, 2019
2. Digital Computer Electronics, Albert Paul Malvino and Jerald A Brown (3rd Edition), McGraw Hill Education India, 2001
3. Digital Design and Computer Architecture, David Money Harris and Sarah L Harris, Elsavier, 2007
4. But How do it Know? The Basic Principles of Computers for Everyone, John C Schott, John C Scott Publishers, 2009
5. Code: The Hidden Language of Computer Hardware and Software (2nd Edition), Petzold Charles, Microsoft Press , 2022
6. Digital Computer Fundamentals (6th Edition), Thomas C Bartee, Tata Mcgraw Hill Education, 2011

1 0 0 1

22HS006 TAMILS AND TECHNOLOGY

Course Objectives

- Analyze graffiti on potteries as a form of historical and cultural documentation during the Sangam Age.
- Investigate the building materials and the historical context of Hero stones during the Sangam Age by Analyzing the details of stage constructions in Silappathikaram and their cultural significance.
- Examine ancient knowledge of oceans and its impact on Tamil society.

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the significance of the weaving industry during the Sangam Age and its cultural importance.
2. Understand the significance of dams, tanks, ponds, and sluices in the agricultural and irrigation practices of the Chola Period.
3. Explore the architectural designs and structural construction methods used in household materials during the Sangam Age.
4. Explore the art of shipbuilding in ancient Tamil culture and its role in maritime trade and transportation.
5. Trace the development of scientific terminology and vocabulary in Tamil language.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	2			1	
2									2	2				
3									2	2			1	
4									2	3			1	
5									2	3				

UNIT I **3 Hours**

WEAVING AND CERAMIC TECHNOLOGY

Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

UNIT II **3 Hours**

DESIGN AND CONSTRUCTION TECHNOLOGY

Designing and Structural construction House and designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period

UNIT III **3 Hours**

MANUFACTURING TECHNOLOGY

Art of Ship Building-Metallurgical studies-Iron industry-Iron smelting,steel-Copper and gold-Coins as source of history-Minting of Coins-Beads making-industries Stone beads -Glass beads-Terracotta beads-Shell beads-bone beats-Archeological evidences-Gem stone types described in Silappathikaram.

UNIT IV **3 Hours**

AGRICULTURE AND IRRIGATION TECHNOLOGY

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry- Wells designed for cattle use- Agriculture and Agro Processing-Knowledge of Sea-Fisheries- Pearl-Conche diving-Ancient Knowledge of Ocean-Knowledge Specific Society.

UNIT V **3 Hours**

SCIENTIFIC TAMIL

Development of Scientific Tamil-Tamil computing-Digitalization of Tamil Books-Development of Tamil Software-Tamil Virtual Academy-Tamil Digital Library-Online Tamil Dictionaries-Sorkuvai Project.

Total: 15 Hours

Reference(s)

1. Dr. K. K. Pillay , Social Life of Tamils, A joint publication of TNTB & ESC and RMRL
2. Dr. S. Singaravelu, Social Life of the Tamils - The Classical Period, International Institute of Tamil Studies.
3. Dr. S. V. Subatamanian , Dr.K.D. Thirunavukkarasu, Historical Heritage of the Tamils, International Institute of Tamil Studies.
4. Dr. M. Valarmathi, The Contributions of the Tamils to Indian Culture, International Institute of Tamil Studies
5. Keeladi - Sangam City Civilization on the banks of river Vaigai, Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu
6. Dr. K. K. Pillay, Studies in the History of India with Special Reference to Tamil Nadu.

பாடத்திட்டத்தின் நோக்கம்

- சங்க காலத்தில் வரலாறு மற்றும் கலாச்சார ஆவணங்களின் ஒரு வடிவமாக, மட்பாண்டங்கள் மீதான கிராஃபிட்டியை பகுப்பாய்வு செய்தல்.
- சிலப்பதிகாரத்தில் கட்டப்பட்ட மேடை கட்டுமானங்களின் விவரங்களையும் அவற்றின் கலாச்சார முக்கியத்துவத்தையும் பகுப்பாய்வு செய்வதன் மூலம், சங்க காலத்தில் மாவீரர் கற்களின் கட்டுமானப் பொருட்கள் மற்றும் வரலாற்று சூழலை ஆராய்தல்.
- சமுத்திரங்கள் பற்றிய பண்டைய அறிவையும், தமிழ் சமூகத்தில் அதன் தாக்கத்தையும் ஆராய்வது ஆகியவை இப்பாடத்திட்டத்தின் நோக்கம் ஆகும்.

கற்றலின் விளைவு

1 சங்க காலத்தில் நெசவுத் தொழிலின் முக்கியத்துவத்தையும் அதன் கலாச்சார முக்கியத்துவத்தையும் புரிந்து கொள்ளல்.
2 சோழர் கால விவசாய மற்றும் நீர்ப்பாசன நடைமுறைகளில் அணைகள், குளங்கள் மற்றும் மதகுகளின் முக்கியத்துவத்தைப் புரிந்து கொள்ளல்.
3 சங்க காலத்தில் வீட்டுப் பொருட்களில் பயன்படுத்தப்பட்ட கட்டடக்கலை வடிவமைப்புகள் மற்றும் கட்டமைப்பு கட்டுமான முறைகளை ஆராய்தல்.
4 பண்டைய தமிழ் கலாச்சாரத்தில், கப்பல் கட்டும் கலை, கடல் வர்த்தகம் மற்றும் போக்குவரத்தில் அதன் பங்கை ஆராய்தல்.
5 தமிழ் மொழியில் அறிவியல் சொற்களஞ்சியம் மற்றும் சொல்லகராதியின் வளர்ச்சியைக் கண்டறிதல்.

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: **3**

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: **3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22IT301 PROBABILITY, STATISTICS AND QUEUING THEORY 3 1 0 4

Course Objectives

- Understand the basic concepts of probability and the distributions with characteristics and also two-dimensional random variables
- Summarize and apply the methodologies of the statistics and queuing theory.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learningalgorithms and analytical tools to enable information retrieval and decision making in scientific and business applications

Course Outcomes (COs)

1. Demonstrate and apply the basic probability axioms and concepts in the core areas.
2. Apply the concepts of probability distributions in an appropriate place of computers and Engineering.
3. Implement basic statistical inference techniques engineering problems.
4. Design an experiment using ANOVA technique and summarize the measurements for statistical quality control.
5. Identify and apply the queuing methodologies to optimize the result of the waiting line.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2											1	
2	1	2											1	
3	1	2											1	
4	1	2												2
5	1	2												2

UNIT I **9 Hours**

PROBABILITY AND RANDOM VARIABLE

Axioms of probability-Conditional probability-Total probability-Bayes theorem-Random variable-Probability mass function-Probability density functions-Properties-Moments - Moment generating functions and their properties.

UNIT II **9 Hours**

STANDARD DISTRIBUTIONS

Discrete distributions: Binomial - Poisson - Negative Binomial - Continuous distributions: Uniform - Exponential - Gamma - Normal distributions and their properties.

UNIT III **9 Hours**

TESTING OF HYPOTHESIS

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on normal distribution for single mean and difference of means -Small sample tests: t-test for mean -F- test - Chi-square test for Goodness of fit and Independence of attributes.

UNIT IV **9 Hours**

DESIGN OF EXPERIMENTS AND CONTROL CHART

One way and two way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design - Control charts for measurements (X and R charts) - Control charts for attributes (p, c and np charts).

UNIT V **9 Hours**

QUEUING THEORY

Pure Birth and Death Process -Characteristics of Queuing models- Kendalls notation- Single and multi server Markovian queuing models- M/M/1 and M/M/C (Finite and infinite capacity)- Pollaczek-Khinchine formula.

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, PHL Publisher, 1996.
2. Kishore S Trivedi, Probability and Statistics with Reliability Queuing and Computer Science Applications, John Wiley and Sons, Second Edition, 2012.
3. Arnold O Allen, Probability Statistics and Queuing Theory with Computer Applications, New Age International, 2003.
4. Jay L Devore, Probability and Statistics for Engineering and The Sciences, Thomson Learning, Seventh Edition, 2002.
5. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists

22IT302 DATA STRUCTURES I 3 0 2 4

Course Objectives

- Implement array and hash data structure for real world applications.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the performance of various data structures using asymptotic notations.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement the array data structure and its types for searching and sorting operations.
2. Outline the algorithm efficiency with different asymptotic notations for optimizing the code.
3. Implement the linear node-based data structure for real world applications.
4. Evaluate the performance of Hash over arrays and list in memory access.
5. Analyze the tree traversal algorithms for various non-linear data structures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	1
2	2	2	2	2	2						2	2	1	
3	2	3	3	2	2						2	2	2	1
4	3	3	3	3	2						3	3	3	
5	3	2	3	3	3						3	3	2	2

UNIT I **10 Hours**

FOUNDATIONAL DATA STRUCTURES

Algorithms and Data Structures - Data Structures hierarchy -Types of Data- Singular Data and Plural Data - Position indexing : Array - Sets - Ordered Arrays - Searching over Arrays and Ordered Arrays.

UNIT II **7 Hours**

ALGORITHM EFFICIENCY

Algorithm efficiency using Asymptotic Notations - Optimizing code with and without Big O Notation - Optimizing for optimistic scenarios - Trade- offs between Time and Space.

UNIT III **10 Hours**

ADT AND NODE BASED DATA STRUCTURES

ADT : Stacks - Queues - Recursion - Recursive Algorithms for Speed - Node Based Data Structures : Linked list - Need of Linked List - Arrays vs Linked List - Types of Linked List and its operations - Skip Lists.

UNIT IV **8 Hours**

FAST LOOKUP WITH HASH

Hash Table - Hash functions - Internal implementation of Hash - Iteration over Hash - Hash operations - Hash of Hash - Array of Hash - Hash of Array.

UNIT V **10 Hours**

TREES

Tree - Binary Tree - Binary Search Tree - Tree traversal - AVL Tree - Red Black Tree - B Tree - B+ Tree - Heap.

8 Hours

EXPERIMENT 1

Implement a python program for the supermarket application using Stack and Queue for basket storage and checkout respectively.

4 Hours

EXPERIMENT 2

Implement a python program for using a singly linked list. managing a train station and need to keep track of passengers on a particular train

4 Hours

EXPERIMENT 3

Create a python program that allows users to search for a person's phone number quickly in the phone directory.

2 Hours

EXPERIMENT 4

Implement a Python program to sort the student grades for the quiz competition.

2 Hours

EXPERIMENT 5

Implement a digital signature generator and verifier using hash functions and public-key cryptography. Users can sign documents and verify the authenticity of signed documents.

10 Hours

EXPERIMENT 6

Implement a python program to give a direction for a Stranger. Landmark will be considered as a node and the path between the two landmark is the link

Total: 45 +30= 75 Hours

Reference(s)

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures & Algorithms in Python, Wiley, 2013.
2. Larry Wall, Tom Christiansen & Randal L. Schwartz, Progrmaming Perl, O"Reilly, 3rd edition, 2000.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2016.
4. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
5. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011.
6. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009.

22IT303 COMPUTER ORGANIZATION AND ARCHITECTURE 3 1 0 4

Course Objectives

- Understand the computer architecture concepts related to design of processors, memory management and I/O system.
- Explore the GPU computing architecture and develop an environment for creating high performance GPU-accelerated applications using CUDA programming.
- Gain knowledge on modern processor architecture to design the best processor/computing system.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the processor architecture and instruction sets of x86/x64 and ARM architecture.
2. Design a data path for a simple processor and compare the various techniques related to simultaneous execution of multiple instructions from a program.
3. Organize the computer memory to speed up the performance and facilitate the transfer of data between the computer's central processing unit and the external devices.
4. Analyze the GPU computing architecture and develop applications to run on NVIDIA GPUs using the CUDA programming environment.
5. Analyze the modern processor architectures and instruction sets and implement a RISC-V processor in a low-cost FPGA board.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2								2		1
2	3	3	2	2								2		2
3	2	2	2									2	2	2
4	2	2	2	2	3							2	1	1
5	2	2	2	2								2		2

UNIT I **9 Hours**

UNDERSTANDING PROCESSOR ARCHITECTURE AND INSTRUCTION SETS

Basic Computer Organization and Design - Instruction Set principles - x86 and x64 architecture & instruction sets - 32 bit and 64 bit ARM architecture & instruction sets.

UNIT II **9 Hours**

PROCESSOR DESIGN

Designing a Data path for a Simple Processor - DLX Pipeline - Super Pipelining - Super scalar processor - Instruction level parallelism (ILP) - Speculative Execution - Side channel attack (Spectre and Meltdown)

UNIT III **9 Hours**

MEMORY UNIT AND I/O ORGANIZATION

Memory Hierarchy - Cache Architectures - Levels in Cache - Improving Cache Performance - Memory Prefetch - Tera MTA - Connecting I/O Devices to the Processor.

UNIT IV **8 Hours**

EXPLORING GPU ARCHITECTURE

GPU Vs CPU architecture - GPU Architecture Basics - NVIDIA"s CUDA Toolkit - CUDA Programming

UNIT V **10 Hours**

MODERN COMPUTER ARCHITECTURE

Domain-Specific Computer Architectures - Sony PlayStation design PS3/PS5, MAC M1 chip, Xbox, Cerebas - Wafer Scale Computing, Accelerators (FPGA, ASIC) - RISC-V Architecture and Instruction Set - Implementing RISC-V in a field-programmable gate array (FPGA).

Tutorial: 15 Hours
Total: 60 Hours

Reference(s):

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, McGraw-Hill,Third Reprint, 2015.
2. David A, Patterson and John L, Hennessy, Computer Organization and Design: The hardware/ software interface, MorganKaufmann,4th edition, 2014.
3. Jim Ledin, Modern Computer Architecture and Organization - Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers - Second Edition,2022.

22IT304 PRINCIPLES OF PROGRAMMING LANGUAGES 3 0 2 4

Course Objectives

- Understand the history and evolution of programming language.
- Gain knowledge about the different data types and control flow statements.
- Impart knowledge about the subprograms, functions, debugging and error handling mechanisms.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Outline the programming paradigms and the basic structure of programming language.
2. Assess the implementation of different types of data, variable and types system.
3. Analyze suitable conditional statements and control structures for real world applications.
4. Develop programs using subprograms and explore their types for problem solving.
5. Determine the tools for error handling and event handling in Programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1	1	3						1	2	1	
2	2	3	3	1	3						2	2	1	
3	1	2	3	1	3						2	2	2	
4	1	2	3	1	3						2	2		2
5	1	2	3	1	3						2	2		2

UNIT I **8 Hours**

UNDERSTANDING PROGRAMMING PARADIGMS

Natural Vs Artificial language - Common Programming Paradigms - Syntax and semantics - Language Evaluation Criteria - Programming Language Grammar.

UNIT II **10 Hours**

VARIABLES AND DATA TYPES

Variable Declarations - Guidelines for Initializing Variables - Power of Variable names - Fundamental Data types - Type Systems - Type Inference and Polymorphism.

UNIT III **10 Hours**

STATEMENTS

Expressions and Assignment statements - Organizing straight-line code - Using conditionals - Controlling loops - Unusual control structures - General control issues.

UNIT IV **9 Hours**

SUBPROGRAMS

Fundamentals of Subprograms - Design issues - Parameter passing methods - Overloaded subprograms - Generic subprograms - Implementing subprograms.

UNIT V **8 Hours**

DEBUGGING AND ERROR HANDLING

Debugging - Debugging Strategies - Debugging Tools - Error Messages - Documentation - Test cases - Debugging with print statements - Debugging with comments and questions - Exception handling and Event handling

EXPERIMENT 1 **6 Hours**

Online shopping cart: Develop an application to implement online shopping cart and generate bill for the purchased products.

EXPERIMENT 2 **3 Hours**

Pocket Bazaar: Develop an application to manage an inventory of products for grocery stores

EXPERIMENT 3 **3 Hours**

Vacation Destination Decision Maker: Create an application program that helps a user decide on their next vacation destination based on their preferences.

EXPERIMENT 4 **3 Hours**

Temperature monitor: Develop an application for temperature monitoring system and provide an alert message.

EXPERIMENT 5 **3 Hours**

Develop an access control system that simulates the granting access to authorized personnel based on their credentials, such as ID cards and PIN codes.

EXPERIMENT 6 **6 Hours**

Math Quiz Generator: Design a math quiz generator that generates questions of various difficulty levels and arithmetic operations.

EXPERIMENT 7 **6 Hours**

Build a maze solver application that finds a path from the entrance to the exit of a maze

Total:45+30 = 75 Hours

Reference(s)

1 Code Complete, Steve McConnell, Microsoft Press, 2004.
2 Concepts of Programming Languages Robert. W. Sebesta 10/E, Pearson Education.
3 Programming Language Design Concepts, D. A. Watt, Wiley Dreamtech, 2007.
4 Programming Languages, 2nd Edition, A.B. Tucker, R. E. Noonan, TMH.
5 Programming Languages, K. C. Louden, 2nd Edition, Thomson, 2003

22IT305 SOFTWARE ENGINEERING 3 0 0 3

Course Objectives

- Understand the systematic approach related to the design, development and maintenance of a software system
- Analyze the limitations of manual testing process and provide a succinct summary of those limitations with the help of automated testing tools.
- Understand the Enterprise Architecture (EA) framework that provides the building blocks for successful digital business transformation.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, andan engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the publichealth and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverseteams, and in multidisciplinary settings.

PO11 Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the software development methodologies to various real life scenarios.
2. Apply modern tools and techniques to develop scalable, maintainable, and reliable software systems.
3. Analyze the coding strategies and techniques to write well-structured, efficient, and error-free code.
4. Apply specific modern testing tools to ensure the quality and reliability of software products.
5. Analyze the elements, structure, and positioning of an Enterprise Architecture framework used for successful digital business transformation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	1	
2	3	3	2	2	3		2		2			2		2
3	2	2	2				2		2			2	1	
4	2	2	2		3		2		2			2		2
5	2	2	2						2				1	

UNIT I **9 Hours**

SOFTWARE DEVELOPMENT PROCESS

Phases in Software Development - Traditional Software Development Models - Agile Methodologies - Agile Scaling Frameworks - Lean Software Development - Software Requirements Specification (SRS) - Project Scheduling and Estimation.

UNIT II **10 Hours**

TOOLS AND TECHNIQUES FOR SOFTWARE DEVELOPMENT

DevOps - Version control with Git - Containerization Using Docker and Kubernetes- Application Performance Monitoring (APM) - Continuous Integration Continuous deployment (CICD) - Clean Room build.

UNIT III **9 Hours**

CODE QUALITY

Software Metaphors - Upstream Prerequisites - Key Construction Decisions - Defensive Programming - Code Tuning Strategies and Techniques.

UNIT IV **9 Hours**

TESTING

Writing good test cases - Test driven development - Test Automation - Testing using Selenium tool - Continuous Testing - Exploratory Testing - Testing in Agile and DevOps Environments.

UNIT V **8 Hours**

ENTERPRISE ARCHITECTURE AND MODELING

Enterprise Architecture (EA) in Digital Transformation - Agility in Digital Business - Measuring EA: Metrics, KPIs and Risks.

Total: 45 Hours

Reference(s)

1. Roger S.Pressman, Software Engineering: A Practitioners Approach, McGraw Hill International edition, Seventh edition, 2020.
2. Steve Mc Connell, Code Complete - A practical handbook of software construction, Second Edition, 2004.
3. Tushar K Hazra, Bhuvan Unhelker, Enterprise Architecture for Digital Business -Integrated Transformation Strategies- Integrated Transformation strategies, First edition, 2021.
4. Gene Kim, Kevin Behr, and George Spafford, The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win, IT Revolution Press, 2018.

22HS004 HUMAN VALUES AND ETHICS 2 0 0 2

Course Objectives

- Understand the concept of good values and comprehend the importance of value-based living.
- Recognize the culture of peace through education.
- Identify and apply the practices for value development and clarification.

Programme Outcomes (POs)

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the importance of human values and ethics in life.
2. Execute the importance of harmonious living in a diverse society.
3. Analyze the sensitivity to the crying needs of society such as ungodliness, corruption, poverty, and suffering, and play a vital role in eradicating them.
4. Plan intellectually mature, morally upright, ethically correct, and spiritually inspired decisions.
5. Execute a correct balance between professional excellence and social commitment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1								3	2	1			2	
2								3	2	1			2	
3								3	2	1			2	
4								3	2	1			2	
5								3	2	1			2	

UNIT I **6 Hours**

COURSE INTRODUCTION - NEED, BASIC GUIDELINES AND ANALYSIS

Importance of Human Values & Ethics in 21st Century - Understanding the theory of basic human values and ethics - Openness to change - Self enhancement - Conservation - Self transcendence - Schwartz Value Survey: Self-Assessment

UNIT II **6 Hours**

EMBRACING THE COMMON ETIQUETTE

Altruism- Integrity - Freedom - Justice - Honesty - Truthfulness - Responsibility - Compassion

UNIT III **6 Hours**

CONTINUOUS HAPPINESS AND PROSPERITY

An overview on basic Human Aspirations - Understanding and living in harmony at various levels of life - Embracing self-love and wellness - Understanding harmony in the family and society

UNIT IV **6 Hours**

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

Reflection on growing global multifold problems: poverty, pollution, hunger, disease, unemployment, caste system, child labour, gender equality, politics and violence. Understanding the challenges in cultural, personal, social, political, and economic environment

UNIT V **6 Hours**

UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS CO-EXISTENCE

Understanding the harmony in Nature - Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions

Total: 30 Hours

Reference(s)

1 Martin, G. The Little Book of Ethics: A Human Values Approach. Australia: G.P. Martin. 2011.

2 Gupta, N. L. Human Values for The 21St Century. India: Anmol Publications Pvt. Limited. 2002.

3 Mishra, A. Happiness Is All We Want. India: Bloomsbury Publishing.2017.

4 Universal Human Values. (n.p.): Booksclinic Publishing. 2023.

5 A Textbook on Professional Ethics and Human Values. India: New Age International (P) Limited.2007.

22HS005 SOFT SKILLS AND EFFECTIVE COMMUNICATION 0 0 2 1

Course Objectives

- Communicate in formal discussions at the workplace efficaciously and proficiently.
- Describe experiences and events, and briefly give reasons and explanations for opinions andplans.
- Convey agreement and disagreement in a polite but firm manner in both written and spoken formats.

Programme Outcomes (POs)

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1 Enhance confidence in expressing thoughts in grammatically proper language and etiquette inwaiting for the opportunity to provide input.

2 Effectively communicate in English on formal occasions and proficiency in the use of linkwords and other discourse markers

3 Provide constructive feedback and file logical complaints.

4 Analyse the understanding of oral and written communication in real-world situations.

5 Apply the improved spelling and punctuation in writing and heightened understanding of tone,pitch and stress in oral formats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT I **10 Hours**

SELF-EXPRESSION

Group discussion/ Peer discussion - Communicating decisions and opinions - Tone, Pitch, Stress - Agreeing, Disagreeing, Suggesting, Speculating - Comparing and Contrasting - Comparatives and Superlatives - Discourse markers – Interjections - Decision making - Synthesis - Higher order thinking Group discussion/Peer discussion - Effective Communication Types of communication - Written vs Spoken - Contractions Intonation Stress Active voice - Question tags - Confidence and body language Guided writing- Outlining Main Points - Group discussion/Peer discussion - Avoiding common errors Reduction of MTI - Common errors - Barriers to communication Accent

UNIT II **10 Hours**

CREATIVE EXPRESSION

JAM, Debate, Review writing, Social media posts Synonyms - Antonyms Cloze test Phrasal verbs Spotting errors Collocation - Commonly mispronounced

UNIT III **10 Hours**

FORMAL EXPRESSION

Writing: Giving written feedback, Review writing, and Letter of complaint. Speaking: Giving constructive feedback and offering suggestions, asking for inputs, commenting politely on appropriate phrases - Giving written feedback, Review writing, and Letter of complaint. Critical reasoning - Modal verbs - Polite ways to express negatives

Total: 30 Hours

Reference(s)

1 Word Power Made Easy by Norman Lewis, W. R. Goyal Pub. & Distributors, 2009.

2 Sasikumar, V, et al., A Course in Listening & Speaking Foundation Books, 2005.

3 Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.

4 Prasad, Hari Mohan. A Handbook of Spotting Errors, Mcgraw Hill Education, 2010.

5 Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012

6 Business English by Ken Taylor, Orient Blackswan, 2011

22IT401 DISCRETE MATHEMATICS 3 1 0 4

Course Objectives

- Implement the definitions of relevant vocabulary from graph theory and combinatorics and be able to perform related calculations.
- Understand and use the terms Cardinality, finite, countably infinite and uncountably infinite, and determine which of these characteristics is associated with a given set.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand and apply the concepts of Boolean algebra and characteristics in computers.
2. Apply formalized arguments to classify and assess real-world arguments.
3. Represent the characteristics of predicate logic in computer engineering.
4. Apply different properties of injection, surjection, bijection, composition and inverse functions in software engineering.
5. Interpret the concepts of Permutations, Combinations and Mathematical induction in the phenomena of real world.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1											1	
3	1	2												
4	2	2												
5	1	2												2

UNIT I **9 Hours**

BOOLEAN ALGEBRA

Introduction of Boolean algebra - Truth table - Basic logic gate - Basic postulates of Boolean algebra - Principle of duality- Canonical form - Karnaugh map.

UNIT II **9 Hours**

PROPOSITIONAL CALCULUS

Propositions- Logical connectives-Compound propositions-Conditional and biconditional propositions-Truth tables - Tautologies and Contradictions - Logical and equivalences and implications-DeMorgans Laws-Normal forms-Principal conjunctive and disjunctive normal forms - Rules of inference- Arguments-Validity of arguments.

UNIT III **9 Hours**

PREDICATE CALCULUS

Predicates-Statement Function - Variables-free and bound variables- Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements- Theory of inference- The rules of universal specification and generalization-Validity of arguments.

UNIT IV **9 Hours**

SET THEORY AND FUNCTIONS

Set Operations-properties-Power set-Relations-Graph and matrix of a relation- Partial Ordering-Equivalence relations-Partitions- Functions -Types of Functions- composition of relation and functions-inverse functions.

UNIT V **9 Hours**

COMBINATORICS

Basics of Counting - Counting arguments- Pigeonhole Principle- Permutations and Combinations-Recursion and recurrence relations-Generating Functions- Mathematical Induction- Inclusion - Exclusion

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Trembly J P and Manohar R, Discrete Mathematical Structures with Applications to computer Science, Tata McGraw Hill Publications Co. Ltd., New Delhi 30th Re-print 2007.
2. Alan Doerr and Kenneth Levasseur, Applied Discrete Structures for Computer Science, Galgotia Publications Pvt. Ltd. Delhi. 2010.
3. Ralph P Girmaldi and Ramana B.V. Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education Asia, Delhi, 2007.
4. Kolman Busby Ross, Discrete Mathematical Structures , Prentice-Hall India, New Delhi, Fifth Edition, 2007.
5. Rosen K.H Discrete Mathematics and its Applications, Tata McGraw Hill Publications, New Delhi. 7th Edition, 2011.

22IT402 DATA STRUCTURES II 3 0 2 4

Course Objectives

- Understand and use the various major modern data structures like Trie, Rope, Segment tree and Octree.
- Apply the graph data structure and tree traversal algorithms for solving real time problems.
- Analyze the performance of algorithm design techniques with different data structures.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement the Trie data structure and its basic search operations.
2. Outline the traversal algorithm and its types with graph data structure.
3. Implement Minimum Spanning tree algorithms and analyze their performance.
4. Design and implement different problems using the backtracking and branch and bound techniques and analyze the time complexities of them.
5. Implement modern data structures like Segment tree, Quadtree and Octree for real world applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	2
2	2	2	2	2	2						2	2	2	2
3	2	3	3	2	2						2	2	2	2
4	3	3	3	3	2						3	3	2	2
5	3	2	3	3	3						3	3	2	2

UNIT I **9 Hours**

TRIE DATA STRUCTURES

Trie Structure-Types-Prefix-Based Search-Space Efficiency-Time Complexity-Compact Tries- Applications-Suffix Array and Suffix Tree-Rope.

UNIT II **9 Hours**

GRAPH

Graph representation-Breadth-first traversal-Depth-first traversal-Shortest Path Algorithms: Unweighted Shortest Paths-Dijkstras Algorithm-Travelling Salesman Problem-Analysis of shortest path algorithms.

UNIT III **9 Hours**

GRAPH MST

Minimum Spanning Tree: Prims Algorithm-Kruskals Algorithm-Disjoint-Set Union (Union-Find)-A* algorithm-Flood filling algorithm-Analysis of MST algorithms.

UNIT IV **9 Hours**

ALGORITHM DESIGN TECHNIQUES

NP Complete problems- Backtracking: N-Queens Problem and Subset-Sum problem - Branch and bound: Knapsack problem-Approximation algorithms for NP hard problems: Traveling salesman-P, NP, NP-Complete and NP-Hard Problems.

UNIT V **9 Hours**

MODERN DATA STRUCTURES

Segment Tree-Interval Tree-Fenwick Tree-K-D Tree-Quadtree and Octree-Circular Buffer (Ring Buffer)-Marshaling/Unmarshalling-JSON-benefits-Schema-limitations-Protobuf.

EXPERIMENT 1 **4 Hours**

Implement a trie data structure to efficiently support autocomplete suggestions based on user input in google docs.

EXPERIMENT 2 **4 Hours**

Implement an Algorithm to find the shortest route and travel time between two locations within a city's transportation network.

EXPERIMENT 3 **10 Hours**

Design a cost-efficient telecommunication network to connect multiple cities using Kruskal's algorithm.

EXPERIMENT 4 **4 Hours**

Implement a chess game application using backtracking.

EXPERIMENT 5 **4 Hours**

Implementing Segment Tree for Range Sum Query in a Real-time Data Analytics Platform for student management system.

EXPERIMENT 6 **4 Hours**

Implement a geographic information system (GIS) for locating a city as node using quadtree

Total:45 + 30= 75 Hours

Reference(s)

1. Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley publications,2013.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C,2nd Edition,Pearson Education,2016.
3. Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures-A Pseudocode Approach with C, Thomson 2011.
4. Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.
5. Reema Thareja, Data Structures Using C, Second Edition , Oxford University Press, 2011

3 1 0 4

22IT403 OPERATING SYSTEMS

Course Objectives

- Establish a solid foundation in the introductory concepts of operating systems and gain insights into the structures, services, and roles of operating systems in computing environments.
- To apply process scheduling algorithms in a multi-programming environment and implement the various deadlock strategies effectively to prevent each other from accessing the computer resources
- To gain knowledge on the operations of memory management and File management.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the basic structure and architectural components of the operating system and interpret how application programs interact with the operating system through APIs.
2. Apply the various scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. Analyze memory allocation and deallocation mechanisms involved in memory management for a specific system.
4. Apply the various file handling strategies to manage files on a secondary storage structure and in a distributed environment.
5. Analyze the virtualization technologies and their types to simulate hardware functionality and create a virtual computer system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2			2		2		2	2	2	
2	3	3	2	2	3		2		2			2	2	
3	2	2	2				2		2			2	2	
4	2	2	2		3		2		2			2	2	
5	2	2	2						2				2	

UNIT I **8 Hours**

INTRODUCTION TO OPERATING SYSTEMS

Basic Operating System Concepts-Operating System Structure and Components-Operating System Services and Interfaces-Role of the Kernel and User Space-System calls and System Programs-Open Source and Closed source operating systems.

UNIT II **12 Hours**

PROCESS MANAGEMENT

Processes and Threads-Process Scheduling and CPU Scheduling Algorithms-Process Synchronization and Concurrency Control-Deadlocks and Handling Strategies-Inter-Process Communication (IPC)- Multi-Core and Multi-Processor Management

UNIT III **9 Hours**

MEMORY MANAGEMENT

Memory Hierarchy-Address Spaces and Memory Allocation-Paging and Segmentation-Page Replacement Algorithms-NUMA (Non-Uniform Memory Access)-Memory Compression-Memory Tiering.

UNIT IV **8 Hours**

FILE SYSTEM DESIGN AND AND IMPROVEMENTS

File System Structures-Storage Technologies-SSD and Flash Storage Optimization-Copy-on-Write (CoW) File Systems-File System Journaling-Distributed File Systems and Cloud Storage-File System Monitoring and Analytics

UNIT V **8 Hours**

VIRTUALIZATION AND RECENT DEVELOPMENTS

Virtualization Principles and Types (Hardware, Software, Network, Storage)-Hypervisors and Virtual Machine Monitors-Microkernels and Exokernels-Security and Integrity in Virtualized Environments-Security in Operating Systems-Operating Systems for Quantum Computers-Cross-Platform Compatibility.

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2. Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. Ltd, 2014
3. William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4. Harvey M. DeitelM, Operating Systems, Pearson Education Pvt. Ltd, 2007.
5. Distributed file system for cloud: A Clear and Concise Reference Kindle Edition by Gerardus Blokdyk
6. https://www.redhat.com/en/topics/virtualization

22IT404 WEB TECHNOLOGY AND FRAMEWORKS 2 0 2 3

Course Objectives

- Understand the Web Application Architectures and trace the evolution of the web and introduce concepts like Web 3.0 and Decentralized Web.
- Familiar with the different Web development Frameworks and Full stack development.
- Explore the emerging web technologies and implement best practices for making web applications accessible to all users

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the architecture of various web applications and develop simple use cases for the real time web applications
2. Implement web applications using client-side scripting language and server-side scripting languages.
3. Integrate the web applications with databases using Web frameworks.
4. Develop a complete, functional web application that incorporates both front-end and back-end components.
5. Implement the emerging web technologies in web application development projects.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	2
2	2	2	2	2	2						2	2	2	2
3	2	3	3	2	2						2	2	2	2
4	3	3	3	3	2						3	3	2	2
5	3	2	3	3	3						3	3	2	2

UNIT I **5 Hours**

INTRODUCTION TO WEB APPLICATION

Evolution of the web-Understanding Web Application Architectures:Server Side Rendered Applications-Single Page Application SPA-Mobile Application Development-Comparison of Monolithic and Microservice architectures-Serverless computing-HTTP Protocol and Methods-Web Browsers and Rendering Engines-Use cases of various web applications, including Flipkart, BIT Discourse, BIP, Wiki and Moodle.

UNIT II **7 Hours**

SCRIPTING LANGUAGES

Client-side Scripting vs Server-Side Scripting-Client-side Scripting: Execution Location-Languages: JavaScript Fundamentals-Document Object Model DOM. Server-Side Scripting: Execution Location-Languages-PHP Programming fundamentals

UNIT III **6 Hours**

WEB DEVELOPMENT FRAMEWORKS

Introduction to Web Development Frameworks -MVC Architecture - Building APIs with a Framework - RESTful APIs and API Design - Building a RESTful API - Database Integration with ORM/ODM - Building a Basic Front-End Application.

UNIT IV **6 Hours**

FULL STACK DEVELOPMENT

Full-Stack Development - Combining Front-End and Back-End Technologies - Building a Full-Stack Web Application- 12 factor application model - Deployment and Hosting Options - Continuous Integration and Continuous Deployment CI/CD - Performance Optimization and Scalability.

UNIT V **6 Hours**

EMERGING WEB TECHNOLOGIES

Emerging Web Technologies-Progressive Web Apps PWAs-WebAssembly and WebRTC-Web Security Best Practices-Open Web Application Security Project OWASP-Web Accessibility and Inclusive Design-Web Performance Optimization.

EXPERIMENT 1 **6 Hours**

Create a Multipage Website that serves as a personal portfolio using the browser's developer tools and CSS to enhance the web page.

EXPERIMENT 2 **3 Hours**

Implement an animated web application for Rock, Paper, Scissors game to handle input validation ensuring that the user's choice is one of Rock, Paper, or Scissors.

EXPERIMENT 3 **3 Hours**

Create a simple inventory management system to generate QR code for each product thereby allowing user validation using PHP.

EXPERIMENT 4 **3 Hours**

Develop a secure online banking system using a server-side framework like Flask, Django, or Ruby to avoid risk to financial systems.

EXPERIMENT 5 **7 Hours**

Develop a Full Stack Web Application for task management system in a Corporate Environment for tracking project progress and streamlining work assignments.

EXPERIMENT 6 **4 Hours**

Create a RESTful API for an online store used to manage different products using Node.js or Express.

EXPERIMENT 7 **4 Hours**

Develop a real-time chat application with a continuous integration and continuous deployment (CI/CD) pipeline and set up monitoring to ensure optimal performance.

Total: 30 + 30= 60 Hours

Reference(s)

1. P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education,2009.
2. James Gillies and Robert Cailliau, How the Web Was Born: The Story of the World Wide Web, 2000
3. D Crockford , The Good Parts, O Reilly , 2009
4. Mark Masse , REST API Design Book,O Reilly,2011
5. Matti Luukkainen and Jarkko Moilanen , Fullstack Open: Deep Dive Into Modern Web Development
6. Michal Zalewski , The Tangled Web: A Guide to Securing Modern Web Applications 2011

3 0 2 4

22IT405 DATABASE MANAGEMENT SYSTEM

Course Objectives

- Analyze the data models, conceptualize and Design a database system using E-R diagrams.
- Gain knowledge on the design principles of relational and modern database systems like SQL, NoSQL and NewSQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11. Project Management and Finance: Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the data models and the types of data used in databases.
2. Implement SQL queries for creating databases and performing the relational operations.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes.
5. Analyze the performance of NoSQL and NewSQL databases related to design.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2						2	2	2	2
2	2	2	2	2	2						2	2	2	2
3	2	3	3	2	2						2	2	2	2
4	3	3	3	3	2						3	3	2	2
5	3	2	2	3	3						3	3	2	2

UNIT I **8 Hours**

INTRODUCTION TO DATABASES AND DBMS

Understanding Data and Information - Database vs DBMS - Modern Databases - DBMS Architecture and Components - Data Models - Relational Model - Codd"s 12 Rules - Object-Relational Mapping (ORM).

UNIT II **10 Hours**

STRUCTURED QUERY LANGUAGE (SQL)

SQL Basic Commands - Constraints - Database Objects - SQL Functions - Subqueries- Correlated Subqueries- Nested subqueries - Recursive queries - Common Table Expressions (CTEs) - Triggers and Stored procedures.

UNIT III **9 Hours**

DATABASE DESIGN AND NORMALIZATION

Database Design fundamentals - Entity-Relationship Diagrams (ERD) - ERD to tables - Functional Dependencies and Normal Forms: 1NF, 2 NF, 3 NF, BCNF, 4 NF, 5NF and 6 NF - Domain-Key Normal Form (DKNF) - Nested Normal Form (NNF) - Denormalization and Trade-offs - Emerging trends in Database Design - Dealing with real-world complexities in Database Design- CASE Tools for Database Design.

UNIT IV **9 Hours**

QUERY OPTIMIZATION AND TRANSACTION MANAGEMENT

Query Optimization and Execution Plans -Optimization Visualization Tool - DB Sharding - Vitess - Vitess vs MySQL- Table partitioning - Transaction Management and ACID Properties - Concurrency Control: Lock based protocols -Deadlock handling - Multi version concurrency control (MVCC) - Transaction isolation.

UNIT V **9 Hours**

NOSQL AND NEWSQL DATABASES

NoSQL Vs NewSQL- NoSQLDatabases: MongoDB and Cassandra - NewSQL databases: Redis and NuoDB -Selection of NoSQL or NewSQL over RDBMS - CAP Theorem and BASE Properties - HeidiSQL - In-Memory Databases and Caching - Database Security and Encryption - Database Performance Tuning

EXPERIMENT 1 **4 Hours**

Create a relational database with tables for storing employee details and perform CRUD operations.

EXPERIMENT 2 **6 Hours**

Create a relational database for e-commerce applications and add primary key, foreign key, check constraints and triggers.

EXPERIMENT 3 **6 Hours**

Create an ER diagram for the library management system and implement the database schema in RDBMS.

EXPERIMENT 4 **3 Hours**

Create a MongoDB database for an event management system.

EXPERIMENT 5 **4 Hours**

Design a distributed database for an e-commerce platform to handle order processing.

EXPERIMENT 6 **4 Hours**

Develop an in-memory caching solution using Redis for a content publishing platform (Blog).

EXPERIMENT 7 **3 Hours**

Develop a secure RDBMS solution for a banking financial transactions system.

Total: 45+30=75 Hours

Reference(s)

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, McGraw - Hill, Sixth Edition, 2018
2. Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems, Pearson Education, Seventh Edition, 2016
3. Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management, Thompson Learning Course Technology, Ninth edition, 2011
4. Guy Harrison, Next Generation Databases: NoSQLand Big Data, Apress.

22HS007 ENVIRONMENTAL SCIENCE **2 0 0 0**

Course Objectives

- Understand the interdisciplinary and holistic nature of the environment
- Identify the significance of natural resources and environment on the quality of life and stimulate the quest for sustainable development
- Assess the socio-economic, political and ethical issues in environmental science

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Examine the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources
2. Analyze the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation
3. Identify the existing environmental challenges related to pollution and its management
4. Select suitable strategies for sustainable management of components of environmental science
5. Correlate the impacts of population and human activities on environment

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1											1	
3	2	2					1							
4	1													
5	2													

UNIT I **6 Hours**

NATURAL RESOURCES

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer - pesticide problems (eutrophication, blue baby syndrome, biomagnification). Energy resources - renewable (solar, wind, and hydro).

UNIT II **6 Hours**

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features: desert ecosystem. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III **6 Hours**

ENVIRONMENTAL POLLUTION

Pollution: Definition - causes - effects - control measures of air pollution - Water pollution - Sewage water treatment by activated sludge and trickling filter process - Noise pollution - Thermal pollution. Disaster management - causes - effects - control measures of floods - Earthquake

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development - Definition - Unsustainable to sustainable development - solid waste management - causes - effects - 5R Principles - landfills, incineration, composting. Water conservation - rain water harvesting - watershed management. Climate change - Global warming - acid rain - Ozone layer depletion. E-waste

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

Human population: Population growth - characteristics - variation among nations - population explosion - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

Total: 30 Hours

Reference(s)

1. Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, 4th Edition, New Age International Publishers, New Delhi, 2014.
2. T.G.Jr. Miller and S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi, 2014.
3. A. K. De, Environmental Chemistry, 7th Edition, New age international publishers, New Delhi, 2014.
4. Raven, P.H , Hassenzahl, D.M. and Berg, L.R., Environment, 8th edition. John Wiley & Sons, 2012.
5. Pepper I.L, Gerba C.P. and Brusseau M.L, Environmental and Pollution Science. Academic Press, 2011.

22HS008 ADVANCED ENGLISH AND TECHNICAL EXPRESSION 0 0 2 1

Course Objectives

- To enable students to achieve proficiency in academic writing
- Effectively use and appreciate the nuances of the language and engage an audience
- Use advanced tools of language to improve communicative competence and prepare for professional demands at the workplace

Programme Outcomes (POs)

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1 Understand the clarity in articulating the objectives and aims and improved proficiency in usingthe English language

2 Communicate effectively and with good interpersonal skills; speak in public, engage the audience, and lead a group discussion

3 Critically evaluate the ethics of persuasive appeals and confidence to influence opinion

4 Analyse a specific piece of information; take in what is read, and use good writing techniqueswith proper grammar and syntax in all formal situations

5 Create awareness and empathy to emotional signals in communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				

UNIT I **15 Hours**

CREATIVE EXPRESSION

Proposals & Grant applications, Argumentative essays & editorials, Sales Pitches, Campaigning, Commercials/advertisements, effectively answering the famous interview question: 'Why should we hire you?' Sentence and paragraph formation - Rhetorical questions - Emphasis & effective repetition - Empathetic expression, knowing the audience, capturing attention - Creating Memes, Comic Strips, Stand-up comedy, Caption writing, and Limericks, Vocabulary and slang words for comedy - Similes & Metaphors - Homophones, homonyms, alliteration, wordplay

UNIT II **15 Hours**

FORMAL EXPRESSION

Writing: Action plans, Cover letters, Mind-Mapping, Paragraph writing Logical reasoning - SVA - Advanced level - Style: Clarity, Concision, Coherence, Evocativeness, Efficacious Vocabulary - Conditional Clause - Be verbs- Tenses- advanced - Opening and closing sentences - Action plans, Anecdotal references, order of communication/ narration, complete communication- Wh-questions - Effective beginning and closing - Rhetorical questions - Appraising target audience - Pronunciation, Enunciation, Tone, Pace and Volume. - Writing: SOPs, Research Objectives, Thesis Statement, Indexing, Scholarly Articles, Academic Writing, Executive Summary, Survey Questionnaires, Citations and Bibliography - Reading: Quantitative & qualitative analysis, Analysis and paraphrasing of reference materials Speaking: Commentate live events, give instructions to operate machines/ conduct experiments Listening: Informational listening, Reflective listening, - Discriminative listening - Connective words - Prefixes and Suffixes - Quoting and paraphrasing Proofreading - Directed writing and writing formats - Note taking - Active verbs

Total: 30 Hours

Reference(s)

1 Sangeeta Sharma et.al. Communication Skills for Engineers and Scientists, PHI Learning Pvt.Ltd, 2011

2 Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.

3 Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, TataMcGraw Hill & Co. Ltd., 2001

4 Personality Development, Harold R. Wallace &L. Ann Masters, Cengage Learning, New Delhi

5 Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd.1990, Delhi

6 English Grammar, Composition and Usage by N.K. Agrawal&F.T. Wood, Macmillan India Ltd.,New Delhi

22IT501 PRINCIPLES OF COMMUNICATION **3 0 0 3**

Course Objectives

- Understand the basic concepts of communication and its types
- Convert analog signals to digital format and describe Pulse and digital Modulation techniques
- Gain knowledge on various mobile communication technologies and their performances

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PSO 2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the performance of AM, FM and PM systems
2. Analyze and design various pulse modulation schemes for the transmission of analog message signal
3. Analyze the performance of various digital modulation techniques
4. Compare and analyze different multiple access techniques used for wireless communication systems
5. Design the spread spectrum modulation schemes for secured communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												1
2	1	2												1
3	1	2												2
4		2	1											2
5		2	2											1

UNIT I **9 Hours**

ANALOG COMMUNICATION

Elements of Communication systems - Communication channels, Need for modulation, Baseband and Pass band signals, Amplitude Modulation: Double sideband with Carrier (DSB-C), Double side band without Carrier DSB-SC, Single Side Band Modulation SSB, Modulators and Demodulators, Vestigial Side Band (VSB), Quadrature Amplitude Modulator, Radio Transmitter and Receiver-Basic principles of Frequency Modulation and Phase Modulation - Frequency Translation – Super-heterodyne Receiver - Envelope Detector - FM Receiver.

UNIT II **9 Hours**

PULSE MODULATION

Sampling process - Pulse Amplitude modulation - Pulse width modulation - Pulse position modulation - Bandwidth Noise trade off - Quantization process - Pulse Code Modulation - Noise considerations in PCM systems - Time Division Multiplexing.

UNIT III **9 Hours**

DIGITAL MODULATION

Introduction to pass band data transmission - Pass band transmission model - Coherent binary modulation techniques: BPSK, QPSK - Coherent Quadrature modulation techniques: QAM - Non-coherent binary modulation: BFSK, DPSK - performance of digital modulation systems based on probability of error, band width.

UNIT IV **9 Hours**

MOBILE COMMUNICATION TECHNOLOGIES

Wireless transmission - Signal propagation - Medium access control: Motivation for a specialized MAC - TDMA - FDMA - CDMA - GSM: System architecture - Radio interface - Protocols - Localization and calling - Handover – Security-HSCSD-UMTS-LTE-3GPP (5G).

UNIT V **9 Hours**

SPREAD SPECTRUM MODULATION

Pseudo noise Sequences - A Notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Frequency hopping spread spectrum: Slow Frequency hopping, Fast Frequency hopping - RAKE receiver for wireless communication using CDMA

Total: 45 Hours

Reference(s)

1. Simon Haykin, Communication systems, 5th Edition, John Wiley and Sons, 2018.
2. Introduction to mobile network engineering : GSM, 3G-WCDMA, LTE and teh road to 5G,4th Edition,2018.
3. John Proakis, Massoud Salehi, Digital Communication, 5th Edition, McGraw-Hill, 2014.
4. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson, 2014.
5. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley, 2018.
6. A B Carlson and Paul Crilly, Communication Systems, 5th Edition, McGraw-Hill, 2017.

22IT502 COMPUTER NETWORKS **3 0 2 4**

Course Objectives

- Understand the division of network functionality into layers and to familiarize the functions and protocols of each layer of TCP/IP protocol suite.
- Understand the components required to build different types of network and to learn concepts related to network addressing.
- Understand the flow of information from one node to another node in the network and to learn the application layer utilities.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare OSI model with TCP/IP protocol suite and design a network based on four different topologies.
2. Design and analyze error and flow control algorithms for communication between adjacent nodes in a network.
3. Apply the suitable routing algorithms for the given network.
4. Develop a client/server application using TCP/UDP and design algorithms for end-end communication.
5. Analyze the capabilities of application layer utilities and replicate the same for new applications.

Articulation matrix:

CO No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	3	1	3											2
2	1	2	3	1	1									2
3	3	2	2											2
4	1	3	2											2
5	3	2												2

UNIT I **9 Hours**

DATA COMMUNICATIONS

Introduction: Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, OSI Model - Physical Layer: Introduction to Physical Layer - Transmission Media: Guided Media, Unguided Media.

UNIT II **9 Hours**

DATA LINK LAYER

Introduction to Data Link Layer: Link Layer Addressing - Error Detection and Correction: Block Coding, Cyclic Codes, Checksum, Forward Error Correction - Data Link Control: DLC services, Data-Link Layer Protocols, HDLC, Point-to-Point Protocol - Media Access Control: Random Access and Controlled Access

UNIT III **9 Hours**

NETWORK LAYER

Network Layer Services - Packet Switching - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMPv4 - Routing Algorithms- Unicast Routing Protocols - Next Generation IP: IPv6 Addressing, IPv6 Protocol.

UNIT IV **9 Hours**

TRANSPORT LAYER

Introduction to Transport Layer: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol, Selective Repeat Protocol, Bidirectional Protocols: Piggybacking - User Datagram Protocol - Transmission Control Protocol - Congestion Control.

UNIT V **9 Hours**

APPLICATION LAYER

Client Server Programming - WWW - HTTP - FTP - DNS – SNMP - DHCP.

EXPERIMENT 1 **5 Hours**

Design a Local area network for organization of 5 laboratories with interdepartmental connectivity and show the simulated output.

EXPERIMENT 2 **5 Hours**

Implement Cyclic Redundancy Check and Checksum algorithms to detect and correct errors while transferring files (.jpeg, .txt, .csv) over unreliable networks.

EXPERIMENT 3 **5 Hours**

Configure routers and switches to manage and optimize network traffic, ensuring reliable internet connectivity and efficient data flow for home or office networks and show the simulated output.

EXPERIMENT 4 **5 Hours**

Configure the network address using Address Resolution Protocol (ARP) to map IP addresses to MAC addresses in a college network, and Reverse ARP (RARP) to obtain their IP addresses from an available server and show the simulated output.

EXPERIMENT 5 **5 Hours**

Implement Distance Vector and Link State Routing algorithms to determine the most efficient path for data transmission across large corporate networks.

EXPERIMENT 6 **5 Hours**

Develop a real-time chat application that uses Transmission Control Protocol (TCP) for reliable, ordered communication and User Datagram Protocol (UDP) for faster, connectionless messaging.

Total: 45+30=75 Hours

REFERENCE(S)

1. Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2017.
2. James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005
3. Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009
4. Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008
5. William Stallings, Data and Computer Communication, Pearson Education, 2007
6. Douglas E.Comer and M.S.Narayanan, Computer Networks and Internets, Pearson Education, 2008

22IT503 INFORMATION CODING TECHNIQUES 3 1 0 4

Course Objectives

- Apply the concept of probability to model information and compress text
- Use the principles of differential coding to compress speech
- Exploit the three types of redundancies to design image compression algorithms
- Understand compression and decompression techniques.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the concept of probability to model information and compress text
2. Apply the principles of differential coding to compress speech
3. Analyze the techniques involved in the design of audio and video compression algorithms
4. Apply compression techniques to compress text and images
5. Design algorithms to ensure error-free communication/information retrieval

Articulation Matrix

CO No	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	2	2											2
2	2		2											2
3		2	2											2
4	1	2	2											1
5		2	2											2

UNIT I **9 Hours**

INFORMATION ENTROPY FUNDAMENTALS

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II **9 Hours**

DATA AND VOICE CODING

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III **9 Hours**

AUDIO AND VIDEO CODING

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

UNIT IV **9 Hours**

COMPRESSION TECHNIQUES

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V **9 Hours**

ERROR CONTROL CODING

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

Tutorial: 15 Hours

Total: 60 Hours

Reference(s)

1 Simon Haykin, Communication Systems, John Wiley and Sons, 4th Edition, 2014

2 Fred Halsall, Multimedia Communications, Applications Networks Protocols and Standards, Pearson Education, 2012

3 Mark Nelson, Data Compression Book, BPB Publication, 2010

4 Rafael C.Gonzalez and Richard E.Woods, Digital image processing, PHI, 2013

22IT504 INTERNET OF THINGS 2 0 2 3

Course Objectives

- Learn the IoT enabling technologies and understand the IoT reference architecture with realworld design constraints.
- Learn the working principle of IoT protocols with respect to various layers.
- Learn the programming concepts for microcontrollers and Raspberry Pi.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare the enabling technologies and communication models of internet of things.
2. Analyze the machine-to-machine communication model and IoT reference model for end to endcommunication.
3. Analyze the IoT protocols for various layers and apply for developing real time IoT applications
4. Develop applications using microcontrollers for addressing real world needs.
5. Develop applications for smart cities using Raspberry Pi.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													2
2	2	1	3											2
3	3	2	-											2
4	2	1	-											3
5	1	2	-											3

UNIT I **8 Hours**

INTRODUCTION TO INTERNET OF THINGS

Characteristics of IoT, Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems - Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates - Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.

UNIT II **5 Hours**

M2M AND IOT ARCHITECTURE

Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways, Local and Wide Area Networking, Data management, Everything as a Service, M2M and IoT Analytics, Knowledge Management - IoT Reference Model.

UNIT III **6 Hours**

IOT PROTOCOLS

PHY/MAC Layer: 3GPP MTC, IEEE 802.15 - WirelessHART- Z-Wave, BLE- Zigbee - DASH7 - Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP- DCCP- Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.

UNIT IV **5 Hours**

PROTOTYPING IOT OBJECTS USING MICROCONTROLLER

Introduction - Equivalent Microcontroller Platform - Setting up the Board - Programming for IoT - Reading from Sensors, Communication: Connecting Microcontroller with Mobile devices - Communication through Bluetooth, WiFi, and Ethernet.

UNIT V **6 Hours**

PROTOTYPING IOT OBJECTS USING RASPBERRY PI

Introduction to Raspberry Pi - About the board - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Interfacing external gadgets - Controlling Output, Reading Input from Pins. IoT Physical Servers & Cloud Offerings

EXPERIMENT 1 **5 Hours**

Write a code to measure and transmit the room temperature with date and time to the web server using Wi-Fi module.

EXPERIMENT 2 **5 Hours**

Implement the code for the detection of ethanol and carbon-dioxide in the air using Gas sensors.

EXPERIMENT 3 **4 Hours**

Create an Arduino software in pc to predict the obstacles using infrared sensors and measuring the distance between them.

EXPERIMENT 4 **4 Hours**

Created a simple local web server to display the location details and to find the speed of a moving object using an accelerometer sensor.

EXPERIMENT 5 **6 Hours**

Implement and set up Wi-Fi credentials on the Arduino to connect to the Raspberry Pi gateway for the Smart Home application.

EXPERIMENT 6 **6 Hours**

Create a dashboard to monitor all students details in one common link using of Pub Nub cloud server.

Total: 60 Hours

Reference(s)

1 Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2 Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, ISBN: 978-1-118-47347-4, Willy Publications.
3 Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
4 Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013.
5 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley, 2012.
6 CunoPfister, Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Kindle Edition.

22IT507 MINI PROJECT I 0 0 2 1

Course Objectives

- Identify the problem statement and apply the engineering concepts to find the solution.
- Improve the analyzing capability of the students.
- Increase the exuberance in finding the solution to various problems.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PSO1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications. PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, and techniques that contribute to obtaining the solution ofthe project.
4. Test and validate through conformance of the developed prototype and analysis of the cost effectiveness.
5. Prepare the report and present oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2			2	2	2			1	1
2	1	2	1	1	2			2	2	2			1	1
3	1	2	1	1	2			2	2	2	2		1	1
4	1	2	1	1	2			2	2	2	2		1	1
5	1	2			2			2	2	2			1	1

22IT601 DATA MINING AND WAREHOUSING 3 0 2 4

Course Objectives

- Gather and analyze large sets of data to gain useful business understanding
- Understand the data mining functionalities, technologies and steps in preprocessing the data
- Learn data mining algorithms, methods and tools

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO12 Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Design data warehouse by applying principles of dimensional modelling and ETL concepts
2. Analyze various data pre-processing techniques for efficient data mining.
3. Apply association rule mining for finding hidden and interesting patterns in data.
4. Apply statistical procedure, machine learning and neural network-based classification algorithms for data prediction
5. Apply clustering algorithms for the application and generalizations for real time problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		3		2								1	
2			2		3	2						1	1	
3	1		3		2								2	
4	1		3		2	2						1	1	
5	1		3		2	2						1	1	

UNIT I **9 Hours**

INTRODUCTION TO DATA WAREHOUSING

Raw data to valuable information-Lifecycle of Data - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Basic elements of data warehousing - Principles of dimensional modeling: Star schema, Snowflake schema and Galaxy schema.

UNIT II **9 Hours**

INTRODUCTION TO DATA MINING

Introduction to Data Mining Systems, Knowledge Discovery Process -Data Objects and attribute types, Statistical description of data, Data Preprocessing- Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT III **9 Hours**

ASSOCIATION RULE MINING

Market Basket Analysis, Frequent Item sets, Closed Itemsets, Association Rules, Frequent Itemset Mining Methods- Apriori algorithm, Generating Association rules from Frequent Itemsets, A Pattern-Growth Approach for mining frequent Itemsets, Mining Frequent Itemsets using the Vertical Data Format.

UNIT IV **9 Hours**

CLASSIFICATION

Classification and Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Lazy learners.

UNIT V **9 Hours**

CLUSTERING

Types of Data in Cluster Analysis, Data similarity and dissimilarity measures, Categorization of Major Clustering Methods -Partitioning Methods-K-means, K-medoids, Hierarchical Methods-Agglomerative vs Divisive - Outlier Analysis and Detection.

EXPERIMENT 1 **4 Hours**

Creation of a Data Warehouse

EXPERIMENT 2 **4 Hours**

Apriori Algorithm for market Basket Analysis

EXPERIMENT 3 **4 Hours**

Frequent Pattern-Growth Algorithm

EXPERIMENT 4 **4 Hours**

Bayesian Classification

EXPERIMENT 5 **4 Hours**

Decision Tree Induction Algorithm

EXPERIMENT 6 **5 Hours**

K-means clustering algorithm

EXPERIMENT 7 **5 Hours**

Hierarchical clustering algorithm

Total: 75 Hours

Reference(s)

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques,Third Edition, Elsevier, 2012.
2. Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2010.
3. Alex Berson, Stephen J Smith, Data warehousing, Data mining, and OLAP, Tata McGraw Hill edition, 2007.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Introduction to Data Mining, Pearson Education, 2007.
5. G. K. Gupta ,Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.

22IT602 PRINCIPLES OF COMPILER DESIGN 3 1 0 4

Course Objectives

- Understand the principles, algorithms, and data structures involved in the design and construction of compilers
- Acquire knowledge in construction of scanners, parsers and in intermediate code generation
- Familiar with the code generation schemes and optimization methods.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the role of each phase of a compiler and the compiler construction tools
2. Construct Finite automata to recognize regular language
3. Construct Parser to recognize Context Free Grammar
4. Generate intermediate code for programming constructs
5. Apply optimization techniques in code generation and analyze the issues in code generation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2										1	
2	2	1	2										1	
3	1		2										2	
4	1		2										1	
5	1		2										2	

UNIT I **8 Hours**

INTRODUCTION TO FORMAL LANGUAGES AND COMPILERS

Formal Language – Elements of Language - Formal Grammar – Chomsky Classification. Compilers: Language Processors – Structure of a Compiler - Grouping of Phases into Passes - Compiler Construction Tools.

UNIT II **9 Hours**

LEXICAL ANALYSIS

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Specification of tokens - Recognition of Tokens. Finite automata - Regular expression to finite automata- Optimization of DFA based Pattern Matches-Lexical Analyzer Generator Lex.

UNIT II **11 Hours**

SYNTAX ANALYSIS

Introduction-Role of the parser - Context-Free Grammars -Writing a Grammar-Top Down parsing - LL(1) Grammars- Non-recursive Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing-LR Parsers: Simple LR Parser - Canonical LR Parser - LALR Parser – Parser Generator YACC.

UNIT IV **8 Hours**

INTERMEDIATE CODE GENERATION

Variants of Syntax Trees- Three-Address Code - Types and Declarations - Translation of Expressions - Control Flow - Switch-Statements - Backpatching

UNIT V **9 Hours**

CODE GENERATION

Issues in the Design of a Code Generator - The Target Language - Basic Blocks and Flow Graphs- Optimization of Basic Blocks - A Simple Code Generator- Principal Sources of Optimization.

Tutorial:15 Hours

Total: 60 Hours

REFERENCES

1. Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman Compilers: Principles, Techniques and Tools, 2nd Edition, Pearson, 2012.
2. Torbengidius Mogensen, “Basics of Compiler Design”, Springer, 2011.
3. Charles N, Ron K Cytron, Richard J LeBlanc Jr., “Crafting a Complier”, Pearson Education, 2010
4. D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, Modern Compiler Design, Wiley, 2008
5. Kennath C. Louden, Compiler Construction Principles and Practice. New Delhi: Vikas publishing House, 2006.
6. Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2007.

22IT603 CLOUD COMPUTING 3 0 2 4

Course Objectives

- Provide the ideal solution to manage enterprise resources effectively and efficiently by cloud computing.
- Identify the security and privacy issues in cloud computing.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO12 Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Undersrand the concept of virtualization in Cloud Computing.
2. Deploy applications over different Cloud computing infrastructures.
3. Implement Cloud Dockers to automate the deployment of applications.
4. Analyze the security and privacy issues in cloud computing.
5. Implement the cloud applications to solve real time problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3					1			2	2	
2			1	3	2							2	1	
3			2	1	3							2	2	
4	1		2	1	3				1			2	2	
5	1		3		2				1			2	3	

UNIT 1 **9 Hours**

INTRODUCTION

Introduction to Cloud Computing –Characteristics and Benefits of Cloud Computing- Hardware and software - Evolution of cloud computing - Server virtualization: parallel and vector processing.

UNIT II **9 Hours**

CLOUD SERVICE MODELS

Software as a Service (SaaS) - Infrastructure as a Service (IaaS)- Platform as a Service (PaaS) - Cloud Data Center - Service Oriented Architecture (SoA) – Basic approach to a Data center Based SoA.

UNIT III **9 Hours**

CLOUD DOCKER

Introduction – Docker Architecture –Docker Engine - Docker Containers - Docker Objects – Docker Run - Pipeline – Automation Scripts.

UNIT IV **9 Hours**

CLOUD SECURITY

Securing cloud boundary – Service boundary – Security mapping – Brokered cloud storage access - Storage location and tenancy – Encryption – Establishing the Identity and Presence.

UNIT V **9 Hours**

CLOUD APPLICATIONS AND STORAGE

Applications in the cloud – Functionality mapping – Applications attributes – Cloud APIs-Cloud storage definition – Managed and Unmanaged cloud storage – Exploring cloud backup solutions – Cloud storage interoperability.

EXPERIMENT 1 **4 Hours**

Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows

EXPERIMENT 2 **4 Hours**

Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

EXPERIMENT 3 **4 Hours**

Implement the procedure to transfer the files from one virtual machine to another virtual machine for reliable data access with the help of any open stack virtual machine

EXPERIMENT 4 **4 Hours**

Install the single node private cloud environment to resource allocation

EXPERIMENT 5 **4 Hours**

Implement the procedure to create and deploy a simple web application in public cloud environment

EXPERIMENT 6 **4 Hours**

Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim

EXPERIMENT 7 **3 Hours**

Create and Deploy applications on Microsoft Windows Azure

EXPERIMENT 8 **3 Hours**

Install Hadoop single node cluster and run simple applications like word count.

Total: 75 Hours

Reference(s):

1. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.
2. Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014.
3. Adrian Mouat — Using Docker: Developing and Deploying software with containers,O'Reilly Media,2016.
4. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009., CRC Press, 2017
5. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.

22IT607 MINI PROJECT II 0 0 2 1

Course Objectives

- Identify the problem statement and apply the engineering concepts to find the solution.
- Improve the analyzing capability of the students.
- Increase the exuberance in finding the solution to various problems.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes thatmeet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communicate effectively on complex engineering activities with the engineering community andwith society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learningalgorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies
3. Utilize the new tools, algorithms, and techniques that contribute to obtaining the solution oftheproject.
4. Test and validate through conformance of the developed prototype and analysis of the costeffectiveness.
5. Prepare the report and present oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2			2	2	2			1	1
2	1	2	1	1	2			2	2	2			1	1
3	1	2	1	1	2			2	2	2	2		1	1
4	1	2	1	1	2			2	2	2	2		1	1
5	1	2			2			2	2	2			1	1

22IT701 CRYPTOGRAPHY AND INFORMATION SECURITY 3 0 0 3

Course Objectives

- Understand information security's importance in our data-driven digital world.
- Acquire the knowledge of key concepts of information security and how they work.
- analyze situations of computer and network usage from a security perspective, identifying the salient issues, technologies, policies, laws, standards, and practices.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Understand the information security concepts.
2 Analyze the standards and practices involved in security policies.
3 Apply the security technologies to segregate the organizations systems from the insecure Internet.
4 Analyze the concepts behind traditional symmetric encryption systems with modern asymmetric encryption systems.
5 Analyze the key laws, policies, standards and practices in the field of information security

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	2								1	
2	2	2	2	3	3								2	
3	2	1	1	2	1					-			2	
4	1	2	2	3	3								2	
5	1	2	2	3	3								3	

UNIT I **9 Hours**

INTRODUCTION TO INFORMATION SECURITY

The History of Information Security-Key Information Security Concepts-The Security Systems Development Life Cycle- Security Professionals and the Organization- Need for Security.

UNIT II **9 Hours**

INFORMATION SECURITY POLICY, STANDARDS AND PRACTICES

Information Security Planning and Governance - Information Security Policy, Standards, and Practices – The Information Security Blueprint -Security Education, Training, and Awareness Program – Continuity Strategies.

UNIT III **9 Hours**

SECURITY TECHNOLOGIES

Introduction-Access Control, Identification, Authentication, Authorization and Accountability-Firewalls Virtual Private Networks (VPNs)- Intrusion Detection and Prevention Systems - Scanning and Analysis Tools- Biometric Access Controls.

UNIT IV **9 Hours**

CRYPTOGRAPHY

Foundations of Cryptology-Cipher Methods-Cryptographic Algorithms-Cryptographic Tools-Protocols for Secure Communications-Attacks on Cryptosystems.

UNIT V **9 Hours**

LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY

Law and Ethics in Information Security - General Computer Crime Laws - International Laws and Legal Bodies - Agreement on Trade-Related Aspects of Intellectual Property Rights - Digital Millennium Copyright Act (DMCA) - Ethics and Information Security-Codes of Ethics and Professional Organizations.

Total: 45 Hours

Reference(s)

1. Michael E Whitman, Herbert J Mattord , Principles of Information Security ,Sixth Edition, Cengage Learning,2017.
2. Mark Stamp, Information Security: Principles and Practices, Wiley, Second edition,2011
3. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India/Pearson Education, New Delhi, 2007.
4. Charles B.fleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson Education, 2014.
5. Dieter Gollmann, Computer Security, John Wiley & Sons Ltd., 2011.
6. SunitBelapure and Nina Godbole, Cyber Security, Wiley, 2011

22IT702 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 3 0 2 4

Course Objectives

- Impart artificial intelligence principles, techniques and its history
- Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems
- Develop intelligent systems by assembling solutions to concrete computational problems

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO1. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1 Understand Artificial Intelligence (AI) methods and their foundations.
2 Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
3 Apply knowledge of reasoning and knowledge representation for solving real world problems
4 Analyze the role of learning algorithms in problem solving
5 Analyze the construction of learning and expert systems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3											1	
2	2	3	3										2	
3	2	3	3										2	
4	2	3	3	3									3	
5	2	2	3	3									3	

UNIT I **9 Hours**

ARTIFICIAL INTELLIGENCE AND ITS ISSUES

Definitions - Importance of AI, Evolution of AI - Applications of AI, Classification of AI systems with respect to environment, Knowledge Inferring systems and Planning, Uncertainty and towards Learning Systems.

UNIT II **9 Hours**

OVERVIEW TO PROBLEM SOLVING AND HEURISTIC APPROACH

Problem solving by Search - Problem space - State space - Performance Measurement - Game playing mini-max algorithm, Alpha-Beta Pruning - Search Algorithms - Breadth-first search - Depth-first search, A* search - The effect of heuristic accuracy on performance - Generating heuristics from relaxed problems - Local Search and Optimization Problem - Hill-climbing search - Constraint Satisfaction Problem - Variations on the CSP formalism.

UNIT III **9 Hours**

KNOWLEDGE REPRESENTATION, UNCERTAINTY AND KNOWLEDGE REASONING

Logical systems Knowledge Based systems - Propositional Logic Constraints - Predicate Logic First Order Logic - Inference in First Order Logic - Ontological Representations and applications -Overview Definition of uncertainty - Bayes Rule Inference - Belief Network - Decision Network.

UNIT IV **9 Hours**

LEARNING SYSTEMS

Knowledge in learning: Explanation based learning - Forms of Learning Types - Supervised, Unsupervised, Learning Decision Trees - Statistical learning methods: Instance based learning - Neural Network - Reinforcement learning: Passive and active communication: Formal grammar - Augmented Grammars - Future of AI.

UNIT V **9 Hours**

EXPERT SYSTEMS AND GAMES

Expert Systems - Stages in the development of an Expert System - Probability based Expert Systems - Expert System Tools - Difficulties in Developing Expert Systems - Applications of Expert Systems - Game theory, classification of games, game playing strategies, prisoner s Dilemma, Game playing techniques.

EXPERIMENT 1 **5 Hours**

Data pre-processing, annotation and creation of datasets using various AI tools

EXPERIMENT 2 **5 Hours**

Implementation of Breadth First and Depth First searching techniques

EXPERIMENT 3 **5 Hours**

Implementation of Hill Climbing algorithm and A* algorithm

EXPERIMENT 4 **5 Hours**

Designing a chat-bot application

EXPERIMENT 5 **5 Hours**

Implementation of Inference system

EXPERIMENT 6 **5 Hours**

Implementation of n-Queens problem where n>=1 to n<=9

Total: 45 + 30 = 75 Hours

Reference(s)

1 Russell, S. and Norvig, P, Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall,2015.
2 Poole, D. and Mackworth, A, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press,2010
3 Ric, E., Knight, K and Shankar, B, Artificial Intelligence, 3rd edition, Tata McGraw Hill,2009
4 Luger, G.F, Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson,2008.
5 Padhy, N.P, Artificial Intelligence and Intelligent Systems, Oxford University Press,2009.
6 David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010

22IT707 PROJECT WORK I 0 0 4 2

Course Objectives

- Work in teams to propose, formulate, and solve a challenging open-ended design problem ofsignificant scope, depth, and breadth.
- Understand and incorporate engineering standards and multiple realistic constraints, withinrealistic design time, budget, and performance objectives.
- Develop a prototype of the proposed design and demonstrate the prototype in accordance withthe specifications.
- Effectively communicate information relating to all aspects of the design process in written,oral, and graphical form.

Programme Outcomes (POs)

PO1 Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the costeffectiveness.
5. Prepare report and present the oral demonstrations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	3	1	3	3	3	3	3		2	3	3
2	2	2	3	3	1	3	3	3	3	3		2	3	3
3	2	2	3	3	3	3	3	3	3	3	3	2	3	3
4	2	2	3	3	3	3	3	3	3	3	3	2	3	3
5	2	2			2			3	3	3		2	3	3

22HS201 COMMUNICATIVE ENGLISH II 1 0 2 2

Course Objectives

- Command over the English language for day-to-day transactions.
- Improve listening and reading skills
- Enhance confidence in expressing with clarity and elegance

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Engage with the English language in functional contexts
2. Express in both descriptive and narrative formats
3. Understand and make effective use of the English Language in Business contexts
4. Actively read and comprehend authentic text
5. Express opinions and communicate experiences.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3		3	1	1
2									3	3		3	1	1
3									3	3		3	1	1
4									3	3		3	1	1
5									3	3		3	1	1

UNIT I **15 Hours**

SELF-EXPRESSIONRESSION

Personal Goals and Values - Being a Team Player-Expressing strengths and weaknesses-Abstract nouns -Adjectives-Active Listening skills-Note making-Pronunciation and Accent
Personal goals and values - Reading for Gist and Details-Professional ethics-Reported Speech-Conjunctions Reading skills - phonemics, word/phrase recognition, sight words
Personal Goals and Values-Conditional clauses- Hypothetical questions and answers-Sentence Structure-Simple Present Tense-Perfect tense

UNIT II **15 Hours**

CREATIVE EXPRESSION

Instructive and Expository Expression - Creating brochures, catalogues, and manuals for products/ services, Giving directions, Process writing, Sequencing experiments, Concept explanation-Reported speech-Voice Sentence equivalence-Proofreading

UNIT III **15 Hours**

FORMAL EXPRESSION

Notices and Announcements-Writing: Creating notices and circulars for events, announcing college tours and lost and found-Varied Vocabulary - Gender Sensitive Vocabulary, Non-discriminatory Vocabulary, Concise Vocabulary-Paragraph writing - Effective titles, topics and supporting sentences, calling in registrations and queries. Effective communication- Understanding purpose, reach and target audience, achieving complete communication Punctuation - Capitalization, Numeration, Use of proper nouns and articles-Spelling-Reading: Analyzing and interpreting notices and circulars-Understanding the gist of short real-world notices, and messages. Culling out keywords Information words vs Supporting Words-Interpreting Abbreviations, Acronyms and Short-forms-Listening: Analyzing and interpreting announcements Decoding - Screening for salient points-Note Making-Raising queries for clarification-Speaking: Announcements-Giving complete information-Pronunciation and Enunciation Pace, Intonation, and Pitch-Conducting Events-Speaking: Master of ceremonies, short speeches - welcome speech, the vote of thanks/ valedictory speech, award-acceptance speech Writing: Invitations, Preparation of script/draft after interviewing someone. Adjectives-Pronunciation/ Punctuation Precision and Concision-Politeness markers

Total:15+30= 45 Hours

Reference(s)

1. Sasikumar, V, et.al. A Course in Listening & Speaking FoundationBooks, 2005.
2. Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students: with Answers. Cambridge: Cambridge University Press, 1985.
3. Prasad, Hari Mohan. A Handbook of Spotting Errors. Mcgraw Hill Education, 2010.
4. Reynolds, John. Cambridge First Language English. 2018th ed., Hodder Education, 2018.
5. Wiggins, Grant P., and Jay McTighe. Understanding by Design. Association for Supervision and Curriculum Development, 2008.

22HSH01 **HINDI** **1 0 2 2**

Course Objectives

- To help students acquire the basics of Hindi
- To teach them how to converse in Hindi on simple day- to -day situations
- To help students understand a simple technical text in Hindi

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. Construct simple sentences and use vocabulary required for day- to -day conversation.
2. Distinguish and understand the basic sounds of Hindi language.
3. Apply appropriate grammar to write and speak in Hindi language
4. Comprehend the conversation and give correct meaning
5. Take up Hindi examinations conducted by Dakshin Bharat Hindi Prachar Sabha

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I **9 Hours**

VOWELS AND CONSONANTS

Hindi Alphabet: Introduction (Self introduction) - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu & Visarg -Table of Alphabet -Vocabulary.

UNIT II **9 Hours**

NOUNS

Nouns: Genders -Masculine & Feminine -Reading Exercises

UNIT III **9 Hours**

PRONOUNS AND TENSES

Pronouns and Tenses - Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

UNIT IV **9 Hours**

CLASSIFIED VOCABULARY

Classified Vocabulary: Parts of body -Relatives Spices Eatables -Fruit & Vegetables -Clothes -Directions -Seasons Professions.

UNIT V **9 Hours**

CONVERSATIONS

Speaking -Telling the times -Saying the Numbers from 1 to 50 Speaking practice for various occasions.

Total: 15+30= 45 Hours

Reference(s)

1. B.R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi, 2009.
2. Hindi Prachar Vahini - 1
3. Videos, Stories, Rhymes and Songs.

22HSG01 **GERMAN** **1 0 2 2**

Course Objectives

- To help students appear for the A1 level Examination
- To teach them how to converse fluently in German in day-to-day scenarios

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. Listen and identify individual sounds of German
2. use basic phonemes and words while speaking
3. read and understand short passages on familiar topics
4. use basic sentence structures while writing
5. understand basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I **9 Hours**

INTRODUCTION

Introduction to the German language-Alphabets-Numbers Greetings -Days and Seasons-Working with Dictionary.

UNIT II **9 Hours**

LANGUAGE AND ITS COMMON USE

Nouns -articles-Speaking about oneself-Listening to CD supplied with books-paying special attention to pronunciation

UNIT III **9 Hours**

TECHNICAL DEUTSCHE

Regular &Irregular verbs -Personal pronouns-family-Introduction to types of sentences

UNIT IV **9 Hours**

INTERROGATION

Question words -Types of Questions -Nominative case-Verb Conjugation -country -nationalities

UNIT V **9 Hours**

IMPLEMENTATION

Verbs to be & to have -conjugation -Hobbies -Framing basic Questions and answers

Total: 15+30= 45 Hours

Reference(s)

1. Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALS FREMDSPRACHE, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2015.
2. Langenscheidt Eurodictionary, German English / English German, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009.
3. Grundkurs, DEUTSCH Lehrbuch Hueber Munichen, 2007.

22HSJ01 **JAPANESE** **1 0 2 2**

Course Objectives

- To train students for N5 Level Examination
- To teach them use basic Japanese sentences in day-to-day conversation
- To make students familiar with the Japanese cultural facets and social etiquette

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. Recognize and write Japanese alphabet
2. Speak using basic sounds of the Japanese language
3. Apply appropriate vocabulary needed for simple conversation in Japanese language
4. Apply appropriate grammar to write and speak in Japanese language
5. Comprehend the conversation and give correct meaning

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3				

UNIT I **9 Hours**

SELF INTRODUCTION / DEMONSTRATIVES / NOUN MODIFIERS

Introduction to Japanese Japanese script - Pronunciation of Japanese(Hiragana (Katakana) Long vowels - Pronunciation of in,tsu,ga -Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. Speaking: Self Introduction - Listening: Listening to Greetings, Listening to specific information: Numbers, Time

UNIT II **9 Hours**

TIME EXPRESSION / VERBS - PAST

Introduction to time -Introduction of verbs -Listening to specific information

UNIT III **9 Hours**

ADJECTIVES

Word Sentence -Introduction to Adjectives -Technical Japanese Vocabulary -Pair Activity Day to day situational conversation
Listening to Japanese Alphabet Pronunciation -Simple Conversation

UNIT IV **9 Hours**

CONJUGATION OF II ADJECTIVE

Past tense of Noun sentences and Na adjective sentences -Past tense of ii adjective sentences -houga adjective desu -Technical Japanese Vocabulary -Individual Activity - Listening to conversation with related particles

UNIT V **9 Hours**

CONJUGATION OF VERBS - TE FORM / TA FORM / NAI FORM / PLAIN FORM

N gahoshidesu - V masu form tai desu - Verb te form - Technical Japanese Vocabulary -Listening to different Counters, simple conversations with verbs and adjectives

Total: 15+30= 45 Hours

Reference(s)

1. Minna no Nihongo Japanese for Everyone Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. Minna no Nihongo Japanese for Everyone Elementary Main Textbook 1-2 Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

22HSF01 **FRENCH** **1 0 2 2**

Course Objectives

- To prepare the students for DELF A1 Examination
- To teach them to converse fluently in French in day-to-day scenarios

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. Help students acquire familiarity in the French alphabet & basic vocabulary
2. Listen and identify individual sounds of French
3. Use basic sounds and words while speaking
4. Read and understand short passages on familiar topics
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									3	3				
2									3	3				
3									3	3				
4									3	3				
5									3	3		-		

UNIT I **9 Hours**

ENTRER EN CONTACT

La langue franÃƒÂ§aise, alphabets, les numÃƒÂ©ros, les jours, les mois. Grammaire Les verbes s appeler, etre, avoir, les articles definis, indefinis Communication Saluer, s informer sur quelqu un, demander de se presenter Lexique L alphabet, les nationalites, l age, les pays, les couleurs, les jours de la semaine, les mois de l annee, les professions

UNIT II **9 Hours**

PARTAGER SON LIEU DE VIE

Les francais et leur habitat, des habitations insolites -Grammaire Verbes Conjugaison Present (Avoir / Etre / ER, IR, RE Regulier et Irregulier) Adjectifs les propositions de lieu Communication Chercher un logement, decrire son voisin, s informer sur un logement - Lexique L habitat, les pieces, l equipement, la description physique

UNIT III **9 Hours**

VIVRE AU QUOTIDIEN LES LOISIRS DES FRANCAIS, LES GOUTS DES AUTRES, LES ACTIVITES QUOTIDIENNES

Grammaire Articles contractes, verbes vouloir, pouvoir, devoir, adjectifs interrogatifs, future proche Communication Exprimer ses gouts, parler de ses loisirs, justifier un choix, exprimer une envie - Lexique le temps libre et les loisirs, les saisons, les activites quotidiennes, le temps (le matin, le soir, la nuit)

UNIT IV **9 Hours**

COMPRENDRE SON ENVIRONNEMENT SOUVRIR A LA CULTURE

Grammaire Verbes Finir, Sortir, les adjectifs demonstratifs, le passe compose, l imparfait Communication Propose a quelqu un de faire quelque chose, raconter une sortie au passe, parler d un film Lexique Les sorties, la famille, l art, les vetements et les accessoires

UNIT V **9 Hours**

GOUTER A LA CAMPAGNE

Grammaire La forme negative, les verbes acheter, manger, payer, articles partitifs, le pronom en de quantite

Communication Accepter et refuser une invitation, donner des instructions, commander au restaurant Lexique Les services et les commerces, les aliments, les ustensiles, l argent

Total: 15+30= 45 Hours

Reference(s)

1. Grammaire Progressive du Francais, CLE International, 2010
2. Saison1, Marie Noelle Cocton et al, Didier, 2014.
3. Preparation a l examen du DELF A1 Hachette
4. Reussir le DELF A1 Bruno Girardeau
5. Website: Francais Linguaphone Linguaphone Institute Ltd., London, 2000.
6. Francais Harrisonburg : The Rosetta Stone : Fairfield Language Technologies, 2001

22IT001 EXPLORATORY DATA ANALYSIS 2 0 2 3

Course Objectives

- Outline an overview of exploratory data analysis
- Implement data cleaning and preparation techniques
- Perform descriptive statistics and data visualization techniques to present insights from the data
- Apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- Use dimensionality reduction techniques for simplifying complex datasets and visualize high-dimensional data

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the fundamentals of exploratory data analysis
2. Implement the data cleaning and preparation techniques
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3								2	3
2	2	2	2	3	3								2	2
3	2	3	2	2	3								3	2
4	2	2	2	2	3								2	2
5	2	2	3	2	1								2	3

UNIT I **6 Hours**

EXPLORATORY DATA ANALYSIS

Overview of Exploratory Data Analysis- importance of EDA - data analysis process: data collection, data cleaning, and data exploration- Introduction to common data types and formats - Introduction to Python - data analysis libraries

UNIT II **6 Hours**

DATA CLEANING AND PREPARATION

Introduction to data quality issues and common data cleaning techniques - Handling missing data and outliers - Data transformation techniques - Feature engineering and variable creation

UNIT III **6 Hours**

DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Descriptive statistics: measures of central tendency, dispersion, and shape - Data visualization principles and best practices - Exploratory data visualization using Matplotlib and Seaborn

UNIT IV **6 Hours**

EXPLORATORY DATA ANALYSIS TECHNIQUES

Univariate analysis: exploring single variables - Bivariate analysis: exploring relationships between variables - Multivariate analysis: analyzing relationships among multiple variables - Exploring time series data.

UNIT V **6 Hours**

DIMENSIONALITY REDUCTION TECHNIQUES

Introduction to dimensionality reduction - Principal Component Analysis (PCA) and its applications - Distributed Stochastic Neighbor Embedding (t-SNE) for visualization

EXPERIMENT 1 **6 Hours**

Apply the data preprocessing methods on the given Sstudent test performance dataset and visualize the results.

EXPERIMENT 2 **6 Hours**

Perform univariate analysis to analyze the distribution of each variable in student's exam results dataset and visualize the results

EXPERIMENT 3 **6 Hours**

Visualize the relationship between the features on students' exam results analysis dataset using bivariate analysis

EXPERIMENT 4 **6 Hours**

Visualize the relationship between the features on students' exam results analysis dataset using multivariate analysis.

EXPERIMENT 5 **6 Hours**

Implement the program to reduce the dimensionality of the MNIST dataset and visualize the reduced data using a scatter plot.

Total: 60 Hours

Reference(s)

1. Provost Foster and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking O Reilly Media Inc. 2013. (Unit 1)
2. McKinney Wes Python for Data Analysis O Reilly Media Inc 2022 Unit 1 3 5
3. Knaflic Cole Nussbaumer Storytelling with data A data visualization guide for business professionals John Wiley & Sons 2015 (Unit 2)
4. Kazil Jacqueline and Katharine Jarmul Data wrangling with python tips and tools to make your life easier O Rilly Media Inc 2016 (Unit 3)
5. Wickham Hadley and Garrett Grolemund R for data science import tidy transform visualize and model data O Reilly Media Inc 2016 (Unit 4, 5)
6. Matthew O Ward Georges Grinstein, Daniel Keim Interactive Data Visualization Foundations Techniques and Applications 2nd Edition CRC press 2015

22IT002 RECOMMENDER SYSTEMS 3 0 0 3

Course Objectives

- Understand the foundations of the recommender system.
- Learn the significance of machine learning and data mining algorithms for Recommender systems
- Learn about collaborative filtering
- Design and implement a recommender system.
- Learn collaborative filtering.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics
4. Implement a simple recommender system.
5. Analyze evaluating Paradigms of recommender systems and its applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1									2
2	1	2	1	1	1									2
3	2	3	1	1	1									3
4	3	2	2	2	1									2
5	2	2	1	2	1									2

UNIT I **9 Hours**

INTRODUCTION

Introduction and basic taxonomy of recommender systems Traditional and non-personalized Recommender Systems Overview of data mining methods for recommender systems similarity measures Dimensionality reduction Singular Value Decomposition SVD

UNIT II **9 Hours**

CONTENT-BASED RECOMMENDATION SYSTEMS

High-level architecture of content-based systems Item profiles Representing item profiles Methods for learning user profiles Similarity-based retrieval and Classification algorithms.

UNIT III **9 Hours**

COLLABORATIVE FILTERING

A systematic approach Nearest-neighbor collaborative filtering (CF) user-based and item-based CF components of neighborhood methods (rating normalization similarity weight computation and neighborhood selection

UNIT IV **9 Hours**

ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction Types of Attacks Detecting attacks on recommender systems Individual attack Group attack Strategies for robust recommender design Robust recommendation algorithms.

UNIT V **9 Hours**

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms User Studies Online and Offline evaluation Goals of evaluation design Design Issues Accuracy metrics Limitations of Evaluation measures

Total: 45 Hours

Reference(s)

1. Charu C Aggarwal Recommender Systems The Textbook Springer 2016
2. Dietmar Jannach Markus Zanker Alexander Felfernig and Gerhard Friedrich Recommender Systems An Introduction Cambridge University Press (2011) 1st ed.
3. Francesco Ricci Lior Rokach Bracha Shapira Recommender Systems Handbook 1st ed Springer (2011)
4. Jure Leskovec Anand Rajaraman Jeffrey David Ullman Mining of massive datasets 3rd edition Cambridge University Press 2020

22IT003 BIG DATA ANALYTICS 3 0 0 3

Course Objectives

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in MapReduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1 Understand the big data and use cases for business domains
2 Analyze the NoSQL databases and its related concepts.
3 Apply Map reduce workflows for web applications.
4 Analyze the basic concepts of Hadoop.
5 Apply Hadoop related tools for Big Data Analytics.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								2	2
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								1	3

UNIT I **9 Hours**

INTRODUCTION TO BIG DATA

Introduction to big data Convergence of key trends Unstructured data Industry examples of big data Web analytics Big data applications Big data technologies Introduction to Hadoop Open source technologies Cloud and big data Mobile business intelligence Crowd sourcing analytics Inter and trans firewall analytics.

UNIT II **9 Hours**

NOSQL DATA MANAGEMENT

Introduction to NoSQL Aggregate data models Key value and document data models Relationships Graph databases Schema less databases Materialized views Distribution models Master-slave replication Consistency Cassandra Cassandra data model Cassandra examples Cassandra clients

UNIT III **9 Hours**

MAP REDUCE APPLICATIONS

MapReduce workflows Unit tests with MRUnit Test data and local tests Anatomy of MapReduce job run Classic Map reduce YARN Failures in classic Map-reduce and YARN Job scheduling Shuffle and sort Task execution MapReduce types Input formats Output formats

UNIT IV **9 Hours**

BASICS OF HADOOP

Data format Analyzing data with Hadoop Scaling out Hadoop streaming Hadoop pipes Design of Hadoop distributed file system (HDFS) HDFS concepts Java interface Data flow Hadoop I/O Data integrity Compression Serialization Avro File based data structures Cassandra Hadoop integration.

UNIT V **9 Hours**

HADOOP RELATED TOOLS

Hbase Data model and implementations Hbase clients Hbase examples Praxis. Pig Grunt Pig data model Pig Latin Developing and testing Pig Latin scripts. Hive Data types and file formats HiveQL data definition HiveQL data manipulation HiveQL queries.

Total: 45 Hours

Reference(s)

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today"s Businesses", Wiley,2013
2. Eric Sammer, "Hadoop Operations", O"Reilley, 2012.
3. Sadalage Pramod J. NoSQL distilled 2013
4. E. Capriolo D. Wampler and J. Rutherglen Programming Hive O Reilley 2012.
5. Lars George HBase The Definitive Guide O Reilley 2011
6. Eben Hewitt Cassandra The Definitive Guide O Reilley 2010.

22IT004 NEURAL NETWORKS AND DEEP LEARNING

2 0 2 3

Course Objectives

- Understand the major concepts in deep neural networks.
- Apply Convolutional Neural Network architectures for any real-life applications
- Analyze the key computations underlying deep learning to build and train deep neural networks for various tasks.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Understand the basic concepts of neural networks.
2 Analyze the categories of associative memory and unsupervised learning networks.
3 Apply Convolutional Neural Networks and its variants for web and mobile applications.
4 Build and train the deep learning neural network models.
5 Apply autoencoders and generative models for given application.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **6 Hours**

INTRODUCTION TO NEURAL NETWORKS

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II **6 Hours**

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III **6 Hours**

THIRD-GENERATION NEURAL NETWORKS

Spiking Neural Networks-Convolutional Neural Networks Deep Learning Neural Networks-Extreme Learning Machine Model Convolutional Neural Networks The Convolution Operation Mo ivation Pooling Variants of the basic Convolution Function Structured Outputs Data Types Efficient Convolution Algorithms Neuroscientific Basis Applications Computer Vision Image Generation Image Compression

UNIT IV **6 Hours**

DEEP FEEDFORWARD NETWORKS

History of Deep Learning A Probabilistic Theory of Deep Learning Gradient Learning Chain Rule and Backpropagation Regularization Dataset Augmentation Noise Robustness Early Stopping Bagging and Dropout batch normalization VC Dimension and Neural Nets

UNIT V **6 Hours**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks Introduction Recursive Neural Networks Bidirectional RNNs Deep Recurrent Networks Applications Image Generation Image Compression Natural Language Processing Complete Auto encoder Regularized Autoencoder Stochastic Encoders and Decoders Contractive Encoders

Total: 30 Hours

EXPERIMENT 1 **3 Hours**

Implement simple vector addition in TensorFlow.

EXPERIMENT 2 **3 Hours**

Implement a regression model in Keras.

EXPERIMENT 3 **3 Hours**

Implement a perceptron in TensorFlow/Keras Environment.

EXPERIMENT 4 **3 Hours**

Implement a Feed-Forward Network in TensorFlow/Keras.

EXPERIMENT 5 **3 Hours**

Implement an Image Classifier using CNN in TensorFlow/Keras.

EXPERIMENT 6 **3 Hours**

Improve the Deep learning model by fine tuning hyperparameters.

EXPERIMENT 7 **3 Hours**

Implement a Transfer Learning concept in Image Classification.

EXPERIMENT 8 **3 Hours**

Using a pre trained model on Keras for Transfer Learning

EXPERIMENT 9 **3 Hours**

Perform Sentiment Analysis using RNN

EXPERIMENT 10 **3 Hours**

Implement an LSTM based Autoencoder in TensorFlow/Keras.

Total: 60 Hours

Reference(s)

1. S Rajasekaran, G A Vijayalakshmi Pai, Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications, PHI Learning, 2017
2. Charu C. Aggarwal, Neural Networks and Deep Learning A Textbook, Springer International Publishing, 1st Edition, 2018
3. James A Freeman, David M S Kapura, Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016
5. Francois Chollet, Deep Learning with Python, Second Edition, Manning Publications, 2021
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

22IT005 NATURAL LANGUAGE PROCESSING 2 0 2 3

Course Objectives

- Understand the fundamental concepts for natural language processing and automatic speech recognition
- Understand technologies involved in developing speech and language applications.
- Demonstrate the use of deep learning for building applications in speech and natural language processing

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in natural language processing.
2. Implement basic and some advanced text processing and feature representation techniques
3. Implement, and evaluate advanced NLP applications, including sentiment classification, named entity recognition, text summarization, machine translation, and modern deep learning models.
4. Apply fundamental principles of speech production and perception and analyze speech signals.
5. Design automatic speech recognition systems and develop applications for speaker recognition

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **6 Hours**

INTRODUCTION TO NATURAL LANGUAGE PROCESSING

Overview of NLP - Introduction to Levels of NLP - Morhpology: Derivational & Inflectional Morphology - POS tagging - Parsing: Shallow and Dependency Parsing, Semantics: Word Level Semantics and Thematic roles.

UNIT II **6 Hours**

TEXT PROCESSING AND FEATURE REPRESENTATION

Introduction to Corpora, Sentence Segmentation, Stemming: Porter Stemmer, Bag of words and Vector Space Model, Topic Modeling, N-gram Language Model, Smoothing, Word Embeddings: Word2Vec, Glove and Fasttext.

UNIT III **6 Hours**

APPLICATIONS OF NLP

Sentiment Classification using ML & DL models, Named Entity Recognition - CRF and LSTMs, Text Summarization - Statistical and Deep Learning models - Machine Translation - Encoder & Decoder Model, Attention Models, Question Answering - Knowledge based Q&A and Deep Learning models for Q&A.

UNIT IV **6 Hours**

SPEECH PROCESSING AND FEATURE REPRESENTATION OF SPEECH SIGNAL

Fundamentals of speech production – Perception of sound – Vocal tract model – Phonetics - Short-Time analysis of the signal – Energy – Zero crossing – Autocorrelation – Short time Fourier analysis - Mel Frequency Cepstral Coeffecients, Perceptual linear prediction (PLP), Linear prediction cepstral coefficients (LPCC), Gammatone Frequency Cepstral Coefficients (GFCC), i-vector.

UNIT V **6 Hours**

AUTOMATIC SPEECH AND SPEAKER RECOGNITION

Automatic Speech recognition formulation: Isolated word recognition – Large vocabulary continuous speech recognition - HMM/GMM based speech recognition – DNN/HMM model -- CNN based speech recognition - RNN language Models – Evaluation metrics, Speaker - recognition model – Alexa/Google assistant-based application development.

EXPERIMENT 1 **3 Hours**

POS Tagging and Parsing using various python packages.

EXPERIMENT 2 **3 Hours**

Implementing N-gram language models for next word prediction.

EXPERIMENT 3 **3 Hours**

Implementing Word embedding based text classification.

EXPERIMENT 4 **3 Hours**

Implementing CNN for sentiment analysis.

EXPERIMENT 5 **3 Hours**

Implementing RNN for Named Entity recognition.

EXPERIMENT 6 **3 Hours**

Implementing text summarization using deep learning.

EXPERIMENT 7 **3 Hours**

Implementing chatbot using deep learning.

EXPERIMENT 8 **3 Hours**

Developing speech recognition system to recognize voice commands

EXPERIMENT 9 **3 Hours**

Developing speech recognition system to recognize continuous speech

EXPERIMENT 10 **3 Hours**

Implementing CNN based speech recognition using mel spectal images.

Total: 60 Hours

REFERENCE(S)

1. Dan Jurafsky, James H. Martin “Speech and Language Processing”, Draft of 3rd Edition,Prentice Hall 2022.
2. Jacob Benesty, M. M. Sondhi, Yiteng Huang "Springer Handbook of Speech Processing", Springer, 2008.
3. Uday Kamath, John Liu, James Whitaker "Deep Learning for NLP and Speech Recognition" Springer, ,2019.
4. Steven Bird, Ewan Klein, Edward Loper "Natural Language Processing with Python", O'Reilly Media. 2009.
5. Ben Gold, Nelson Morgan, Dan Ellis “Speech and Audio Signal Processing: Processing and Perception of Speech and Music”, John Wiley & Sons, 2011.

22IT006 COMPUTER VISION 2 0 2 3

Course Objectives

- Understand the fundamental concepts related to Image formation and processing
- Learn feature detection, matching and detection
- Become familiar with feature-based alignment, motion estimation and 3D reconstruction
- Understand image-based rendering and recognition.
- Learn to detect and analysis objects from motion or scene

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand basic knowledge, theories and methods in image processing and computer vision.
2. Implement basic and some advanced image processing techniques in OpenCV.
3. Apply 2D feature-based based image alignment, segmentation, motion estimations and 3D image reconstruction techniques
4. Design and develop innovative image processing and computer vision applications.
5. Apply the concept in understanding the scene and process the background part of the image

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		2		2	1	2	2	3	
3	3	3	2	2	3				1	1	2	2	3	
4	2	3	3	2	3				2	1	2	3	2	
5	2	3	3	2	2	2			2	1	2	3	3	

UNIT I **6 Hours**

INTRODUCTION TO IMAGE FORMATION AND PROCESSING

Computer Vision Geometric primitives and transformations Photometric image formation The digital camera Point operators Linear filtering More neighborhood operators Fourier transforms Pyramids and wavelets Geometric transformations Global optimization.

UNIT II **6 Hours**

FEATURE DETECTION, MATCHING AND SEGMENTATION

Points and patches - Edge detection - Edges Lines Segmentation - Region Based Segmentation - Graph Based segmentation - Active contours - Split and merge Mean shift and mode finding - Normalized cuts Graph cuts and energy-based methods.

UNIT III **6 Hours**

FEATURE-BASED ALIGNMENT AND 3D RECONSTRUCTION

2D and 3D feature-based alignment Pose estimation Geometric intrinsic calibration - Triangulation Two frame structure from motion - Shape from X Active range finding - Surface representations - Point based representations - Volumetric representations - Model based reconstruction.

UNIT IV **6 Hours**

IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images Light fields - Video based Rendering - Object detection - Face recognition - Instance recognition - Category recognition Context and scene understanding.

UNIT V **7 Hours**

MOTION ANALYSIS AND SCENE ANALYSIS

Optical Flow – Detection and Correspondence of Interest Points - Detection of Motion Patterns – Video Tracking – Motion Models to aid tracking: Kalman Filters - stereo mapping - image fusion - Detection of known objects by linear filters - Detection of unknown objects - Corner detection - image tagging.

EXPERIMENT 1 **3 Hours**

Perform histogram equalization on the image.

EXPERIMENT 2 **3 Hours**

Perform the edge detection process and extract edges from the input image

EXPERIMENT 3 **5 Hours**

Perform segmentation, extract and display the segmented region.

EXPERIMENT 4 **3 Hours**

Program to detect an object from the input frame.

EXPERIMENT 5 **5 Hours**

Program to track the object between two frames from image/video.

EXPERIMENT 6 **5 Hours**

Program to demonstrate to understand a scene and generate caption.

EXPERIMENT 7 **5 Hours**

Program to classify defective object from the correct object.

Total: 60 Hours

REFERENCE(S)

1. Richard Szeliski, Computer Vision Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.
6. Jurgen Beyerer, Fernando Puente Leon, Christian Frese," Machine Vision Automated Visual Inspection: Theory, Practice and Applications", 2016, Springer
7. AI Bovik, "The Essential Guide to Image Processing", 2009, Academic Press

22IT007 AGILE SOFTWARE DEVELOPMENT 3 0 0 3

Course Objectives

- Understand agile software development practices.
- Understand the Agile Scrum framework and development practices.
- Apply software design principles and refactoring techniques to achieve agility.
- Understand Agile requirements and perform testing activities within an agile project.
- Understand the benefits and pitfalls of working in an Agile team in terms of quality assurance.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand genesis of Agile and driving forces for choosing Agile techniques.
2. Apply the Agile Scrum framework and development practices.
3. Apply iterative software development processes by planning and executing them.
4. Analyze the impact of the success of social aspects behind the software testing.
5. Analyze techniques and tools for improving team collaboration and management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	2		-							2	2	
2	1	2	2									-	2	
3	1		2		2							2	2	
4	1		2		2							2	2	
5	1		1		2							2	2	

UNIT I **9 Hours**

AGILE METHODOLOGY

Theories for Agile management - agile software development - traditional model vs. agile model - classification of agile methods - agile manifesto and principles - agile project management - agile team interactions - ethics in agile teams - agility in design - testing - agile documentations - agile drivers - capabilities and values

UNIT II **9 Hours**

AGILE PROCESSES

Extreme Programming: Method overview - lifecycle - work products, roles and practices - Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Kanban model

UNIT III **9 Hours**

AGILITY AND KNOWLEDGE MANAGEMENT

Agile information systems - agile decision making - Earls schools of KM - institutional knowledge evolution cycle - development, acquisition, refinement, distribution, deployment, leveraging - KM in software engineering - managing software knowledge - challenges of migrating to agile methodologies - agile knowledge sharing - role of story-cards - Story - card Maturity Model (SMM)

UNIT IV **9 Hours**

AGILITY AND REQUIREMENTS ENGINEERING

Impact of agile processes in RE - current agile practices - variance - overview of RE using agile - managing unstable requirements - requirements elicitation - agile requirements abstraction model - requirements management in agile environment, agile requirements prioritization - agile requirements modeling and generation - concurrency in agile requirements generation

UNIT V **9 Hours**

AGILITY AND QUALITY ASSURANCE

Agile Interaction Design - Agile product development - Agile Metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - Agile approach to Quality Assurance - Test Driven Development - Pair programming: Issues and Challenges - Agile approach to Global Software Development

Total: 45 Hours

Reference(s)

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds), Agile Software Development, Current Research and Future Directions, Springer - Verlag Berlin Heidelberg, 2010
2. David J. Anderson; Eli Schragenheim, - Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003
3. Hazza& Dubinsky, - Agile Software Engineering, Series - Undergraduate Topics in Computer Science, Springer, VIII edition, 2009
4. Craig Larman, - Agile and Iterative Development -A manager""s Guide, Addison - Wesley, 2004
5. Kevin C. Desouza, - Agile information systems: conceptualization, construction, and managemen, Butterworth - Heinemann, 2007

22IT008 UI AND UX DESIGN 3 0 0 3

Course Objectives

- Study about designing web pages and understand the difference between UI and UX Design.
- Understand the concept of UX design and how it has evolved
- Understand UX design process and methodology.
- Learn the Importance and scope of Interaction design, User centered design

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand to do user research, persona mapping, customer journey mapping
2. Design of interactive products Methods of interaction design Tools for interaction design
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests Learning steps for digital products.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1												1	1
2	1	2	2		1								2	1
3		3	3		1								2	1
4		2	2										1	2
5		2	2										1	2

UNIT I **9 Hours**

USER-CENTERED DESIGN PROCESS

Scripting Languages - HTML, CSS - Fundamentals of graphics design, principles of visual design - Overview of UI & UX Design - Overview of the UX Design Process - Difference between User Interface (UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation - Primary and Secondary persona - Requirement definition - Creative ideation - brainstorming and ideation techniques - Scenarios and functionality extraction - Information Architecture - Task flows - Wireframe design

UNIT II **9 Hours**

FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN

Design Principles for UX and UI Design - UI Elements-Patterns - Material Design (Google) and Human Interface Design (Apple) guidelines - Interaction Principles & Interaction Behaviour - Master the Brand Platforms & Style Guides - comments and current UI patterns - Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

UNIT III **9 Hours**

ELEMENTARY SKETCHING

Principles of Sketching - Core Responsive Design - Wireframing vs Wireflows - Click through Wireframing Prototyping - Wireflow Creation - Work with different tools - Figma - Low-High Fidelity Design : Inclusive Design and Designing for Accessibility - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Designing animations and interactions

UNIT IV **9 Hours**

UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING

Building a Design System - Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration - Use of grids in UI design - Design animations and interaction patterns for key UI elements

UNIT V **9 Hours**

USABILITY EVALUATION AND PRODUCT DESIGN

Type of usability evaluation - Qualitative & Quantitative evaluation - Guerilla testing , A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud - Think aloud - Introduction and advantages - Designing evaluation protocol - Conducting usability evaluation study - Conduct Usability Test explicit - Synthesize Test Findings - practices in corporate World Product Design : Types of products & solutions - Design Psychology for e-commerce sites , CMS - Design Thinking Life Cycle

Total: 45 Hours

Reference(s)

1. Norman, Donald A. The Design of Everyday Things. Basic Books, 2002. ISBN: 9780465067107.
2. Nielsen, Jakob. Usability Engineering. Morgan Kaufmann, 1993. ISBN: 9780125184069.
3. Mullet, Kevin, and Darrell Sano. Designing Visual Interfaces: Communication Oriented Techniques. Prentice Hall, 1994. ISBN: 9780133033892.
4. Wilbent. O. Galitz ,The Essential Guide To User Interface Design, John Wiley&Sons, 2001.
5. Ben Sheiderman, Design The User Interface, Pearson Education, 1998.
6. Alan Cooper, The Essential Of User Interface Design, Wiley- Dream Tech Ltd.,2002.

22IT009 WEB FRAMEWORKS 3 0 0 3

Course Objectives

- Understand the architecture behind an Angular application and how to use it
- Understand the significance of using MongoDB as a database system
- Understand the role of React in designing front-end components
- Build a Web Server in Node and understand how it really works
- Develop a web application and API using web frameworks

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply modules and components and Animations for creating Forms and developing web pages
2. Create web applications by performing CRUD operations in database using web frameworks
3. Design Progressive Web Application with dynamic HTML web pages using Angular.
4. Designing single page applications with reusable UI components using React CSS and SaaS
5. Use Node Package Manager and Node packages for Server-Side programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		2				2	2			2	
2	1		1		3				2	2			3	
3	1		2		2				2	2			3	
4	1		1		3				2	2			2	
5	1		1		3				1	1			2	

UNIT I **9 Hours**

ANGULAR FRONT-END FRAMEWORK

Introduction - Setup - Architecture: Modules, Components, Services and DI fundamentals - Components and Templates - Configuration - Forms - Observables & RxJS - Boot Strapping - Ng Modules - Dependency Injection - Http Client - Routing and Navigation - Animations

UNIT II **9 Hours**

FRAMEWORKS WITH DATABASES

MongoDB - MongoDB Basics - Documents - Collections - Query Language - Installation - The mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB - CRUD operations - projections - Indexing - Aggregation - Replication - Sharding - Creating backup - Deployment

UNIT III **9 Hours**

ANGULAR TECHNIQUES

Service workers & PWA - Server side rendering - Angular Libraries - Schematics - CLI Builders - Angular Ivy - Web Workers

UNIT IV **9 Hours**

REACT

React Introduction - React ES6 - React Render HTML - React JSX - Components - React Classes - Composing Components - Passing Data - Dynamic Composition - React state - setting State - Async State Initialization - Event Handling Communicating from Child to Parent - Stateless Components - Designing components - React Forms - React CSS - React SaaS

UNIT V **9 Hours**

NODE JS BACK-END FRAMEWORK

Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js EventEmitter - Frameworks for Node.js - Express.js Web App - Serving static Resource - Node.js Data Access

Total: 45 Hours

Reference(s)

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
2. Christoffer Noring, Pablo Deeleman,Learning Angular, Packt Publishing Limited, 2nd Revised edition edition, 2017.
3. Caleb Dayley Brad Dayley,Brendan Dayley ,Node.js, MongoDB and Angular Web Development, 2nd Edition,Pearson, 2018.
4. Shyam Seshadri, Angular: Up and Running- Learning Angular, Step by Step , O"Reilly; First edition, 2018

22IT010 APP DEVELOPMENT 2 0 2 3

Course Objectives

- Understand android SDK
- Gain a basic understanding of Android application development
- Inculcate working knowledge of Android Studio development tool

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Identify fundamental concepts of mobile programming that make it unique from programming for other platforms
2. Analyze the essential of Android Application with their anatomy and terminologies
3. Apply rapid prototyping techniques to design, develop and deploy the Android Applications
4. Analyze the essentials of User Interface Design in IOS with SQLite Database
5. Design the flutter applications on the Android marketplace for distribution

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3								1	
2	1	2	2		3								2	
3	1		2		3								2	
4	1	1	2		3								3	
5	1	2	2		3								3	

UNIT I **5 Hours**

INTRODUCTION TO ANDROID

The Android Platform - Android SDK - Eclipse Installation - Android Installation - building your First Android application - Understanding the Android Manifest file

UNIT II **6 Hours**

ANDROID APPLICATION DESIGN ESSENTIALS

Anatomy of Android applications - Android terminologies - Application Context - Activities - Services - Intents - Receiving and Broadcasting Intents - Using Intent Filter - Permissions

UNIT III **6 Hours**

COMMON ANDROID APIS

Testing Android applications - Publishing Android applications - Using Android Data and Storage APIs - managing data using SQLite - Using Android Web APIs - Using Android Telephony APIs - Deploying Android Applications to the World

UNIT IV **6 Hours**

IOS USER INTERFACE DESIGN ESSENTIALS

IOS features - UI implementation - Touch frameworks - Data persistence using Core Data and SQLite - Integrating calendar and address book with social media application - Using WIFI - iPhone marketplace

UNIT V **7 Hours**

APP DEVELOPMENT WITH FLUTTER

Flutter Introduction - Create First Flutter Application - Exploring commonly used flutter widgets: Container - Margin - Padding and Box Constraints - Custom Fonts - Column and Expanded Widgets - Image Asset - Raised Button - and Alert Dialog

EXPERIMENT 1 **4 Hours**

Develop a simple application with one EditText so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice

EXPERIMENT 2 **4 Hours**

Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number

EXPERIMENT 3 **4 Hours**

Create a SIGNUp activity with Username and Password. Validation of password should happen based on the following rules:
Password should contain uppercase and lowercase letters.
Password should contain letters and numbers.
Password should contain special characters.
Minimum length of the password (the default value is 8).
On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that display a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another

EXPERIMENT 4 **4 Hours**

Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name

EXPERIMENT 5 **4 Hours**

Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds

EXPERIMENT 6 **5 Hours**

Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts

EXPERIMENT 7 **5 Hours**

Implement UI elements like TextFields, Label, Toolbar, Statusbar, Tabbar

Total: 60 Hours

Reference(s)

1 Lauren Darcey and Shane Conder, "Android Wireless Application Development", Second Edition, Pearson Education, 2011
2 Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
3 Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd 3. R3. Android Application Development All in one for Dummies by Barry Burd
4 Alberto Miola, "Flutter Complete Reference: Create beautiful, fast and native apps for any device" ISBN-13 9780141044804
5 David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.55

22IT011 SOFTWARE TESTING AND AUTOMATION 3 0 0 3

Course Objectives

- Understand the importance of software testing in the software development process
- Analyze different testing methodologies and techniques to create test plans, test cases, and test scripts
- Apply automation testing tools and frameworks to design and implement automated test suites

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the importance of testing in the software development process
2. Compare the different test case design strategies
3. Analyze the different levels of testing and their importance
4. Apply test management techniques and the role of a test specialist
5. Analyze the software test automation and its requirements

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		1								1	
2	2	3	2		2								1	
3	2	2	2		2								1	
4	2	3	2		3								1	
5	3	2	1		3								2	

UNIT I **9 Hours**

INTRODUCTION

Basic definitions - Software Testing Principles - The Tester"s Role in a Software Development Organization - Origins of Defects - Cost of Defects - Defect Classes - The Defect Repository and Test Design - Defect Examples - Developer/Tester Support of Developing a Defect Repository

UNIT II **9 Hours**

TEST CASE DESIGN STRATEGIES

Test Scenarios - Test Cases - Test case Design Strategies - Black Box Approach to Test Case Design - Using White Box Approach to Test design - Test Adequacy Criteria - Static testing vs. Structural testing - Code functional testing - Coverage and Control Flow Graphs - Covering Code Logic - Paths - Code complexity testing - Additional White box testing approaches - Test Coverage

UNIT III **9 Hours**

LEVELS OF TESTING

Types of testing - manual and automation - Introduction to testing methods - White-box, Black-box and Grey-box - Functional testing - Non-functional testing - Introduction to levels of testing - Unit Testing, Integration Testing, System Testing, User Acceptance Testing - Introduction to types of testing - Regression Testing, Smoke Testing, Database Testing, Usability Testing, Load Testing, Stress Testing, Performance Testing, Compatibility Testing, Security Testing, Internationalization Testing, Localization Testing

UNIT IV **9 Hours**

TEST MANAGEMENT

People and organizational issues in testing - Organization structures for testing teams - testing services - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - test management - test process - Reporting Test Results - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group - The Structure of Testing Group - The Technical Training Program

UNIT V **9 Hours**

TEST AUTOMATION

Software test automation - Design and Architecture for Automation - Automation testing - Automation Tools - Selenium Web Driver - Create Selenese Commands - TestNG - TestNG Annotations - Jmeter - Assertions in JMeter - Junit

Total: 45 Hours

Reference(s)

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing - Principles and Practices", Pearson Education, 2006
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007
3. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003
4. Edward Kit, "Software Testing in the Real World - Improving the Process", Pearson Education, 1995
5. Boris Beizer, "Software Testing Techniques", Second Edition, Van Nostrand Reinhold, New York, 1990
6. Aditya P. Mathur, "Foundations of Software Testing - Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

22IT012 DEVOPS **3 0 0 3**

Course Objectives

- Introduce DevOps terminology, definition & concepts
- Understand the different Version control tools like Git, Mercurial
- Understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- Understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real-world problems

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand different actions performed through Version control tools like Git
2. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle
3. Build Jenkins workspace for Automated Continuous Deployment
4. Perform configuration management using Ansible
5. Understand to leverage Cloud-based DevOps tools using Azure DevOps

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2								3	
2	3	3	3	3	2								2	
3	2	2	2	3	2								2	
4	2	2	2	2	2								2	
5	2	2	2	2	2								3	

UNIT I **7 Hours**

INTRODUCTION TO DEVOPS

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and GitHub

UNIT II **10 Hours**

COMPILE AND BUILD USING MAVEN

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles - Maven repositories (local, central, global) - Maven plugins - Maven create and build Artifacts - Dependency Management - Installation of Gradle - understanding build using Gradle

UNIT III **12 Hours**

CONTINUOUS INTEGRATION USING JENKINS

Install & Configure Jenkins - Jenkins Architecture Overview - creating a Jenkins Job - Configuring a Jenkins job - Introduction to Plugins - Adding Plugins to Jenkins - commonly used plugins (Git Plugin, Parameter Plugin- HTML Publisher - Copy Artifact, and Extended choice parameters). Configuring Jenkins to work with Java - Git - and Maven - Creating a Jenkins Build and Jenkins workspace

UNIT IV **9 Hours**

CONFIGURATION MANAGEMENT USING ANSIBLE

Ansible Introduction - Installation - Ansible master/slave configuration - YAML basics - Ansible Modules - Ansible Inventory files - Ansible playbooks - Ansible Roles - and ad-hoc commands in Ansible

UNIT V **7 Hours**

BUILDING DEVOPS PIPELINES USING AZURE

Create GitHub Account, Create Repository - Create Azure Organization - Create a new pipeline - Build a sample code - Modify azure - pipelines - yaml file

Total: 45 Hours

Reference(s)

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014
3. Mitesh Soni, "Hands-On Azure DevOps: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure DevOps And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure, English Edition, Paperback - 1 January 2020
4. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015
5. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016
6. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019

22IT013 VIRTUALIZATION IN CLOUD COMPUTING 3 0 0 3

Course Objectives

- Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud-based applications
- Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure
- Identify major security and privacy problems in cloud computing environment
- Apply the ability to use the architecture of cloud, service and delivery models
- Implement the key enabling technologies that help in the development of cloud.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the concept of virtualization and its properties.
2. Apply different forms of virtualization.
3. Implement various architectures for implementing virtualization methods.
4. Create virtual machines and installing various operating systems.
5. Evaluate the performance of the virtual machines and deployed applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3									1	
2			1	2	3								1	1
3			2	1	3								1	2
4	1		2	1	3								2	2
5	1		3		2								2	2

UNIT I **9 Hours**

UNDERSTANDING VIRTUALIZATION

Describing Virtualization-Microsoft Windows Drives Server Growth -Explaining Moores Law-Understanding the Importance of Virtualization -Examining Todays Trends -Virtualization and Cloud Computing -Understanding Virtualization Software Operation -Virtualizing Servers -Virtualizing Desktops -Virtualizing Applications.

UNIT II **9 Hours**

HYPERVISORS

Describing a Hypervisor -Exploring the History of Hypervisors -Understanding Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor -Holodecks and Traffic Cops -Resource Allocation -Comparing Todays Hypervisors -VMware ESX -Citrix Xen -Microsoft Hyper-V -Other Solutions.

UNIT III **9 Hours**

UNIT III

Introduction to Virtual Machine - CPUs in a Virtual Machine -Memory in a Virtual Machine -Network Resources in a Virtual Machine - Storage in a Virtual Machine -Understanding How a Virtual Machine Works -Working with Virtual Machines -Virtual Machine Clones -Templates -Snapshots -OVF -Containers

UNIT IV **9 Hours**

CREATION OF VIRTUAL MACHINES

Understanding Configuration Options-Installing Windows on a Virtual Machine- Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions- Managing CPUs for a Virtual Machine-Configuring VM CPU Options-Managing Storage for a Virtual Machine- Managing Networking for a Virtual Machine- Copying a Virtual Machine- Managing Additional Devices in Virtual Machines

UNIT V **9 Hours**

AVAILABILITY

Increasing Availability-Protecting a Virtual Machine-Protecting Multiple Virtual Machines-Protecting Data Centers - Examining Virtual Infrastructure Performance Capabilities -Deploying Applications in a Virtual Environment-Understanding Virtual Appliances and vApps -Open Stack and Containers.

Total: 45 Hours

Reference(s)

1. Matthew Portney, Virtualization Essentials, John Wiley & Sons, Second Edition, 2016
2. Kailash Jayaswal, Jagannath Kallakurchi,Donald J.Houde,Dr.devan Shah, Cloud Computing Black Book, Dreamtech press, 2015
3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S,Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013
4. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
5. http//www.microsoft.com/learning/default.mspx
6. https://www.oreilly.com/library/view/cloud- security-and/9780596806453/ch04.html

22IT014 CLOUD SERVICES AND DATA MANAGEMENT

3 0 0 3

Course Objectives

- Analyze the basic concepts of Cloud and capabilities across the various Cloud service models
- Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and OpenStack
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply Cloud Computing reference architecture for developing clouds
2. Analyze the different forms of cloud service models
3. Apply the characteristics and architecture of IaaS using various real-world applications.
4. Evaluate PaaS concepts and architectures with real-world examples
5. Analyze, and synthesize concepts related to the SaaS delivery model.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1									2
2	3	1	2	3	2									2
3	1	1	3	1	3									2
4	1	1	1	2	3									2
5	1	3	3	2	2									1

UNIT I **9 Hours**

CLOUD COMPUTING REFERENCE ARCHITECTURE (CCRA)

Introduction to Cloud Computing Reference Architecture (CCRA), Benefits of CCRA, Architecture Overview, Versions and Application of CCRA for Developing Clouds.

UNIT II **9 Hours**

INTRODUCTION OF DELIVERY MODELS IN CLOUD COMPUTING

Introduction to Cloud Delivery Models, List Various Cloud Delivery Models, Advantages of Delivery Models in Cloud, Trade-off in Cost to Install Versus Flexibility, Cloud Service Model Architecture.

UNIT III **9 Hours**

INFRASTRUCTURE AS A SERVICE (IAAS)

Introduction to Infrastructure as a Service Delivery Model, Characteristics of IaaS, Architecture, Examples of IaaS, Applicability of IaaS in the Industry.

UNIT IV **9 Hours**

PLATFORM AS A SERVICE (PAAS)

Introduction to Platform as a Service Delivery Model, Characteristics of PaaS, Patterns, Architecture and Examples of PaaS, Applicability of PaaS in the Industry.

UNIT V **9 Hours**

SOFTWARE AS A SERVICE (SAAS)

Introduction to Software as a Service Delivery Model, Characteristics of SaaS, Architecture, Examples of SaaS, Applicability of SaaS in the Industry.

Total: 45 Hours

Reference(s)

1. (IBM ICE), Cloud Computing Architecture, IBM Global Technology Services Thought Leadership White Paper, April 2011
2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
3. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, 2011
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O reilly, SPD, 2011

22IT015 CLOUD STORAGE TECHNOLOGIES 3 0 0 3

Course Objectives

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
2. Apply the usage of advanced intelligent storage systems and RAID.
3. Evaluate various storage networking architectures - SAN, including storage subsystems and virtualization.
4. Execute the different roles in providing disaster recovery and remote replication technologies.
5. Implement the security needs and security measures to be employed in information storage management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	3	3								2	
2	3	1	2	3	3									1
3	1	1	2	3	3									2
4	3	2	1	2	2									1
5	1	3	2	1	2									2

UNIT I **8 Hours**

STORAGE SYSTEMS

Cloud Storage Fundamentals and Architecture - Cloud Storage Providers and Services - Access methods (RESTful APIs, SDKs) for cloud object storage - Block storage technologies in cloud environments - File Storage in the Cloud: Network File System (NFS) and Server Message Block (SMB) protocols -Hybrid Cloud Storage - Data Migration - Data Lifecycle Management in the Cloud

UNIT II **9 Hours**

INTELLIGENT STORAGE SYSTEMS AND RAID

Storage Tiering and Caching - Automated Data Placement and Load Balancing: Intelligent Algorithms for Data Placement, Load Balancing Strategies for Distributed Storage Systems, Dynamic Resource Allocation - RAID Technologies in Cloud Storage: RAID Levels - Data Striping, Mirroring, and Parity for Fault Tolerance - RAID Configuration and Performance Optimization

UNIT III **10 Hours**

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Storage Networking in Cloud Environments - Understanding storage protocols - Network-attached storage (NAS) vs. storage area network (SAN) - Storage virtualization techniques and technologies - Network-Attached Storage (NAS) - Storage Area Network (SAN) - iSCSI and Fiber Channel over IP (FCIP) in Cloud Storage - Network Virtualization and Overlay Networks - Storage Virtualization and Abstraction - Network Performance Optimization - Network Security in Cloud Storage

UNIT IV **9 Hours**

BACKUP, ARCHIVE AND REPLICATION

Cloud Backup: Strategies and Architecture, Data Deduplication and Compression, Security - Cloud Archive: Strategies and Architecture, Replication for Data Redundancy: Synchronous and asynchronous replication methods - Disaster Recovery in the Cloud - Hybrid Backup and Archiving in Cloud Environments - Backup and Archive Management in Cloud Environments

UNIT V **9 Hours**

SECURING STORAGE INFRASTRUCTURE

Storage Security Fundamentals: Key Security Principles, Threats and Vulnerabilities in Storage Infrastructure, Access Control and Authentication: Role-based Access Control (RBAC) and Permissions Management, Multi-factor authentication (MFA) for Storage Systems - Storage-level Encryption and Application-level Encryption - Storage infrastructure Management Functions and Processes.

Total: 45 Hours

Reference(s)

1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O Reilly, 2009.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Rittinghouse, John W., and James F. Ransome, Cloud Computing Implementation, Management and Security, CRC Press, 2017.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

22IT016 CLOUD AUTOMATION TOOLS AND APPLICATIONS

3 0 0 3

Course Objectives

- Learn the options for running automation tools, and load balancers in the cloud-native applications.
- Analyze the configuration management in the cloud.
- Learn the types of cloud automation tools.
- Learn load balancing and auto scaling in the cloud.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement cloud native applications on AWS, Terraform etc.
2. Apply VM provisioning and migration in the cloud.
3. Analyze cloud automation and configuration.
4. Apply balance load and auto scaling in the cloud.
5. Analyze the AWS cloud formation use-case.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2	1	3									2
2		2			3									1
3			3	2	3									2
4			2		3								2	
5			2		3									2

UNIT I **7 Hours**

UNDERSTANDING THE CLOUD AUTOMATION

Introduction to Automation & Configuration Tools. Introduction to Terraform. Understanding Terraform Vs CloudFormation. Deploying & Destroying AWS environment with Terraform. Introduction to Packer.

UNIT II **9 Hours**

ABSTRACTION AND VIRTUALIZATION

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding hypervisors Porting Applications, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Centre Automation.

UNIT III **9 Hours**

AUTOMATION AND CONFIGURATION MANAGEMENT IN THE CLOUD

Cloud automation at scale, Cloud Configuration Management unmanaged and managed configuration management, Modification of the capacity of the service, horizontal and vertical scaling, and automatic versus manual scaling. Migrating the business to Cloud. Automating cloud deployments Balancers.

UNIT IV **9 Hours**

LOAD BALANCING AND AUTO SCALING IN CLOUD

Managed instance groups, Auto scaling and health check, Overview of HTTP(S) load balancing. Example: HTTP load balancer, HTTP(S) load balancing, Configuring an HTTP Load Balancer with Auto scaling, SSL proxy load balancing, TCP proxy load balancing, Network load balancing, Internal load balancing, Configuring an Internal Load Balancer, Choosing a load balancer

UNIT V **11 Hours**

AWS CLOUDFORMATION USE-CASE

Introduction to AWS CloudFormation, AWS CloudFormation Features and Components, Working of AWS CloudFormation, setting up AWS CloudFormation, building a Pipeline for Test and Production Stacks, AWS CloudFormation Artifacts, Parameter Override Functions with Code Pipeline, Using AWS CLI. AWS CloudFormation, Terraform, VMware vs Center Configuration Manager (VCM), and Puppet.

Total: 45 Hours

Reference(s)

1. Bernd Ruecker, Practical Process Automation: Orchestration and Integration in Micro services and Cloud Native Architectures, O"Reilly Media, First Edition, 2021.
2. Douglas Comer, The Cloud Computing Book: The Future of Computing Explained, Chapman and Hall/CRC, First Edition, 2021.
3. Karen Tovmasyan, Mastering AWS CloudFormation: Plan, develop, and deploy your cloud infrastructure effectively using AWS CloudFormation, Packt Publishing Limited, First Edition, 2020.
4. Mikael Krief, Mitchell Hashimoto, Terraform Cookbook: Efficiently define, launch, and manage Infrastructure as Code across various cloud platforms, Packet Publishing Limited, 2020.
5. Yogesh Raheja, Dennis McCarthy, Automation with Puppet 5.0, Wiley, First Edition, 2018.

22IT017 SOFTWARE DEFINED NETWORKS 2 0 2 3

Course Objectives

- Understand the need for SDN and its data plane operations
- Understand the functions of control plane
- Comprehend the migration of networking functions to SDN environment
- Explore various techniques of network function virtualization
- Comprehend the concepts behind network virtualization

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply the motivation behind SDN
2. Analyze the functions of the data plane and control plane
3. Evaluate and develop network applications using SDN
4. Execute network services using NFV
5. Implement various use cases of SDN and NFV

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3	1	3								2	
2	2	1	2	2	3								1	
3	2	2	2	3	3								2	
4	2	2	2	3	1								2	
5	3	3	1	1	3								2	

UNIT I **5 Hours**

SDN: INTRODUCTION

History of Software Defined Networking (SDN)-Modern Data Center - Traditional Switch Architecture - Why SDN - Evolution of SDN - How SDN Works - Centralized and Distributed Control and Date Planes

UNIT II **6 Hours**

SDN DATA PLANE AND CONTROL PLANE

Data Plane functions and protocols - OpenFLow Protocol - Packet Processing and Performance Optimization - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface - SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III **6 Hours**

SDN APPLICATIONS

SDN Application Plane Architecture - Network Services Abstraction Layer - Traffic Engineering - Measurement and Monitoring - Security - Data Center Networking - Wide Area Networks (WAN) - Service Provider Networks - Internet Service Providers (ISPs)

UNIT IV **6 Hours**

NETWORK FUNCTION VIRTUALIZATION

Network Virtualization - NFV Architecture - Virtual LANs - OpenFlow VLAN Support - NFV Standards and Frameworks - NFV Concepts - Benefits and Requirements - Reference Architecture

UNIT V **7 Hours**

NFV FUNCTIONALITY

NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use Cases: Virtual Customer Premises Equipment, Virtual Evolved Packet Cor, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV

EXPERIMENT 1 **6 Hours**

Design, and Test the LAN connection for an organization to create a risk-free virtual environment using GNS3 network simulation tool.

EXPERIMENT 2 **8 Hours**

Design a Mininet topology with a single SDN controller and two hosts connected to a switch, and use Wireshark to capture for an institution.

EXPERIMENT 3 **8 Hours**

Design and implement an SDN-based network infrastructure for a smart campus that uses the Northbound API to program flow table rules on the switch for various use cases.

EXPERIMENT 4 **8 Hours**

Install a network topology using the OSM GUI or CLI, connecting the necessary VNFs to form service chains or network service graphs for an organization.

Total: 60 Hours

Reference(s)

1. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design, 1st Edition, CRC Press, 2014.
2. Ken Gray, Thomas D. Nadeau, Network Function Virtualization, Morgan Kauffman, 2016.
3. Oswald Coker, Siamak Azodolmolky, Software-Defined Networking with OpenFlow, 2nd Edition, O"Reilly Media, 2017.
4. Paul Goransson, Chuck Black Timothy Culver, Software Defined Networks: A Comprehensive Approach, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Thomas D Nadeau, Ken Gray, SDN: Software Defined Networks, O"Reilly Media, 2013.

22IT018 SECURITY AND PRIVACY IN CLOUD 3 0 0 3

Course Objectives

- Introduce Cloud Computing terminology, definition & concepts.
- Understand the security design and architectural considerations for Cloud.
- Understand the Identity, Access control in Cloud.
- Follow best practices for Cloud security using various design patterns.
- Monitor and audit cloud applications for security.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the cloud security concepts and fundamentals.
2. Analyze the security challenges in the cloud.
3. Analyze the cloud policy, identity and Access Management.
4. Deliver various risks, audit and monitoring mechanisms in the cloud.
5. Applying the various architectural and design considerations for security in the cloud.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1	2									2
2	1	3	2	3	1									2
3	3	2	2	3	2									2
4	2	1	2	3	3									2
5	1	3	3	1	1									3

UNIT I **8 Hours**

FUNDAMENTALS OF CLOUD SECURITY CONCEPTS

Overview of Cloud Security - Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of Cryptography - Conventional and Public-key cryptography, Hash Functions, Authentication and Digital Signatures

UNIT II **10 Hours**

SECURITY DESIGN AND ARCHITECTURE FOR CLOUD

Security Design Principles for Cloud Computing - Comprehensive Data Protection - End-to-end access control - Common Attack Vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III **9 Hours**

ACCESS CONTROL AND IDENTITY MANAGEMENT

Access Control Requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection

UNIT IV **9 Hours**

CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud Bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V **9 Hours**

MONITORING, AUDITING AND MANAGEMENT

Proactive Activity Monitoring - Incident Response, Monitoring for Unauthorized Access, Malicious Traffic, Abuse of System Privileges - Events and Alerts - Auditing - Record generation, Reporting and Management, Tamper-Proofing Audit logs, Quality of Services, Secure Management, User Management, Identity Management, Security Information and Event Management

Total: 45 Hours

Reference(s)

1. Dave Shackleford, Virtualization Security, SYBEX a Wiley Brand, 2013
2. Mark C. Chu-Carroll, Code in the Cloud, CRC Press, 2011
3. Mather, Kumaraswamy and Latif, Cloud Security and Privacy, Oreilly, 2011
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, 2013.
5. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing, Wiley 2013.

22IT019 CYBER SECURITY 3 0 0 3

Course Objectives

- Learn cybercrime and cyber law.
- Understand the cyber-attacks and tools for mitigating them.
- Understand information gathering.
- Detect and prevent a cyber-attack.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the basics of cyber security, cybercrime and cyber law.
2. Classify various types of attacks and learn the tools to launch the attacks.
3. Apply various tools to perform information gathering for data security and integrity.
4. Apply intrusion techniques to detect intrusion and to observe network traffic for malicious transactions in the network.
5. Apply intrusion prevention techniques to prevent intrusion and to protect against known and unknown threats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	2								2	
2	1	3	1	3	3								2	
3	2	1	1	1	2								2	
4	3	3	2	2	1								3	
5	3	2	2	2	3								3	

UNIT I **9 Hours**

INTRODUCTION

Cyber Security - History of Internet - Impact of Internet - CIA Triad; Reason for Cyber Crime - Need for Cyber Security - History of Cyber Crime; Cybercriminals - A Global Perspective on Cyber Crimes - Classification of Cybercrimes

UNIT II **9 Hours**

ATTACKS AND COUNTER MEASURES

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks - Security Breach - Types of Malicious Attacks - Malicious Software - Common Attack Vectors - Social engineering Attack - Wireless Network Attack - Web Application Attack - Attack Tools - Countermeasures

UNIT III **9 Hours**

RECONNAISSANCE

Harvester - Who is - Netcraft - Host - Extracting Information from DNS- Extracting Information from E-mail Servers - Social Engineering Reconnaissance; Scanning - Port Scanning - Network Scanning and Vulnerability Scanning - Scanning Methodology - Ping Sweer Techniques - Nmap Command Switches - SYN - Stealth - XMAS - NULL - IDLE - FIN Scans - Banner Grabbing and OS Fingerprinting Techniques

UNIT IV **9 Hours**

INTRUSION DETECTION

Host -Based Intrusion Detection-Network -Based Intrusion Detection-Distributed or Hybrid Intrusion Detection-Intrusion Detection Exchange Format -Honeypots - Example System Snort -Cyber Laws-The Indian IT Act - Cyber Crime and Punishment

UNIT V **9 Hours**

INTRUSION PREVENTION

Firewalls and Intrusion Prevention Systems: Need for Firewalls -Firewall Characteristics and Access Policy - Types of Firewalls - Firewall Basing - Firewall Location and Configurations - Intrusion Prevention Systems - Example Unified Threat Management Products

Total: 45 Hours

Reference(s)

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011
3. https://owasp.org/www-project-top-ten/
4. David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones & Bartlett Learning Publishers, 2013.
5. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011.
6. Kimberly Graves, “CEH Official Certified Ethical Hacker Review Guide”, Wiley Publishers, 2007.
7. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Third Edition, Pearson Education, 2015.
8. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No Starch Press, 2014.

22IT020 MODERN CRYPTOGRAPHY 3 0 0 3

Course Objectives

- Learn about the basics of modern cryptography.
- Focus on how cryptographic algorithms and protocols work and how to use them.
- Build a Pseudorandom permutation.
- Construct the basics of cryptanalytic techniques for ensuring data integrity.
- Use the block ciphers and message authentication codes.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the basic principles of cryptography and general cryptanalysis.
2. Analyze the concepts of symmetric encryption and authentication.
3. Apply the process in public key encryption, digital signatures, and key establishment.
4. Apply the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Demonstrate the use of Message Authentication Codes to authenticate information transmitted between the users.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	
2	1	3	2	1	2							2	2	
3	1	1	2	3	2							3	1	
4	3	1	2	1	3							2	3	
5	2	3	3	3	3							1	2	

UNIT I **9 Hours**

INTRODUCTION

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations

UNIT II **9 Hours**

FORMAL NOTIONS OF ATTACKS

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model

UNIT III **9 Hours**

RANDOM ORACLES

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV **9 Hours**

BUILDING A PSEUDORANDOM PERMUTATION

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

UNIT V **9 Hours**

MESSAGE AUTHENTICATION CODES

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir''s Secret Sharing Scheme- Formally Analyzing Cryptographic Protocols- Zero Knowledge Proofs and Protocols

Total: 45 Hours

Reference(s)

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 7th Edition, 2017.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), 2009.
3. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2007.
4. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2004.

22IT021 CYBER FORENSICS 3 0 0 3

Course Objectives

- Understand the principles and concepts of computer forensics.
- Learn to utilize forensic tools for network-based attacks.
- Identify and apply appropriate methodologies for forensics data.
- Identify and analyze the vulnerabilities in the network.
- Analyze the various hacking techniques and their impacts.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the basics of computer forensics, legal and ethical considerations, and the importance of maintaining the integrity of digital evidence.
2. Apply different types of computer forensic tools to preserve the integrity of data in the network.
3. Analyze and validate forensics data from the communicating devices to detect intruders.
4. Apply the various firewall techniques to detect the vulnerabilities in the networks.
5. Implement real-world hacking techniques to test system security and to ensure the system's safety from hackers.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	2			2					2	
2	2	2	3	2	3			2					2	
3	2	1	3	2	2			3					2	
4	2	1	2	3	3			3					3	
5	2	2	2	2	3			3					3	

UNIT I **9 Hours**

INTRODUCTION TO COMPUTER FORENSICS

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques Incident and incident response methodology Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. Forensics Technology and Systems, Understanding Computer Investigation, Data Acquisition.

UNIT II **9 Hours**

EVIDENCE COLLECTION AND FORENSICS TOOLS

Processing Crime and Incident Scenes, Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT III **9 Hours**

ANALYSIS AND VALIDATION

Validating Forensics Data, Data Hiding Techniques, Performing Remote Acquisition, Network Forensics, Email Investigations, Cell Phone and Mobile Devices Forensics.

UNIT IV **9 Hours**

EMAIL SECURITY

PGP - S/MIME, Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology, Types of Firewalls, Firewall designs, SET for E-Commerce Transactions

UNIT V **9 Hours**

ETHICAL HACKING IN WEB

Social Engineering, Denial of Service, Session Hijacking, Hacking Web servers, Hacking Web Applications, SQL Injection, Hacking Wireless Networks, Hacking Mobile Platforms.

Total: 45 Hours

Reference(s)

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
4. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, Cengage Learning, 2nd Edition, 2005.
5. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

22IT022 ETHICAL HACKING 3 0 0 3

Course Objectives

- Learn about the importance of information security.
- Understand different scanning and enumeration methodologies and tools.
- Understand various hacking techniques and attacks.
- Code programming languages for security professionals.
- Understand the different phases in penetration testing

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Enumerate the numerous assaults carried out during ethical hacking and penetration testing.
2. Apply the hacking techniques and understand the tools to be used for hacking
3. Understand the various vulnerabilities of Windows and Linux OS
4. Apply the techniques to hack web servers and tools for it.
5. Determine the characteristics of the firewall, the intruder detection mechanisms, and the malicious software to protect the system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	2								1	
2	2	2	2	3	3								2	
3	2	1	1	2	1								2	
4	1	2	2	3	3								2	
5	1	2	2	3	3								3	

UNIT I **9 Hours**

INTRODUCTION

Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II **9 Hours**

SCANNING AND ENUMERATION

Introduction to Scanning - Objectives - Scanning Methodology - Tools - Introduction to Enumeration - Enumeration Techniques - Enumeration Procedure - Tools

UNIT III **9 Hours**

SYSTEM HACKING

Introduction - Cracking Passwords - Password Cracking Websites - Password Guessing - Password Cracking Tools - Password Cracking Countermeasures - Escalating Privileges - Executing Applications - Keyloggers and Spyware

UNIT IV **9 Hours**

PROGRAMMING FOR SECURITY PROFESSIONALS

Programming Fundamentals - C language - HTML - Perl - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures - Linux OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures

UNIT V **9 Hours**

NETWORK PROTECTION SYSTEMS

Access Control Lists - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams - Honeypots.

Total: 45 Hours

Reference(s)

1. EC-Council, “Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
2. Jon Erickson, “Hacking, 2nd Edition: The Art of Exploitation", No Starch Press Inc., 2008.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2013.
4. Patrick Engebretson,"The Basics of Hacking and Penetration Testing - Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
5. RafayBoloch,"Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.

22IT023 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

2 0 2 3

Course Objectives

- Understand the basics of Blockchain Technology.
- Learn Different protocols and consensus algorithms in Blockchain.
- Learn the Blockchain implementation frameworks.
- Experiment the Hyperledger Fabric, Ethereum networks.
- Understand the Blockchain Applications.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand emerging abstract models for Blockchain Technology.
2. Analyze the major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. Develop the Blockchain function as a method of securing distributed ledgers and their contents.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
5. Analyze the applications of Blockchain Technologies.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1	-								-	
4	-	2	2	-	3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain, Public Ledgers, Blockchain as Public Ledgers, Block in a Blockchain, Transactions, The Chain and the Longest Chain, Permissioned Model of Blockchain, Cryptographic, Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH, the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW), Hashcash PoW , Bitcoin PoW, Attacks on PoW, monopoly problem, Proof of Stake, Proof of Burn, Proof of Elapsed Time, Bitcoin Miner, Mining Difficulty, Mining Pool, Permissioned model and use cases.

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue, DApps, NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc, Case Study.

EXPERIMENT 1 **5 Hours**

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

EXPERIMENT 2 **5 Hours**

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

EXPERIMENT 3 **5 Hours**

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.

EXPERIMENT 4 **5 Hours**

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.

EXPERIMENT 5 **5 Hours**

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

EXPERIMENT 6 **5 Hours**

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan.

Total: 60 Hours

Reference(s)

1. Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Melanie Swan, Blockchain: Blueprint for a New Economy, OReilly, 2015
4. Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

22IT024 MALWARE ANALYSIS 3 0 0 3

Course Objectives

- Understand the fundamentals of malware, types and its effects.
- Identify and analyze various malware types by static and dynamic analysis.
- Deal with detection, analysis, understanding, controlling, and eradication of malware.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the various concepts of malware analysis and their technologies used.
2. Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.
3. Understand the methods and techniques used by professional malware analysts.
4. Analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	2								2	
2	3	3	2	2	2								2	
3	3	3	3	3	3								3	
4	3	3	3	3	3								3	
5	3	3	3	3	3								3	

UNIT I **9 Hours**

INTRODUCTION AND BASIC ANALYSIS

Introduction to Malware - Malware threats - Malware types: Viruses, Worms, Rootkits, Trojans, Bots, Spyware, Adware, Logic Bombs - Goals of Malware Analysis - AV Scanning - Hashing - Finding Strings - Packing and Obfuscation - PE file format - Static - Linked Libraries and Functions - Static Analysis tools - Virtual Machines and their usage in Malware analysis - Sandboxing - Basic dynamic analysis - Malware execution - Process Monitoring - Viewing processes - Registry snapshots

UNIT II **9 Hours**

ADVANCED STATIC ANALYSIS

The Stack - Conditionals - Branching - Rep Instructions- Disassembly - Global and local variables - Arithmetic operations - Loops - Function Call Conventions - C Main Method and Offsets. Portable Executable File Format - The PE File Headers and Sections - IDA Pro - Function analysis - Graphing - The Structure of a Virtual Machine - Analyzing Windows programs - Anti-static analysis techniques - obfuscation - packing - metamorphism - polymorphism

UNIT III **9 Hours**

ADVANCED DYNAMIC ANALYSIS

Live malware analysis - dead malware analysis - analyzing traces of malware - system calls - api calls - registries - network activities. Anti-dynamic analysis techniques - VM detection techniques - Evasion techniques - Malware Sandbox - Monitoring with Process Monitor - Packet Sniffing with Wireshark - Kernel vs. User-Mode Debugging - OllyDbg - Breakpoints - Tracing - Exception Handling - Patching

UNIT IV **9 Hours**

MALWARE FUNCTIONALITY

Downloaders and Launchers - Backdoors - Credential Stealers - Persistence Mechanisms - Handles - Mutexes - Privilege Escalation - Covert malware launching - Launchers - Process Injection - Process Replacement - Hook Injection - Detours - APC injection.

UNIT V **9 Hours**

ANDROID MALWARE ANALYSIS

Android Malware Analysis: Android architecture - App development cycle - APKTool - APKInspector - Dex2Jar - JD-GUI - Static and Dynamic Analysis - Case Study: Smartphone (Apps) Security

Total: 45 Hours

Reference(s)

1. Michael Sikorski and Andrew Honig,"Practical Malware Analysis" by No Starch Press, 2012, ISBN: 9781593272906
2. Bill Blunden,"The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System", Second Edition, Jones & Bartlett Publishers, 2009.
3. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel" by 2005, Addison-Wesley Professional.
4. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SÃƒÂ©bastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
5. Victor Marak,"Windows Malware Analysis Essentials" Packt Publishing, O"Reilly, 2015.
6. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere,"Android Malware and Analysis", CRC Press, Taylor & Francis Group, 2015.

22IT025 MULTIMEDIA AND ANIMATION 2 0 2 3

Course Objectives

- Understand the basic knowledge of multimedia Systems and related technologies.
- Learn about multimedia elements in a comprehensive way.
- Understand the basics of digital 2D animation to create story and multimedia production
- Design the technical and artistic skills to produce 3D animations.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the usage of the multimedia elements for computer Image Processing.
2. Analyze the different encode and decode techniques.
3. Apply the author 2D and 3D creative and interactive presentations for differenttarget multimedia applications.
4. Apply 2D animation and develop the storyboards.
5. Create and animate the 3D models using software tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1		2									
2	2	2	2	2	2								3	
3	3												2	2
4	2	2	2											2
5	2	3	2											2

UNIT I **6 Hours**

INTRODUCTION TO MULTIMEDIA ELEMENTS

Multimedia - Medium - Properties of a Multimedia System - Traditional Data Stream Characteristics -Text - Basic Sound Concepts – Speech. Image – Computer Image Processing

6 Hours

UNIT II

MULTIMEDIA COMPRESSION

Storage Space - Coding Requirements - Hybrid Coding - JPEG: Image Preparation, Lossy Mode, Lossless Mode, Hierarchical Mode - H.261 - MPEG: Video Encoding, Data Stream, MPEG 3, MPEG 7, MPEG 21

UNIT III **6 Hours**

MULTIMEDIA AUTHORING

Authoring metaphors, Tools Features and Types: Card and Page Based Tools - Icon and Object Based Tools, Time Based Tools - 3D Modeling and Animation Tools - Image Editing Tools - audio Editing Tools - Digital Movie Tools - Creating interactive presentations - virtual learning, simulations.

UNIT IV **6 Hours**

2D ANIMATION

Introduction to 2D Animation, Colour theory & basics - Layout & Designing Basic of sketching - Composition of basic elements - Graphics and advertising - Creating Digital Layout, Professional image editing - Story Boarding, stop motion animation - Production / Post-Production-Background composition - 2D animation and techniques.

UNIT V **6 Hours**

3D ANIMATION

3D Modeling - Modeling Techniques - Types of Modeling - 3D Shading-Use of Material, Shader and Texture editing - Introduction to 3D Animation -3D Animation and Rigging - Setting up controllers for joints - Simple Skeleton structure with proper joint orientation - 3D Lighting and Rendering.

EXPERIMENT 1 **3 Hours**

Image Editing and Manipulation - Basic Operations on images using anyimage editing software.

EXPERIMENT 2 **3 Hours**

Implementation of audio and Video Editing techniques.

EXPERIMENT 3 **3 Hours**

Sketching of cartoon characters.

EXPERIMENT 4 **3 Hours**

Design 2D Logo using the image editing tool.

EXPERIMENT 5 **3 Hours**

Creating gif animated images in 2D Animation**.**

EXPERIMENT 6 **3 Hours**

Exploring the Interface of 3D application & Primitive Modelling.

EXPERIMENT 7 **3 Hours**

Create different types of Materials and Shading.

EXPERIMENT 8 **3 Hours**

Create a simple walk cycle using the character Rigs.

EXPERIMENT 9 **3 Hours**

Create a 3-point Light Setup.

EXPERIMENT 10 **3 Hours**

Create particle Simulation & Rendering.

Total: 30+30 = 60 Hours

Reference(s)

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", ThirdEdition,Springer Texts in Computer Science, 2021.
2. Andleigh, P. K and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2003.
3. Multimedia: Making It Work, Tay Vaughan, 9th Edition,
4. The Illusion of Life: Disney Animation - Frank Thomas and Ollie Johnston
5. Maraffi, Chris, Maya Character Creation: Modeling and Animation Controls. New Riders,2008.
6. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling &Animation,CRC press, 3rd Edition, 2016.

22IT008 UI AND UX DESIGN 3 0 0 3

Course Objectives

- Design web pages and understand the difference between UI and UX Design.
- Understand the concept of UX design
- Understand UXdesign process and methodology.
- Learn the importance and scope of Interaction design, User centered design

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand to perform user research, persona mapping, customer journey mapping
2. Design interactive products methods using interaction design tools.
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests learning steps for digital products.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1												1	1
2	1	2	2		1								2	1
3		3	3		1								2	1
4		2	2										1	2
5		2	2										1	2

UNIT I **9 Hours**

USER CENTERED DESIGN PROCESS

Scripting Languages – HTML, CSS - Fundamentals of graphics design, principles of visual design - Overview of UI & UX Design - Overview of the UX Design Process - Difference between User Interface (UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation –Primary and Secondary persona - Requirement definition - Creative ideation – brainstorming and ideation techniques - Scenarios and functionality extraction - Information Architecture - Task flows - Wireframe design

UNIT II **9 Hours**

FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN

Design Principles for UX and UI Design - UI Elements-Patterns - Material Design (Google) and Human Interface Design (Apple) guidelines - Interaction Principles & Interaction Behaviour - Masterthe Brand Platforms & Style Guides - comments and current UI patterns - Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

UNIT III **9 Hours**

ELEMENTARY SKETCHING

Principles of Sketching - Core Responsive Design - Wireframing vs Wireflows - Click through Wireframing Prototyping - Wireflow Creation - Work with different tools – Figma - Low-High Fidelity Design: Inclusive Design and Designing for Accessibility - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Designing animations and interactions.

UNIT IV **9 Hours**

UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING

Building a Design System – Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration - Use of grids in UI design - Design animations and interaction patterns for key UI elements.

UNIT V **9 Hours**

USABILITY EVALUATION AND PRODUCT DESIGN

Type of usability evaluation – Qualitative & Quantitative evaluation - Guerilla testing , A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud - Think aloud – Introduction and advantages - Designing evaluation protocol - Conducting usability evaluation study – Conduct Usability Test explicit - Synthesize Test Findings - practices in corporate World - Product Design Types of products & solutions - Design Psychology for e-commerce sites , CMS - Design Thinking Life Cycle

Total: 45 Hours

Reference(s)

1. Norman, Donald A. The Design of Everyday Things. Basic Books, 2002. ISBN: 9780465067107.
2. Nielsen, Jakob. Usability Engineering. Morgan Kaufmann, 1993. ISBN: 9780125184069.
3. Mullet, Kevin, and Darrell Sano. Designing Visual Interfaces: Communication Oriented Techniques. Prentice Hall, 1994. ISBN: 9780133033892.
4. Wilbent. O. Galitz ,“The Essential Guide To User Interface Design”, John Wiley&Sons, 2001.
5. Ben Sheiderman, “Design The User Interface”, Pearson Education, 1998.
6. Alan Cooper, “The Essential Of User Interface Design”, Wiley – Dream Tech Ltd.,2002.

22IT026 AUGMENTED REALITYAND VIRTUAL REALITY 2 0 2 3

Course Objectives

- Impart the fundamental aspects and principles of AR/VR technologies.
- Understand the internals of the hardware and software components involved in thedevelopment of AR/VR enabled applications.
- Learn about the graphical processing units and their architectures.
- Gain knowledge about AR/VR application development.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the tools and technologies related to AR/VR.
2. Design various models using modeling techniques.
3. Apply programming concepts and techniques specific to VR development, including 3D graphics.
4. Develop AR/VR applications in different domains.
5. Apply the technologies related to AR to build AR-enabled devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2			2	2	2		2	2	2
2	2	3	3	3	3			2	2	2		2	3	3
3	2	2	2	2	2			2	2	2		2	3	3
4	3	3	3	3	3			2	2	2		2	3	3
5	3	3	3	3	3			2	2	2		2	3	3

UNIT I **6 Hours**

INTRODUCTION

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – Types of Trackers –Human Visual System – Personal Graphics Displays – Human Auditory System

UNIT II **6 Hours**

VR MODELING

Modelling – Geometric Modelling – Virtual Object Shape – Object Visual Appearance – Kinematics Modelling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Physical Modelling – Behavior Modelling – Model Management

UNIT III **6 Hours**

VR PROGRAMMING

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D.

UNIT IV **6 Hours**

APPLICATIONS

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR.

UNIT V **6 Hours**

AUGMENTED REALITY

Introduction to Augmented Reality – Computer vision for AR – Interaction – Modelling and Annotation Navigation – Wearable devices.

EXPERIMENT 1 — 3 Hours

Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.

EXPERIMENT 2 **3 Hours**

Use the primitive objects and apply various projection types by handling camera.

EXPERIMENT 3 **3 Hours**

Download objects from asset store and apply various lighting and shading effects

EXPERIMENT 4 **3 Hours**

Model three dimensional objects using various modelling techniques and apply textures over them.

EXPERIMENT 5 **3 Hours**

Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applicationswhich have limited interactivity.

EXPERIMENT 6 **3 Hours**

Add audio and text special effects to the developed application.

EXPERIMENT 7 **3 Hours**

Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.

EXPERIMENT 8 **3 Hours**

Develop AR enabled applications with interactivity like E learning environment, Virtual walk throughs and visualization of historic places.

EXPERIMENT 9 **3 Hours**

Develop AR enabled simple applications like human anatomy, DNA/RNA structure visualization.

EXPERIMENT 10 **3 Hours**

Develop simple MR enabled gaming applications.

Total:30+30= 60 Hours

Reference(s)

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VRexperiences for mobile”, Packt Publisher, 2018.
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016.
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003.

22IT027 **GAME DEVELOPMENT** **2 0 2 3**

Course Objectives

- Understand the basics of 2D and 3D graphics for game development.
- Learn the stages of game development.
- Understand the basics of a game engine.
- Survey the gaming development environment and tool kits.
- Develop simple games using Pygame environment

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the foundations of 2D and 3d Graphics
2. Design story board with game design documents
3. Analyze implementation of software and hardware rendering in gaming engines.
4. Analyze gaming environments and frameworks.
5. Develop a simple game in Pygame.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								1	1
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **6 Hours**

3D GRAPHICS FOR GAME DESIGN

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II **6 Hours**

GAME DESIGN PRINCIPLES

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Productionand Post – Production.

UNIT III **6 Hours**

GAME ENGINE DESIGN

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV **6 Hours**

OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT V **6 Hours**

GAME DEVELOPMENT USING PYGAME

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics Algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based Arcade Games – Puzzle Games.

EXPERIMENT 1 — 3 Hours

Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game

EXPERIMENT 2 — 3 Hours

Character design, sprites, movement and character control

EXPERIMENT 3 — 3 Hours

Level design: design of the world in the form of tiles along with interactive and collectible objects

EXPERIMENT 4 — 4 Hours

Design of interaction between the player and the world, optionally using the physics engine.

EXPERIMENT 5 **4 Hours**

Developing a 2D interactive using Pygamme

EXPERIMENT 6 **4 Hours**

Developing a Puzzle game

EXPERIMENT 7 **3 Hours**

Design of menus and user interaction in mobile platforms.

EXPERIMENT 8 **3 Hours**

Developing a 3D Game using Unreal

EXPERIMENT 9 **3 Hours**

Developing a Multiplayer game using unity

Total:30+30= 60 Hours

Reference(s)

1 Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach",Addison Wesley,2013.
2 Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress,2007.
3 Paul Craven, "Python Arcade games", Apress Publishers,2016.
4 David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press,2006.
5 Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

22IT028 VIDEO CREATION AND EDITING 2 0 2 3

Course Objectives

- Introduce the broad perspective of linear and nonlinear editing concepts.
- Understand the concept of Storytelling styles.
- Apply audio and video recording and different media tools.
- Understand the concepts of AVID XPRESS DV 4.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare the strengths and limitations of Nonlinear editing.
2. Analyze the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Analyze the core issues of advanced editing and training techniques.
5. Design and develop projects using AVID XPRESS DV 4.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	1	1				1	2	3	2	3	1
2	2	3	3	3	1				1	2	2	1	1	1
3	2	2	3	3	1				3	1	1	1	2	1
4	2	2	2	2	1				3	1	1	1	2	2
5	2	1	3	3	1				3	2	1	2	2	2

UNIT I **6 Hours**

FUNDAMENTALS

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II **6 Hours**

STORYTELLING

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, splitedits - Consumer and pro NLE systems - digitizing images - managing resolutions - Understanding video color - Color Correcting Basics - Color Enhancement Effects mechanics of digital editing - pointer files - media management.

UNIT III **6 Hours**

USING AUDIO AND VIDEO

Audio: Timeline Audio Tracks - Editing Audio- Gaining, Fading and Balancing Audio- Video: Capturing digital and analog video - importing audio on putting video - exporting digital video to tape - recording to CDs and VCDs

UNIT IV **6 Hours**

WORKING WITH FINAL CUT PRO

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Workingwith Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V **6 Hours**

WORKING WITH AVID XPRESS DV 4

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing toRecord and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

EXPERIMENT 1 **3 Hours**

Write a Movie Synopsis (Individual/Team Writing)

EXPERIMENT 2 **3 Hours**

Present team stories in class

EXPERIMENT 3 **4 Hours**

Script/Storyboard Writing(Individual Assignment)

EXPERIMENT 4 **4 Hours**

Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements

EXPERIMENT 5 **4 Hours**

Production: Single camera production personnel & equipment, Documentary Production

EXPERIMENT 6 **3 Hours**

Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching

EXPERIMENT 7 **4 Hours**

Write Documentary & Animation Treatment

EXPERIMENT 8 **5 Hours**

Post-production: Editing, Sound design, Finishing

Total:30+30= 60 Hours

Reference(s)

1 Avid Xpress DV 4 User Guide, 2007.
2 Final Cut Pro 6 User Manual, 2004.
3 Keith Underdahl, Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4 Robert M. Goodman and Partick McGarth, Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw - Hill 2003.

22IT029 DIGITAL MARKETING 3 0 0 3

Course Objectives

- Understand the overview of Digital Marketing.
- Examine the role and importance of digital marketing in the business environment.
- Determine the focuses on digital marketing and its measure

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1 Understand and apply the digital marketing strategies.
2 Compare the strengths and limitations of search engine optimization.
3 Apply the suitable techniques for E-Mail Marketing.
4 Apply the digital marketing strategies in social media applications.
5 Analyze the strategies used in different digital transformation techniques.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								1	1
2	2	2	3		3								2	3
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **9 Hours**

INTRODUCTION TO ONLINE MARKET

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II **9 Hours**

SEARCH ENGINE OPTIMISATION

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT III **9 Hours**

EMAIL MARKETING

EMail Marketing - Types of EMail Marketing - Email Automation - Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT IV **9 Hours**

SOCIAL MEDIA MARKETING

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V **9 Hours**

DIGITAL TRANSFORMATION

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media,Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

Total: 45 Hours

Reference(s)

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373
2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition(April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Michael Millerth, B2B Digital Marketing: Using the Web to Market Directly to Businesses,first edition, Que Biz-Tech series2012.
5. Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice, Paperback - Import, 2012.

22IT030 PROGRAMMING ON EDGE DEVICES 3 0 0 3

Course Objectives

- Compare Fog and Edge Computing with different sets of use cases.
- Illustrate the architecture for the edge device.
- Implement the Microcomputer RaspberryPi and device Interfacing.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the difference between Fog and Edge Computing with usecases.
2. Develop the architecture for IoT edge computing devices based on the requirements.
3. Design and configure the edge devices using RaspberryPi.
4. Implement the Microcomputer RaspberryPi and device Interfacing.
5. Analyze the requirements of Industrial and Commercial edge devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1		2										
2	3	2	2	3	2								2	
3	3	2	3	3	3								3	
4	3	2	3	2	3								3	
5	3	2	-	-	-								2	

UNIT I **9 Hours**

IOT AND EDGE COMPUTING DEFINITION AND USE CASES

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

UNIT II **9 Hours**

IOT ARCHITECTURE AND CORE IOT MODULES

A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples.

UNIT III **9 Hours**

RASPBERRYPI

Introduction to Aurdino and RaspberryPi, RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools.

UNIT IV **9 Hours**

IMPLEMENTATION OF DEVICE INTERFACING

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT communication formats.

UNIT V **9 Hours**

INDUSTRIAL AND COMMERCIAL IOT

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Total: 45 Hours

Reference(s)

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, Wiley publication, 2019, ISBN: 9781119524984.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O"Reilly Media, Inc., 2019, ISBN: 978149204322.
3. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition, 2020 by Perry Lea.

22IT031 ROBOTIC PROCESS AUTOMATION 3 0 0 3

Course Objectives

- Understand the basic concepts, methodologies and tools in RPA.
- Implement the exception handling and automation techniques using RPA.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Interpret the basic concepts and methodologies in RPA.
2. Analyze the UiPath building blocks in the RPA.
3. Apply the RPA techniques to automate the application.
4. Implement the exception handling and BOT in RPA.
5. Implement the RPA to solve real time problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2		2								2	
2	2	2	3		3								2	
3	2	2	3		3								3	
4	2	3	3		3								3	
5	2	3	3		3								3	

UNIT I **9 Hours**

RPA AND PROCESS METHODOLOGIES

BPM, and BPA-Understanding RPA Skills: On-Premise Vs. the Cloud - Lean and Six Sigma Methodologies for Process Improvement - Overview of Agile Methodologies and its importance in RPA

UNIT II **9 Hours**

UIPATH ESSENTIALS

Introduction to UiPath: Installation and activation-UiPath Activities: Flowcharts, Sequences, and Data Manipulation-UiPath Variables and Data Types-Debugging techniques in UiPath-Overview of UiPath Orchestrator: BOT Development and Management-UiPath Automation Best Practices

UNIT III **9 Hours**

ADVANCED RPA TECHNIQUES

Data Manipulation: Collections and Data Table Usage-File Operations: CSV/Excel to data table and vice versa-Working with UiExplorer and Desktop Automation-Web Automation: Basic and Desktop Recording-Advanced Screen Scraping Techniques-Data Scraping and Extraction from Websites

UNIT IV **9 Hours**

HANDLING EXCEPTIONS AND USER EVENTS

Exception Handling Techniques: Try-Catch, Re-throwing Exceptions, and Custom Exception Handling-Logging, Debugging, and Error Reporting Techniques- Handling User Events: Assistant bots, System Event Triggers, and Image and Element Triggers- Monitoring Techniques in RPA- Launching an Assistant bot on a Keyboard Event

UNIT V **9 Hours**

DEPLOYMENT AND MAINTENANCE OF BOT

Overview of Orchestration Server and its functionalities- Orchestrator to Control Bots and Deploy Bots- Uploading Packages, Managing Packages, and Deleting Packages- Publishing and Managing Updates- Continuous Integration and Continuous Deployment (CI/CD) in RPA

Total: 45 Hours

Reference(s)

1. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant.
2. Srikanth Miranda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.

22IT032 AI ON EDGE COMPUTING 3 0 0 3

Course Objectives

- Understanding of the fundamental concepts, principles, and techniques of Artificial Intelligence, including its history, subfields, and applications.
- Reduce network latency and improve response times by processing data and running computations closer to the source or at the network edge.
- Address data privacy and security concerns by keeping sensitive data and computations localized at the edge devices or edge nodes.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the fundamentals of Artificial Intelligence.
2. Analyze the software services and open source communities available for edge computing.
3. Design and optimize edge device architectures, enabling efficient and resource-constrained processing for AI applications at the edge
4. Apply the edge data processing and analytics techniques for easier decision-making process.
5. Deploy AI models on edge devices, ensuring efficient inference, optimization, and integration to enable AI capabilities directly at the edge.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2								2		2
2	2	2	3	3								2		2
3	2	2	3	3								2		2
4	2	3	3	3								2		2
5	2	3	3	3								2		2

UNIT I **9 Hours**

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Introduction to Artificial Intelligence and its subfields - Machine Learning algorithms and techniques - Supervised Learning - Unsupervised Learning - Reinforcement Learning - Deep Learning models and architectures

UNIT II **9 Hours**

INTRODUCTION TO EDGE COMPUTING

Overview of Edge Computing and its significance in AI applications - Edge devices and infrastructure - Challenges and opportunities in AI on Edge Computing

UNIT III **9 Hours**

EDGE DEVICE ARCHITECTURES

Edge devices and hardware platforms for AI - Accelerators and GPUs for Edge Computing - Edge computing frameworks and software tools

UNIT IV **9 Hours**

EDGE DATA PROCESSING AND ANALYTICS

Data preprocessing and feature extraction at the Edge - Real-time analytics and decision-making at the Edge - Edge-based data storage and retrieval

UNIT V **9 Hours**

AI MODEL DEPLOYMENT ON EDGE DEVICES

Model compression and optimization for resource-constrained Edge devices - On-device training and transfer learning - Model deployment and inference techniques on Edge devices

Total: 45 Hours

Reference(s)

1. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.
2. Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014.
3. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor), Wiley, 2019
4. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press)
5. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, PHI 2009.
6. Edge Computing for Internet of Things: From Device to Cloud-Based Services" by Hassan Fouad and Ammar Rayes.

22IT033 IOT ANALYTICS 3 0 0 3

Course Objectives

- Understand the challenges of IoT analytics systems development and deployment
- Learn about data analytics and use cloud offerings related to IoT.
- Understand the Searching and security requirements of IoT.
- Acquire the knowledge of Tools, Platform and Services for IoT Analytics
- Develop IoT infrastructure for real time scenarios.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Identify the networking protocols for connecting devices and challenges of IoT Analytics
2. Understand the cloud based IoT and IoT in Data Analytics
3. Analyze the concepts of Security requirements and Searching the IoT
4. Apply the different tools and services for the IoT Analytics platform
5. Analyze applications of IoT Analytics in a real time scenario

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1	3				2	2			2	
2	2	1	3	2	3				2	2			2	
3	2	2	2	3	3				2	2			2	
4	3	2	3	3	3				2	2			3	
5	3	3	3	3	3				2	3			3	

UNIT I **8 Hours**

INTRODUCTION TO IOT ANALYTICS

Introduction-IoT Data and Big Data - Challenges of IoT Analytics - Applications - IoT Devices and Networking Protocols

UNIT II **9 Hours**

IOT CLOUD, WEB SERVICES AND DATA ANALYTICS

IoT Hardware devices and its limitation - Cloud based IoT Platform - Iaas, Paas and Saas paradigms - Requirements of IoT in Big Data Analytics Platform - Functional Architecture - Data Collection Using Low-power, Long-range Radios - Web server: Web server for IoT applications

UNIT III **10 Hours**

SEARCHING THE INTERNET THINGS AND IOT SECURITY

Introduction - A search architecture for social and physical sensors - Local Event Retrieval - Sensor Metadata - Venue Recommendation - Security Requirements in IoT - Security Concerns in IoT Applications - Security Architecture in the Internet of Things - Insufficient Authentication Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT

UNIT IV **9 Hours**

TOOLS AND SERVICE FOR IOT ANALYTICS

Architecture for IoT Analytics Applications - Nodes - Development Examples - Open source framework for IoT Analytics as a service - Sensing as a service Infrastructure Tools and Platforms

UNIT V **9 Hours**

IOT ANALYTICS APPLICATIONS AND CASE STUDIES

Data Analytics and smart Building - Smart City - Data collection to deployment and operationalization using the vital platform - Transportation - Energy - Agriculture - Healthcare

Total: 45 Hours

Reference(s)

1 Andrew Minteer, Analytics for the Internet of Things: Intelligent analytics for your intelligent devices, Packt Publishing, first edition, July 2017

2 John Soldatos, Building Blocks for IoT Analytics, River Publishers Series In Signal, Image and Speech Processing, 2017

3 Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

4 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things Key applications and Protocols, Wiley, 2012

5 Practical Internet of Things Security by Brian Russell, Drew Van,2018

22IT034 AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES

2 0 2 3

Course Objectives

- Understand the basics of Blockchain Technology
- Learn Different protocols and consensus algorithms in Blockchain
- Understand the Blockchain implementation frameworks
- Experiment the Hyperledger Fabric, Ethereum networks
- Understand the Blockchain Applications

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the concepts behind Blockchain Technology
2. Analyze the major concepts of crypto currency and Bit coin.
3. Analyze the methods for securing distributed ledgers against consensus.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application
5. Analyze the applications of Blockchain Technologies

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1										
4		2	2		3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions - The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic-Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH-the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue- DApps-NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc - Case Study.

EXPERIMENT 1 **5 Hours**

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

EXPERIMENT 2 **5 Hours**

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

EXPERIMENT 3 **5 Hours**

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules

EXPERIMENT 4 **5 Hours**

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network

EXPERIMENT 5 **5 Hours**

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

EXPERIMENT 6 **5 Hours**

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

Total: 60 Hours

Reference(s)

1 Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.

2 Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O Reilly, 2014

3 Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017

4 Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

5 Melanie Swan,Blockchain: Blueprint for a New Economy, O Reilly, 2015

6 Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

22IT035 XML AND WEB SERVICES 3 0 0 3

Course Objectives

- Understand the proficiency in creating, manipulating, and validating XML documents, including understanding XML syntax, structure, and key concepts and use XML technologies such as XML Schema, XPath, and XSLT
- Understand the role of web services in distributed systems.
- Explore SOAP and REST architectures, understand their differences
- Implement XML-based web services using industry-standard technologies like SOAP and WSDL

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the data transformation and manipulation in XML-based systems
2. Design scalable and secure web service architectures using industry-standard protocols like SOAP and REST
3. Implement XML-based solutions for electronic data interchange (EDI), data validation, and interoperability.
4. Apply Rosetta Net Applied XML for industrial applications.
5. Apply XML-based content management solutions, including content modeling, metadata management, and content transformation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3					2	2	1		1	1	
2	2	2	3					2	2	1		2	2	
3	2	3	3					2	2	2		2	2	
4	2	3	3					2	2	2		3	3	

UNIT I **9 Hours**

XML TECHNOLOGY FAMILY

XML - benefits - Advantages of XML over HTML - EDL -Databases - XML based standards - DTD - XML Schemas - X- Files - XML processing - DOM -SAXpresentation technologies - XSL - XFORMS - XHTML - voice XML - Transformation - XSLT - XLINK - XPATH -XQ

UNIT II **9 Hours**

ARCHITECTING WEB SERVICES

Business motivations for web services - B2B - B2C- Technical motivations - limitations of CORBA and DCOM - Service - oriented Architecture (SOA) - Architecting web services - Implementation view - web services technology stack - logical view - composition of web services - deployment view - from application server to peer to peer - process view - life in the runtime

UNIT III **9 Hours**

WEB SERVICES BUILDING BLOCK

Transport protocols for web services - messaging with web services - protocols - SOAP - describing web services - WSDL - Anatomy of WSDL - manipulating WSDL - web service policy - Discovering web services - UDDI - Anatomy of UDDI- Web service inspection - Ad-Hoc Discovery - Securing web services.

UNIT IV **9 Hours**

IMPLEMENTING XML IN E-BUSINESS

B2B - B2C Applications - Different types of B2B interaction - Components of ebusiness XML systems - ebXML - Rosetta Net Applied XML in vertical industry - Web services for mobile devices

UNIT V **9 Hours**

XML AND CONTENT MANAGEMENT

Semantic Web - Role of Meta data in web content - Resource Description Framework - RDF schema - Architecture of semantic web - content management workflow - XLANG -WSFL

Total: 45 Hours

Reference(s)

1 Ron schmelzer et al, XML and Web Services, Pearson Education, 2002
2 Sandeep Chatterjee and James Webber, Developing Enterprise Web Services: An Architects Guide, Prentice Hall, 2004.
3 Frank P. Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2002
4 Keith Ballinger,NET Web Services Architecture and Implementation, Pearson Education, 2003.
5 Henry Bequet and MeerajKunnumpurath, Beginning Java Web Services, Apress, 2004.
6 Russ Basiura and Mike Batongbacal, Professional ASP.NET Web Services, Apress,2. ASP .NET Web Services, Apress, 2003.

22IT036 MINING AND SOCIAL MEDIA WEB ANALYTICS 3 0 0 3

Course Objectives

- Understand the foundations of Social Media and Web Analytics.
- Visualize and understand the data mining aspects in social networks.
- Solve mining problems by different algorithms.
- Understand network measures for social data.
- Understand behavioral part of web applications for Analysis.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand social media, web and social media analytics and their potential impact.
2. Understand the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Apply network measures for social media data.
5. Apply Behavior Analytics techniques to applications that leverage social media data, such as Facebook and Twitter.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		2			2				1	3	2
2	2	2	3		2			2				1	1	2
3	2	2	3		2			1				1	2	3
4	2	2	3		2			1				1	1	2
5	2	2	3		2			2				1	2	2

UNIT I **10 Hours**

ANALYTICS IN SOCIAL MEDIA AND WEB ANALYTICS TOOLS

Social Media Analytics: The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics.
Web Analytics: Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT II **9 Hours**

VISUALIZING SOCIAL NETWORKS

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

UNIT III **9 Hours**

TEXT MINING IN SOCIAL NETWORKS

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

UNIT IV **8 Hours**

NETWORK MEASURES

Centrality: Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Betweenness Centrality, Closeness Centrality, Group Centrality, Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence.

UNIT V **9 Hours**

BEHAVIOR ANALYTICS

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction.

Total: 45 Hours

Reference(s)

1. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 9th Edition, 2019.
2. Matthew A. Russell, Mining the Social Web, O''Reilly, 3rd Edition, ISBN:10:1449367615, 2019.
3. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.
4. Eric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004.
5. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
6. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.

22IT037 OPERATION AND SUPPLY CHAIN ANALYTICS 3 0 0 3

Course Objectives

- Evaluate the effectiveness of different supply chain analytics techniques in optimizing supply chain operations.
- Synthesize data from multiple sources to develop comprehensive supply chain optimization strategies.
- Create and implement solutions to complex supply chain problems using advanced analytics techniques.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the fundamental concepts of operation in supply chain analytics.
2. Analyze supply chain data and identify opportunities for improvement.
3. Apply tools and techniques for supply chain analytics.
4. Develop strategies for optimizing supply chain operations.
5. Analyze the impact of analytics on supply chain management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2			1	1			1	1	1
2	3	3	3	3	3			1	1				1	1
3	2	2	2	3	3			1	1			1		1
4	2	2	2	2	2			1	1			1		1
5	2	2	2	2	2			1	1					1

UNIT I **9 Hours**

INTRODUCTION TO OPERATION AND SUPPLY CHAIN ANALYTICS

Introduction to Supply chain management - Overview of operation and supply chain analytics - Importance of data-driven decision-making in supply chain management - Key performance indicators (KPIs) in supply chain management.

UNIT II **9 Hours**

DATA ANALYSIS FOR SUPPLY CHAIN MANAGEMENT

Data collection and analysis techniques - Data visualization and reporting - Statistical analysis for supply chain management.

UNIT III **9 Hours**

FORECASTING AND DEMAND PLANNING

Forecasting techniques for supply chain management - Demand planning and management - Sales and operations planning (S&OP).

UNIT IV **10 Hours**

INVENTORY MANAGEMENT AND OPTIMIZATION

Inventory management techniques - Safety stock and lead time optimization - Economic order quantity (EOQ) and reorder point (ROP) analysis.

UNIT V **8 Hours**

LOGISTICS AND TRANSPORTATION ANALYTICS

Transportation network optimization - Route optimization and scheduling - Warehouse and distribution center optimization

Total: 45 Hours

Reference(s)

1. "Supply Chain Analytics: Quantitative Methods for Decision Making" by Nada R. Sanders.
2. "Operations and Supply Chain Management" by F. Robert Jacobs and Richard B. Chase.
3. "Data Analytics for Supply Chain Management: Research and Applications" by Xi Chen, Hui Yang, and Lei Yu.
4. "Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl.
5. "Business Analytics: Data Analysis and Decision Making" by Christian Albright and Wayne Winston.

22IT038 SOCIAL NETWORK SECURITY 3 0 0 3

Course Objectives

- Understand the components of the social network.
- Model and visualize the social network.
- Mine the users in the social network.
- Understand the evolution of the social network.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the internals components of the social network.
2. Analyze various representations of social network.
3. Apply extraction and detection techniques for Communities in social networks.
4. Apply prediction methods to compute the next outcome of the social network.
5. Apply access control strategies in social network.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3									
2	1	2	2		3									
3	1		2		3									
4	1	1	2		3									
5	1	2	2		3									

UNIT I **9 Hours**

FUNDAMENTALS OF SOCIAL NETWORKING

Introduction to Semantic Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Historical overview of privacy and security - Major paradigms for understanding privacy and security.

UNIT II **9 Hours**

MODELING AND VISUALIZATION

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data - Random Walks and their Applications - Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III **9 Hours**

EXTRACTION AND MINING IN SOCIAL NETWORKING DATA

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Big data and Privacy.

UNIT IV **9 Hours**

EVOLUTION

Evolution in Social Networks - Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation - Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V **9 Hours**

ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT

Understand the access control requirements for Social Network - Enforcing Access Control Strategies - Authentication and Authorization - Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network - Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.

Total: 45 Hours

Reference(s)

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, - Computational Social Network Analysis: Trends, Tools and Research Advance, Springer, 2012.
4. Borko Furht, - Handbook of Social Network Technologies and Applications, Springer, 1 st edition, 2011
5. Charu C. Aggarwal, - Social Network Data Analytics, Springer; 2014
6. Giles, Mark Smith, John Yen, - Advances in Social Network Mining and Analysis, Springer, 2010.

22IT039 HUMAN COMPUTER INTERACTION 3 0 0 3

Course Objectives

- Learn the foundations of Human Computer Interaction.
- Apply design technologies for individuals and persons with disabilities.
- Understand the model and theories of human computer interaction.
- Learn the guidelines for designing web user interfaces.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the foundations of HCI
2. Design effective HCI for individuals and groups using the design rules.
3. Recognize the models and theories used with HCI.
4. Infer the HCI implications for designing multimedia or ecommerce or e-learning Web sites.
5. Develop and design meaningful user interfaces.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2				2	2			2	
2	1	2	2	2	2				2	2			2	
3	1	2	2	3					3	3			2	
4	2	2	3	2	3				2	2			2	
5	2	2	1	2	3				2	2			2	

UNIT I **9 Hours**

FOUNDATIONS OF HCI

The Human: I/O channels - Memory - Reasoning and problem solving; The Computer: Devices - Memory - processing and networks; Interaction: Models - frameworks - Ergonomics - styles - elements - interactivity- Paradigms. - Case Studies.

UNIT II **9 Hours**

DESIGN

Interactive Design: Basics - process - scenarios - navigation - screen design - Iteration and prototyping. HCI in software process: Software life cycle - usability engineering - Prototyping in practice - design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques - Universal Design.

UNIT III **9 Hours**

MODELS AND THEORIES

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements - Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV **9 Hours**

MOBILE HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V **9 Hours**

WEB INTERFACE DESIGN

Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

Total: 45 Hours

Reference(s)

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Brian Fling, -Mobile Design and Development, First Edition, OReilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, -Designing Web Interfaces, First Edition, OReilly, 2009.

22IT040 E-COMMERCE 3 0 0 3

Course Objectives

- Learn the Various e-commerce business models.
- Understand how companies use e-commerce to gain competitive advantages.
- Familiarize with the planning and execution of e-commerce projects.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the applications of E-commerce
2. Analyze the different consumer based electronic commerce.
3. Develop an e-commerce application.
4. Analyze the performance of the platforms used for M-Commerce.
5. Develop a M-Commerce application.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2			2					2	2	1	
2	2		2			2					2	2	2	
3	1		3			2					3	3	3	
4	2		2			2					2	2	2	
5	2		2			2					2	2	2	

UNIT I **9 Hours**

ELECTRONIC COMMERCE

Frame work, anatomy of ECommerce applications, ECommerce Consumer applications, ECommerce organization applications.

UNIT II **9 Hours**

CONSUMER ORIENTED ELECTRONIC COMMERCE

Mercantile Process models, Electronic payment systems: Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT III **9 Hours**

E-COMMERCE APPLICATIONS DEVELOPMENT

The Changing Face of Application Development, Enterprise Development Needs, Enhanced Web Server, Based ECommerce Site Business Objectives, Categories of Business Value, Assessing a Site"s Current Business Value, Improving Business Value, Managed Solutions.

UNIT IV **9 Hours**

MOBILE ELECTRONIC COMMERCE

Wireless Industry Standards, Wireless Communication Platforms for LANs, Wireless WANs, Facilitators of a Wireless Environment, Concerns for the Mobile Enterprise.

UNIT V **9 Hours**

MOBILE COMMERCE: TECHNOLOGY

A Framework For The Study Of Mobile Commerce, NTT Docomos IMode, Wireless Devices For Mobile Commerce, Towards A Classification Framework For Mobile Location Based Services, Wireless Personal And Local Area Networks, The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

Total: 45 Hours

Reference(s)

1. Kenneth C.Laudon, Carol Guercio Traver ECommerce 2021:Business, Technology, and society, Pearson, 16th Edition, 2021.
2. Mobile Commerce: Framework, Development, and Strategies edited by Paul S. Minhas and Zahir Irani,2019
3. Mobile Commerce: Technology, Theory and Applications by Hannu Verkasalo,3rd Edition, 2019
4. Ravi Kalakota, Andrew B Whinston, Frontiers of Electronic Commerce, Pearson, 2017
5. Gary P Schneider ,E-commerce: Strategy, Technology and Implementation, eleventh edition, Cengage Learning, 2011.

22IT041 C# and .NET 3 0 0 3

Course Objectives

- Understand the concept of Object Oriented Programming
- Apply the Object oriented concepts to solve problems using C#
- Develop Web Applications using .NET
- Develop console applications using C#
- Develop database application on .NET

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes:

1. Understand the basics of C# and .NET framework
2. Develop applications using object-oriented aspects of C#
3. Design Windows applications
4. Create Database applications using ActiveX Data Objects
5. Develop Web based applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	-
2	1	3	2	1	2							2	2	-
3	1	1	2	3	2							3	1	-
4	3	1	2	1	3							2	3	-
5	2	3	3	3	3							1	2	-

UNIT I **9 Hours**

INTRODUCTION TO C#

Understanding .NET Framework - Literals – Variables- Data Types – Operators – Constants - Expressions- Program Control Statements: Branching, Looping-Casting - Methods-Arrays: Array Class, Array List- Strings: String, String Builder-Structures - Enumerations

UNIT II **9 Hours**

OBJECT ORIENTED ASPECTS OF C#

Class – Objects, Constructors – Types of Constructors - Inheritance and its types- Indexers and Properties - Polymorphism – Operator and Method Overloading - Interfaces, Abstract Class- Event Handling, Errors and Exception Handling

UNIT III **9 Hours**

APPLICATION DEVELOPMENT ON .NET

Building Windows Application - Creating Window Forms with Events and Controls - Menu and Toolbar - Delegates - Inheriting Window Forms - SDI and MDI Application - Dialog Box: Modal and Modeless

UNIT IV **9 Hours**

DATABASE APPLICATION ON .NET

Accessing data with ADO.NET: DataSet, Typed Dataset, Data Adapter - Updating Database using Stored Procedures - SQL Server with ADO.NET - Handling Exceptions – Validating Controls - Windows Application Configuration

UNIT V **9 Hours**

WEB BASED APPLICATION DEVELOPMENT ON .NET

Programming Web Application with Web Forms - Introduction to ASP.NET, Working with XML and .NET - Creating Virtual Directory and Web Application - Session Management - Web Services – web.config, Passing Datasets and Returning Datasets from Web Services - Transaction Handling, Exception Handling – Returning Exceptions from SQL Server

References:

1. Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2012
2. Christian Nagel et al. “Professional C# 2012 with .NET 4.5”, Wiley India, 2012
3. Andrew Troelsen , “Pro C# 2010 and the .NET 4 Platform, Fifth edition, APress, 2010
4. Ian Griffiths, Matthew Adams, Jesse Liberty, “Programming C# 4.0”, Sixth Edition, O’Reilly, 2010
5. Matthew MacDonald, “Beginning ASP.NET 4.5 in C#”, APress, 2012
6. Stephen C. Perry, “Core C# and .NET”, Prentice Hall, 2005

22IT042 MANAGEMENT INFORMATION SYSTEMS 3 0 0 3

Course Objectives

- Understand the importance of information in business.
- Analyze the technologies and methods used for effective decision making in an organization.

Programme Outcomes (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the principles of a management information system.
2. Analyze the resources and components of Information System.
3. Develop a centralized Information System.
4. Analyze the decision support systems in Information Systems
5. Develop an enterprise application.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	-
2	1	3	2	1	2							2	2	-
3	1	1	2	3	2							3	1	-
4	3	1	2	1	3							2	3	-
5	2	3	3	3	3							1	2	-

UNIT I **7 Hours**

INTRODUCTION TO MANAGEMENT INFORMATION SYSTEMS

Formation of differential equations- Solutions of first order linear ODE: Leibnitzs and method of separation of variables- Cooling/Heating of an object - A falling object- Modeling of electric circuits: RL and RC circuits - Modeling of population dynamics: Exponential growth and decay - Logistic growth model

UNIT II **11 Hours**

TYPES OF INFORMATION SYSTEM (IS)

Resources and components of Information System, integration and automation of business functions and developing business models. Role and advantages of Transaction Processing System, Management Information System, Expert Systems and Artificial Intelligence, Executive Support Systems and Strategic Information Systems.

UNIT III **9 Hours**

ARCHITECTURE & DESIGN OF INFORMATION SYSTEM

Architecture, development and maintenance of Information Systems, Centralized and Decentralized Information Systems, Factors of success and failure, value and risk of IS.

UNIT IV **9 Hours**

INFORMATION SYSTEMS AND DECISION MAKING PROCESS

Programmed and Non - Programmed decisions, Decision Support Systems, Models and approaches to DSS

UNIT V **9 Hours**

INFORMATION SYSTEMS DEVELOPMENT

Planning the Use of IT - Managing the Computing Infrastructure - Enterprise Applications - Outsourcing - user Rights and Responsibilities

Total: 45 Hours

Reference(s)

1 Management Information System, W.S Jawadekar, Tata Mc Graw Hill Publication.
2 Management Information System, David Kroenke, Tata Mc Graw Hill Publication.
3 MIS: Management Perspective, D.P. Goyal, Macmillan Business Books.
4 MIS and Corporate Communications, Raj K. Wadwha, Jimmy Dawar, P. Bhaskara Rao, Kanishka Publishers.
5 MIS: Managing the digital firm, Kenneth C. Landon, Jane P. Landon, Pearson Education.

22ITM43 PROBLEM SOLVING USING C 2 0 2 3

Course Objectives

- Understand various algorithmic techniques for solving problems.
- Learn the construct of a programming language viz. conditional and iteration
- Analyze arrays and strings, and functions

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the programming constructs to develop C programs
2. Develop simple applications in C using basic constructs, decision making and looping
3. Implement different Operations on arrays, strings and functions
4. Implement Programs with Structures and pointers
5. Demonstrate the use of sequential and random-access file processing with the help of programs

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2		2									
2	3	3	2		2		2							
3	3	3	2		2		2							
4	3	3	2		2		2						2	
5	3	3	2		2		2						2	

UNIT I **6 Hours**

PROBLEM SOLVING USING ALGORITHMS

Algorithm Implementation - Top down design - Simple strategies for developing algorithms - Iteration - Recursion - Fundamental algorithms - Anticipating and Dealing with Errors– Scratch tool.

UNIT II **5 Hours**

BASICS OF C PROGRAMMING

Introduction to C programming - C Program Structure - Program Compilation & Execution - Character Set - Keywords - Data Types - Library functions - Control Statements: Branching and Looping.

UNIT III **7 Hours**

ARRAYS AND FUNCTIONS

One dimensional array –Two dimensional arrays –Multidimensional Array-Strings: Defining, initializing of strings, Processing strings, Array of Strings- Introduction to functions- Storage Classes - Scope Rules - Built-in and user defined functions –Passing Arrays to Function - Call by value – Call by reference - Recursion

UNIT IV **7 Hours**

POINTERS AND STRUCTURES

Wireless Industry Standards, Wireless Communication Platforms for LANs, Wireless WANs, Facilitators of a Wireless Environment, Concerns for the Mobile Enterprise.

UNIT V **5 Hours**

FILE PROCESSING

Files — Basic file handling functions - Types of file processing: Sequential access file - Random access file – Transaction processing using random access files — Command line arguments – Macros and Pre-processor directives.

EXPERIMENT 1 **3 Hours**

Write a C program to perform arithmetic operations on integers and floating point numbers..

EXPERIMENT 2 **3 Hours**

Write a C program to implement ternary operator and relational operators.

EXPERIMENT 3 **3 Hours**

Write a C program to read the values of A, B, C through the keyboard. Add them and after addition check if it is in the range of 100 to 200 or not. Print separate message for each.

EXPERIMENT 4 **3 Hours**

Write a C program to display the roots of a quadratic equation with their types using switch case.

EXPERIMENT 5 **3 Hours**

Write a C program to generate the following triangle.

1
1 2 3
1 2 3 4 5
1 2 3 4 5 6 7

EXPERIMENT 6 **3 Hours**

Write a C program to get a matrix of order 3x3 and display a matrix of order of 4x4, with the fourth row and column as the sum of rows and columns respectively.

EXPERIMENT 7 **3 Hours**

Write a C program to remove the occurrence of "the" word from entered string

EXPERIMENT 8 **3 Hours**

Write a C program to find the factorial of given number.

EXPERIMENT 9 **3 Hours**

Design a structure to hold the following details of a student. Read the details of a student and display them in the following format Student details: rollno, name, branch, year, section, cgpa. **********

NAME:
ROLL NO:
BRANCH:
YEAR:
SECTION:
CGPA:

EXPERIMENT 10 **3 Hours**

Create two files test1.txt and test2.txt and write a C program to read the file text1.txt character by character on the screen and paste it at the end of test2.txt.

Total: 60 Hours

Reference(s)

1 Herbert Schildt, C -The complete Reference, Tata McGraw-Hill, 2013
2 Byron Gottfried , Programming with C, Schaum's Outlines, Tata Mcgraw-Hill,
3 E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012
4 Kernighan B W and Ritchie O M, The C programming Language. Prentice-Hall of India, 2009

22ITM44 DATA STRUCTURES USING C++ 2 0 2 3

Course Objectives

- Understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures
- Analyze the performance of algorithms using time and space complexity.
- Understand the behavior of Linear and Non-Linear data structures
- Choose the appropriate data structures for a specified application
- Write programs in C++ to solve problems using various data structures.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSO1 Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the performances of the sorting and searching algorithms
2. Apply linked list linear data structures operations using dynamic memory allocation
3. Apply stack and Queue data structure operations to solve computational problems
4. Design tree data structures and hashing techniques for effective searching of data
5. Build algorithms for solving real world problems using Graph data structure

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2		2									
2	3	3	2		2		2							
3	3	3	2		2		2							
4	3	3	2		2		2						2	
5	3	3	2		2		2						2	

UNIT I **5 Hours**

INTRODUCTION

Introduction to data structures-types of data structures- Pseudo code - Abstract data types - ADT Implementations performance analysis- time complexity and space complexity- basics of OOPS concepts.

UNIT II **6 Hours**

SORTING AND SEARCHING TECHNIQUES

Searching methods: Linear and binary search methods, Sorting techniques: Insertion Sort - Selection Sort - Bubble Sort - Merge sort - Quick sort.

UNIT III **6 Hours**

LINEAR DATA STRUCTURES

Stack operation - Stack ADT - Applications of stack - Queues operations - Queue ADT - Queue applications – Linked List - Circular - Doubly linked list.

UNIT IV **6 Hours**

TREE

Basic Tree concepts - Binary Trees - Tree Traversals - Binary Search Trees – B Tree - Heap concepts - Heap ADT.

UNIT V **7 Hours**

GRAPHS

Introduction – types of graph- Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm. Minimum Spanning Tree: Prim's Algorithm - Kruskal's Algorithm- graph search methods DFS, BFS

EXPERIMENT 1 **3 Hours**

Implementation of searching algorithms
a) Linear Search
b) Binary Search

EXPERIMENT 2 **4 Hours**

Implementation of sorting algorithms
a) Insertion sort
b) Selection sort
c) Quick sort
d) Merge sort

EXPERIMENT 3 **4 Hours**

Construct a stack ADT and perform push and pop operations.

EXPERIMENT 4 **4 Hours**

Construct a Queue ADT and perform enqueue and dequeue operations.

EXPERIMENT 5 **3 Hours**

Develop a program to create a Binary Search Tree and to traverse the tree.

EXPERIMENT 6 **3 Hours**

Compute the shortest path from a single source node using Dijikstras Algorithm.

EXPERIMENT 7 **4 Hours**

Construct a graph and perform graph traversal (BFS, DFS)

EXPERIMENT 8 **5 Hours**

Develop a program to construct a minimum spanning tree with the given graph using:
a) Prims Algorithm
b) Krushkals Algorithm

Total: 60 Hours

Reference(s)

1. A Abirami, Priya R L , Advanced Data Structures and Algorithms , BPB publisher, 2023 March.
2. Data Structures using C++, Special Edition-MRCET, Tata McGraw-Hill Publishers 2017.
3. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and Mount, Wiley student edition, John Wiley and Sons, 2011.
4. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition, 2013.
5. D.S. Malik, Data Structures Using C++, Second Edition 2010.

22ITM45 DATABASE PROGRAMMING USING SQL 2 0 2 3

Course Objectives

- Understand the basics of database design and relational model.
- Use SQL commands to interact with the database and perform various operations in the database.
- Design a real-world application connected with backend database

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PSO1: Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Identify and analyze the essential concepts and key issues involved in the design of a database.
2 Apply the concepts of relational model and relational query language to perform various database operations.
3 Design database using basic SQL commands.
4 Implement integrity constraints, authorization and TCL commands in SQL.
5 Implement PL/SQL programming and database connectivity using JDBC/ODBC.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		2		2			3					1	
2	2	3	3		2								2	
3	3		2		3								1	
4	3		3		3								1	
5	3	2	3										1	

Unit I **5 Hours**

DATABASE DESIGN

Database-System Applications, Purpose of Database Systems – File system drawbacks, Data Models, View of Data, Database Languages, Database Architecture, Database Users and Administrators.

Unit II **5 Hours**

RELATIONAL MODEL

Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Algebra operations – select, project, union, set difference, Cartesian product, rename.

Unit III **8 Hours**

BASIC SQL QUERY

Introduction to SQL, SQL domain types, Basic DDL commands – Create, Insert, delete, alter, drop, and rename, SQL Clause - select, where, from, order by, between, and, or, not, String operations in SQL, Set operations, null values in SQL, Aggregate functions and its clauses.

Unit IV **6 Hours**

INTERMEDIATE SQL QUERY

SQL Join operations, Views in SQL, Integrity constraints in SQL – not null, primary key, foreign key, unique and check, Assertions, TCL Commands – Commit, Save point and Rollback, Authorization in SQL – grant, revoke and roles.

UNIT V **6 Hours**

PL/SQL PROGRAMMING AND DATABASE CONNECTIVITY

PL/SQL Programming - Functions, Procedures, Triggers and Cursors, Database connectivity with an application.

List of Laboratory Experiments

EXPERIMENT 1 **5 Hours**

Data Definition Language and Data Manipulation Language commands

EXPERIMENT 2 **3 Hours**

SQL Clause, String operations in SQL, Set operations and Aggregate functions.

EXPERIMENT 3 **3 Hours**

Views, Joins and Integrity constraints in SQL

EXPERIMENT 4 **3 Hours**

Transaction Control Language and Authorization commands in SQL

EXPERIMENT 5 **2 Hours**

Database Programming: Implicit and Explicit Cursors

EXPERIMENT 6 **2 Hours**

Procedures and Functions

EXPERIMENT 7 **2 Hours**

Database Programming: Triggers

EXPERIMENT 8 **3 Hours**

Database Connectivity with Front End Tools

EXPERIMENT 9

Case Study using real life database applications

Total 60 Hours

References

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.
3. C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
5. G.K.Gupta, Database Management Systems, Tata McGraw Hill, 2011.

22ITM46 ROBOTIC PROCESS AUTOMATION TECHNIQUES

2 0 2 3

Course Objectives

- Provide insights on robotic process automation (RPA) technology and its value proposition.
- Introduce different platforms for RPA.
- Illustrate basic programming concepts and the underlying logic/structure related to RPA.
- Describe the different types of variables, Control Flow and data manipulation techniques in a RPA platform.
- Describe automation to Email and various types of Exceptions and strategies to handle.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PSO1: Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the need for Robotic Process Automation Technology.
2. Apply several types of data inside a workflow and build workflows in a RPA platform.
3. Analyze Image, Text and Data Tables Automation.
4. Analyze Desktop, Web and Citrix Automation.
5. Design automation to Email and various types of Exceptions and strategies to handle.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2		1					2	1		1	
2	2	3	3		2					2	1		1	
3	3	2	3		2					3	2		2	
4	2	2	3		3					2	3		2	
5	2	3	3		3					2	3		3	

Unit I **8 Hours**

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION

Evolution of RPA- Future of RPA- Differentiating RPA from Automation- Benefits- Types of Bots- Application areas of RPA- Working of Robotic Process Automation- RPA development methodology and key considerations- Basic components in a RPA platform- Types of Templates- User Interface- Domains in Activities- Workflow Files in the RPA platform.

Unit II **6 Hours**

PROCESS COMPONENTS AND ACTIVITIES

User Interface Automation Activities - System Activities – Variables - Managing Variables - Naming Best Practices – The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables – Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices – The Arguments Panel - Using Arguments - Imports Panel and User Events.

Unit III **5 Hours**

APP INTEGRATION, RECORDING AND SCRAPING

App Integration - Recording- Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - Workflow Activities.

Unit IV **6 Hours**

DATA MANIPULATION AND PDF AUTOMATION

Data Manipulation- Automation of Virtual Machines- Introduction to Native Citrix Automation- Image based automation - Keyboard based automation – Information Retrieval - Advanced Citrix Automation challenges - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

UNIT V **5 Hours**

WORKFLOW MANAGEMENT AUTOMATION

Programming – Debugging - Error Handling – Logging – Extensions -Project Organization -RPA Orchestrator Overview, Orchestrator activities, Introduction to Orchestrator Community Edition (CE).

List of Laboratory Experiments

EXPERIMENT 1 **3 Hours**

Install UI path and UI path Studio

EXPERIMENT 2 **3 Hours**

Create a sequence with user's first and last name as input, and order user's favorite snacks, and display the amount

EXPERIMENT 3 **3 Hours**

Design a Process to perform a basic calculation using Arguments.

EXPERIMENT 4 **3 Hours**

Build a Guessing game using Flow Chart

EXPERIMENT 5 **3 Hours**
Create a workflow to display welcome message when the user enters the correct password.

EXPERIMENT 6 **3 Hours**
Create a workflow that will input data from a spreadsheet into the form fields of RPA Challenge.

EXPERIMENT 7 **3 Hours**
Create an automation process that goes through each element of an array, write the length of array and each element to the output panel.

EXPERIMENT 8 **3 Hours**
Design a process to read and closes all PDF files from a folder.

EXPERIMENT 9 **3 Hours**
Automate Calculator Application using Desktop recording

EXPERIMENT 10 **3 Hours**
Handel the Format exception and System exception in basic calculation program.

Total 60 Hours

References

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, Mumbai, 2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.
3. Richard Murdoch, "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant" (1st Edition), Independently published, 2018. ISBN 978-1983036835
4. A Gerardus Blokdyk, "Robotic Process Automation RpaA Complete Guide ", 2020

Online Resources

1. https://www.automationanywhere.com/rpa/robotic-process-automation
2. https://www.geeksforgeeks.org/robotics-process-automation-an-introduction/

22ITM47 FRONT END DESIGN USING HTML, CSS 2 0 2 3

Course Objectives

- Provide basic knowledge of web design using HTML and CSS
- Develop elegant and responsive Front-end by leveraging latest technologies

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1 Understand foundational web concepts, architectures, and technologies.

2 Develop meaningful HTML documents.

3 Apply class attributes of HTML elements to use multimedia contents in their webpage design.

4 Apply various CSS styling techniques to enhance the visual presentation of web pages.

5 Analyze control layout and positioning of HTML elements to grasp the user attention on web pages.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3	2		1						1	2	1	
2	2	3	2		3						3	3	2	
3	2	3	2		3						3	3	2	
4	3	3	2		3						3	3	1	
5	1	3	2		3						3	3	2	

Unit I **6 Hours**

INTRODUCTION

Web Basics: Internet, Intranet, WWW, Static and Dynamic Web Page; Web Clients; Web Servers; Client Server Architecture: Single Tier, Two-Tier, Multi-Tier; HTTP: HTTP Request and Response; URL, Client Side Scripting, Server Side Scripting, Web 1.0, Web 2.0.

Unit II **6 Hours**

HYPER TEXT MARKUP LANGUAGE – PART 1

Introduction to HTML; Elements of HTML Document; HTML Elements and HTML Attributes, Headings, Paragraph, Division, Formating: b, i, small, sup, sub; Spacing: Pre, Br; Formatting Text Phrases: span, strong, ; Image element; Anchors; Lists: Ordered and Unordered and Definition; Tables; Frames.

Unit III **6 Hours**

HYPER TEXT MARKUP LANGUAGE – PART 2

Forms: Form Elements, ID attributes, Class Attributes of HTML Elements; Meta Tag, Audio, Video, Canvas, Main, Section, Article, Header, Footer, Aside, Nav, Figure Tags; HTML Events: Window Events, Form Element Events, Keyboard Events, Mouse Events.

Unit IV **6 Hours**

CASCADING STYLE SHEETS

Introduction; Cascadding Style Sheets (CSS); CSS Syntax; Inserting CSS: Inline, Internal, External, ID and Class Selectors; Colors; Backgrounds; Borders; Text; Font; List; Table; CSS Box Model; Normal Flow Box Layout: Basic Box Layout, Display Property, Padding, Margin; Positioning: Relative, Float, Absolute; CSS3 Borders, Box Shadows, Text Effects and shadow; Basics of Responsive Web Designs; Media Queries, Introduction to Bootstrap.

UNIT V **6 Hours**

LAYOUTS: FLOATS, FLEXBOX, AND CSS GRID FUNDAMENTALS

The 3 ways of building layout - Building a simple float layout – Introduction to Flexbox – Spacing and Aligning Flex Items – The Flex Property - Building a simple flexbox layout – Introduction to CSS Grid – Sizing Grid Columns and Rows – Placing and Spanning Grid Items – Aligning Grid Items and Tracks – Building a Simple CSS Grid Layout.

List of Laboratory Experiments

EXPERIMENT 1 **2 Hours**

Introduction to Web Design and HTML

EXPERIMENT 2 **3 Hours**

HTML Tags:-Develop and demonstrate a HTML document that illustrates

a. Use of Formatting Text.
b. Headings tags(H1,H2,H3,H4,H5,H6)
c. Font Details (Font Size,Style, Type, Color)
d. Setting Color(BG Color)

EXPERIMENT 3 **3 Hours**

Table & Lists:- Develop and demonstrate a HTML document that illustrates

a. Unordered List (UL)
b. Ordered List (OL) and Definition list (DL)
c. Table Alignment (Cell Spacing, Cell Padding, Height, Width, Border, Rowspan, colspan)
d. Setting Different Table Attributes (Color, Image)

EXPERIMENT 4 **4 Hours**

Image & Link:- Develop and demonstrate a HTML document that illustrates

a. Image as a background
b. Hyperlink using an image
c. Hyperlink with another web page (A, Base, Href)
d. Link to email address, FTP Websites

EXPERIMENT 5 **5 Hours**

Forms:- Develop and demonstrate a HTML document that illustrates
Create "Website Login Form" which consists of following details User Name , Password Address, Ph no, Sex, Hobbies, Date Of Birth ,Country , along with submit and Reset Button.

EXPERIMENT 6 **4 Hours**

Multimedia:-

a. Develop a web page to play audio file using Tag.
b. Develop a web page to play video file using Tag.

EXPERIMENT 7 **4 Hours**

DHTML

a. Create a CSS document on Internal style sheet
b. Create a CSS document on External style sheet
c. Create a CSS document on In line style sheet
d. Create a CSS document on placing Images at different position

EXPERIMENT 8 **5 Hours**

Use Inspector/Firebug to try different layouts using the CSS position directive. Move picture, interests and course info around. Here's a reference on CSS positioning. Put picture on the right and the rest of info on the left.

Total 60 Hours

References

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education,2007.
3. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
4. Marty Hall and Larry Brown, Core Web Programming Second Edition, Volume I and II,Pearson Education, 2001.

Online Resources

1. https://www.w3schools.com/html/html_css.asp
2. https://www.javatpoint.com/html-with-css
3. https://www.geeksforgeeks.org/html-tutorial/

22ITM48 DATA ANALYSIS USING PYTHON 2 0 2 3

Course Objectives

- Impart knowledge about the basic of python, class and objects, modules and files
- Understand the steps in preprocessing the data.
- Perform descriptive statistics and data visualization techniques to present insights from the data.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PSO2: Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1 Understand the basics of python for performing data analysis.

2 Implement standard data visualization and data analysis procedures.

3 Analyze the data with a wider range of exploratory and inferential methods.

4 Perform simple statistical analysis, create meaningful data visualizations and predict future trends from data.

5 Implement python packages for mathematical, scientific applications and for web data analysis.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2			3	2								3
2	2	3	2		3									2
3		3			3	3								2
4	3	2	2		3									3
5			2		3	2								3

Unit I **7 Hours**

PYTHON FUNDAMENTALS FOR DATA ANALYSIS

Python data structures - Control statements – Functions - Object Oriented programming concepts using classes - objects and methods - Exception handling - Implementation of user-defined Modules and Package -File handling in python.

Unit II **5 Hours**

INTRODUCTION TO DATA UNDERSTANDING AND PREPROCESSING

Data Analysis process - Dataset generation - Importing Dataset: Importing and Exporting Data - Basic insights from Datasets - Cleaning and Preparing the Data: Identify and Handle Missing Values.

Unit III **8 Hours**

DATA PROCESSING AND VISUALIZATION

Data Formatting - Exploratory Data Analysis - Filtering and hierarchical indexing using Pandas - Data Visualization: Basic Visualization Tools - Specialized Visualization Tools - Seaborn Creating and Plotting Maps.

Unit IV **5 Hours**

MATHEMATICAL AND SCIENTIFIC APPLICATIONS FOR DATA ANALYSIS

Numpy and Scipy Package - Understanding and creating N-dimensional arrays - Basic indexing and Slicing - Boolean indexing - Fancy indexing - Universal functions.

UNIT V **5 Hours**

ANALYZING WEB DATA

Data wrangling - Web scraping - Combining and merging data sets - Reshaping and pivoting - Data Transformation - String Manipulation - Case study for web scraping.

List of Laboratory Experiments

EXPERIMENT 1 **4 Hours**

Programs to demonstrate usage of control

a. Program that reads a set of integers and displays the first and second largest numbers.
b. Program to print the sum of first ‘n’ natural numbers.
c. Program to find the product of two matrices.

EXPERIMENT 2 **4 Hours**

Clean and prepare the California housing dataset for analysis.

a. Identify and handle missing data.
b. Identify and remove outliers.
c. Convert categorical variables to numerical variables.
d. Explore the distribution of the data after cleaning and preparing it.

EXPERIMENT 3 **8 Hours**

Visualizations

a. Find the data distributions using box and scatter plot.
b. Visualizing Measures of Central Tendency, Variation, and Shape.
c. Show the outliers using plot.
d. Plot the histogram, bar chart and pie chart on sample data.
e. Find the mean, median, standard deviation and quantiles of a set of observations

EXPERIMENT 4 **6 Hours**

Write a program to create numpy arrays and do slice arrays, add array indexes, and apply arithmetic, logic, and aggregation functions to some or all array elements.

EXPERIMENT 5 **8 Hours**

Implement Data wrangling with the below functionalities:

a. Load the data into a dataframe, and visualize the data in a tabular format.
b. Dealing with missing values
c. Data Replace
d. Filtering data
e. Merge two raw data into the desired format
f. Remove Duplication

Total 60 Hours

References

1. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media.
2. ReemaThareja, "Python Programming using Problem Solving approach",Oxford University press .
3. Wes Mckinney "Python for Data Analysis", First edition, Publisher O'Reilly Media.

Online Resources

1. https://www.w3schools.com/datascience/ds_python.asp
2. https://www.geeksforgeeks.org/data-science-with-python-tutorial/

22ITM49 SOFTWARE ENGINEERING METHODOLOGIES **2 0 2 3**

Course Objectives

- Understand Software Engineering Lifecycle Models
- Perform software requirements analysis
- Understand the System Analysis and Design concepts
- Understand software testing and maintenance approaches

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO2: Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1 Understand various Software Development Lifecycle Models.

2 Classify end-user requirements into system and software requirements

3 Analyze project management approaches as well as cost and schedule estimation strategies

4 Apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices

5 Develop a simple testing report

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3									1		3
2	2	1	2		1									2
3	2	1	3											2
4	1	2	3	2								1		3
5	1	2	3									1		3

Unit I **6 Hours**

SOFTWARE PROCESS AND PROJECT MANAGEMENT

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile process-Extreme programming-XP Process.

Unit II **5 Hours**

REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document — Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management.

Unit III **8 Hours**

SOFTWARE DESIGN

Design process — Design Concepts-Design Model– Design Heuristic — Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design

Unit IV **6 Hours**

TESTING AND MAINTENANCE

Software testing fundamentals-Internal and external views of Testing-white box testing — basis path testing-control structure testing-black box testing- Regression Testing — Unit Testing — Integration Testing — Validation Testing — System Testing and Debugging

UNIT V **5 Hours**

PROJECT MANAGEMENT

Software Project Management: Estimation — LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model — Project Scheduling — Scheduling, Earned Value Analysis Planning — Project Plan, Planning Process, RFP Risk Management — Identification, Projection — Risk Management-Risk Identification- RMMM Plan-CASE TOOLS

List of Laboratory Experiments

EXPERIMENT 1 **3 Hours**

Development of problem statements.

EXPERIMENT 2 **5 Hours**

Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents.

EXPERIMENT 3 **4 Hours**

Preparation of Software Configuration Management and Risk Management related documents.

EXPERIMENT 4 **8 Hours**

Performing the design by using any design phase CASE tools

EXPERIMENT 5 **4 Hours**

Develop test cases for unit testing and integration testing

EXPERIMENT 6 **6 Hours**

Develop test cases for various white box and black box testing techniques.

Laboratory	**30 Hours**
Theory	**30 Hours**
Total	**60 Hours**

References

1. Roger S. Pressman, "Software Engineering – A practitioner's Approach", Sixth Edition, McGraw-Hill International Edition, 2010 220- 294
2. Ian Sommerville, ―Software Engineering‖, 9th Edition, Pearson Education Asia, 2011 360- 427

Online Resources

1. https://www.geeksforgeeks.org/software-engineering-software-design-process/
2. https://www.geeksforgeeks.org/test-case/
3. https://www.javatpoint.com/test-case

22OIT01 DATA STRUCTURES 3 0 0 3

Course Objectives

- Understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures
- Analyze the performance of algorithms using time and space complexity.
- Understand the behavior of Linear and Non-Linear data structures
- Choose the appropriate data structures for a specified application
- Write programs in C++ to solve problems using various data structures.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the performances of the sorting and searching algorithms
2. Apply linked list linear data structures operations using dynamic memory allocation
3. Apply stack and Queue data structure operations to solve computational problems
4. Design tree data structures and hashing techniques for effective searching of data
5. Build algorithms for solving real world problems using Graph data structure

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2		2									
2	3	3	2		2		2							
3	3	3	2		2		2							
4	3	3	2		2		2						2	
5	3	3	2		2		2						2	

UNIT I **8 Hours**

INTRODUCTION

Introduction to data structures-types of data structures- Pseudo code - Abstract data types - ADT Implementations performance analysis- time complexity and space complexity- basics of OOPS concepts.

UNIT II **9 Hours**

SORTING AND SEARCHING TECHNIQUES

Searching methods: Linear and binary search methods, Sorting techniques: Insertion Sort - Selection Sort - Bubble Sort - Merge sort - Quick sort.

UNIT III **11 Hours**

LINEAR DATA STRUCTURES

Stack operation - Stack ADT - Applications of stack - Queues operations - Queue ADT - Queue applications – Linked List - Circular - Doubly linked list.

UNIT IV **11 Hours**

TREE

Basic Tree concepts - Binary Trees - Tree Traversals - Binary Search Trees – B Tree - Heap concepts - Heap ADT.

UNIT V **6 Hours**

GRAPHS

Introduction – types of graph- Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm. Minimum Spanning Tree: Prim's Algorithm - Kruskal's Algorithm- graph search methods DFS, BFS

Total: 45 Hours

Reference(s)

1. A Abirami, Priya R L , Advanced Data Structures and Algorithms , BPB publisher, 2023 March.
2. Data Structures using C++, Special Edition-MRCET, Tata McGraw-Hill Publishers 2017.
3. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and Mount, Wiley student edition, John Wiley and Sons, 2011.
4. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition, 2013.
5. D.S. Malik, Data Structures Using C++, Second Edition 2010

22OIT02 C++ PROGRAMMING 2 0 2 3

Course Objectives

- Understand the concept of Object-Oriented Programming
- Apply the Object-Oriented concepts to solve problems using C++

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Implement C++ programs using classes and objects.
2. Develop C++ programs using the concept of Inheritance.
3. Design applications using virtual functions.
4. Understand the concept of Operator overloading.
5. Develop GUI applications using C++ library classes.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2			2									
2	1	2			2									
3	1	3	2		2								2	
4	1	3	1		2								2	
5	1	3	3		2								3	

UNIT I **5 Hours**

BASICS OF C++ PROGRAMMING

C++ Program Structure, Character Set and Tokens, Data Type, Type Conversion, Preprocessor Directives, Namespace, Input/output Streams and Manipulators, Dynamic Memory Allocation with new and delete, Control Statements. Functions: Function Overloading, Inline Functions, Default Argument, Pass by Reference, Return by Reference, Scope and Storage Class. Pointers: Pointer variables declaration & initialization, Operators in pointers, Pointers and Arrays, Pointer and Function.

UNIT II **6 Hours**

CLASSES & OBJECTS

A Simple Class and Object, accessing members of class, Initialization of class objects: (Constructor, Destructor), Default Constructor, Parameterized Constructor, Copy Constructor, The Default Copy Constructor, Objects as Function Arguments, Returning Objects from Functions, Structures and Classes, Memory allocation for Objects, Static members, Member functions defined outside the class.

UNIT III **7 Hours**

OPERATOR OVERLOADING & INHERITANCE

Fundamental of operator overloading, Restriction on operator overloading, Operator functions as a class member, Overloading unary and binary operator, Introduction to inheritance, Derived Class and Base Class, Access Specifiers (private, protected, and public), Types of inheritance.

UNIT IV **6 Hours**

VIRTUAL FUNCTION & POLYMORPHISM

Concept of Virtual functions, Late Binding, Abstract class and pure virtual functions, Virtual Destructors, Virtual base class, Friend function and Static function, Assignment and copy initialization, Copy constructor, This pointer, Concrete classes, Polymorphism and its roles.

UNIT V **6 Hours**

FUNCTION TEMPLATES AND EXCEPTION HANDLING

Function templates, Function templates with multiple arguments, Class templates, templates and inheritance, Exceptional Handling (Try, throw and catch), Use of exceptional handling.

List of Laboratory Experiments

Experiment 1 **3 Hours**

Introduction to Object Oriented Programming- Classes and Objects.

Experiment 2 **5 Hours**

Programs using Constructor, Destructor

Experiment 3 **4 Hours**

Programs on operator overloading.

Experiment 4 **5 Hours**

Programs on Inheritance

Experiment 5 **3 Hours**

Programs on Virtual Function

Experiment 6 **3 Hours**

Programs on Friend Function

Experiment 7 **3 Hours**

Programs on exception handling

Experiment 8 **4 Hours**

Programs on Function and Class Templates

Total 60 Hours

Reference(s)

1. E Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing, New Delhi, 2011.
2. Robert Lafore, Object Oriented Programming in C++, Galgotia Publication, 2010.
3. B Trivedi, Programming with ANSI C++, Oxford University Press, 2010
4. H M Deitel and P J Deitel, C++ How to Program, Seventh Edition, Prentice Hall, 2010
5. K R Venugopal, Rajkumar and T Ravishankar, Mastering C++, Tata McGraw Hill Publishing, New Delhi, 2010

22OIT03 PROGRAMMING IN JAVA 2 0 2 3

Course Objectives

- Understand the concept of Object-Oriented Programming
- Develop console applications using Java.
- Develop GUI applications using Java library classes.

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Implement Java programs using classes and objects.
2. Develop Java programs using the concept of Inheritance.
3. Design applications using functions, files and exceptions.
4. Develop console applications using Java OOPS.
5. Develop GUI applications using Java library classes.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2			2									
2	1	2			2									
3	1	3	2		2								2	
4	1	3	1		2								2	
5	1	3	3		2								3	

UNIT I **6 Hours**

INTRODUCTION TO OOP AND JAVA FUNDAMENTALS

Object Oriented Programming — Abstraction — objects and classes — Encapsulation- Inheritance — Polymorphism- OOP in Java — Characteristics of Java — The Java Environment — Java Source File - Structure — Compilation. Fundamental Programming Structures in Java — Defining classes in Java — constructors, methods -access specifiers — static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages — JavaDoc comments.

UNIT II **6 Hours**

INHERITANCE AND INTERFACES

Inheritance — Super classes- sub classes –Protected members — constructors in sub classes- the Object class — abstract classes and methods- final methods and classes — Interfaces — defining an interface, implementing interface, differences between classes and interfaces and extending interfaces — Object cloning -inner classes, Array Lists — Strings

UNIT III **6 Hours**

EXCEPTION HANDLING AND I/O

Exceptions — exception hierarchy — throwing and catching exceptions — built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics — Streams — Byte streams and Character streams — Reading and Writing Console — Reading and Writing Files

UNIT IV **6 Hours**

MULTITHREADING AND GENERIC PROGRAMMING

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming — Generic classes — generic methods — Bounded Types — Restrictions and Limitations.

UNIT V **6 Hours**

EVENT DRIVEN PROGRAMMING

Graphics programming — Frame — Components — working with 2D shapes — Using color, fonts, and images — Basics of event handling — event handlers — adapter classes — actions — mouse events — AWT event hierarchy — Introduction to Swing — layout management — Swing Components — Text Fields, Text Areas — Buttons- Check Boxes — Radio Buttons — Lists- choices- Scrollbars — Windows –Menus — Dialog Boxes.

List of Laboratory Experiments

Experiment 1 **4 Hours**

Introduction to Object Oriented Programming- Classes and Objects.

Experiment 2 **5 Hours**

Programs using inheritance and polymorphism

Experiment 3 **5 Hours**

Programs on operator overloading.

Experiment 4 **5 Hours**

Programs on exception handling

Experiment 5 **5 Hours**

Programs on multi-threading in java

Experiment 6 **6 Hours**

Programs on java swing

Total 60 Hours

Reference(s)

1 Herbert Schildt, Java: The Complete Reference, Eleventh Edition, McGraw-Hill Education, 2018.
2 D.T. Editorial Services, Java 8 Programming Black Book, second edition, Dreamtech Press,2015.
3 Vaskaran Sarcar, Interactive Object-Oriented Programming in Java, Second edition, Apress, 2019

22OIT04 FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS

2 0 2 3

Course Objectives

- Understand functional components of the Database Management System
- Understand need for concurrency and transaction property
- Compare and contrast various indexing strategies in different database systems

Programme Outcomes (POs)

PO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PSO1: Design and develop cost effective, secure, reliable IT, network and web-based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze the essential concepts and key issues involved in the design of a relational database
2. Apply the concepts of normalization and ER model to guarantee an efficient database
3. Analyze the concurrent execution of transaction process and various recoveries from failures
4. Apply indexing and query optimization techniques for a database design
5. Analyze the various advanced database systems for efficient data storage & NOSQL concepts.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		2		2			3					1	
2	2	3	3		2								1	
3	3		2		3								2	
4	3		3		3								2	
5	3	2	3										2	

Unit I RELATIONAL DATABASES 6 Hours

Purpose of Database System - Views of data - Data Models - Database System Architecture - Introduction to relational databases - Relational Model - Keys - Relational Algebra - SQL fundamentals - Advanced SQL features

Unit II DATABASE DESIGN 6 Hours

Entity-Relationship model - E-R Diagrams - Enhanced-ER Model - ER-to-Relational Mapping - Functional Dependencies - First, Second, Third Normal Forms, - Boyce/Codd Normal Form- Multivalued Dependencies and Fourth Normal Form

Unit III TRANSACTION 6 Hours

Transaction Concepts - ACID Properties - Schedules - Serializability - Concurrency Control -Need for Concurrency - Locking Protocols - Two-Phase Locking - Deadlock - Transaction Recovery - Save Points - Isolation Levels

Unit IV FILE AND QUERY PROCESSING 6 Hours

RAID - File Organization - Organization of Records in Files - Indexing and Hashing -Ordered Indices - Static Hashing - Dynamic Hashing - Query Processing Overview - Algorithms for SELECT and JOIN operations

UNIT V ADVANCED DATABASES 6 Hours

Distributed Databases: Architecture, Data Storage, Transaction Processing - Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - Graph Database.

List of Laboratory Experiments

Experiment 1 5 Hours

Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables with suitable examples.

Experiment 2 5 Hours

Implementation of different types of operators in SQL

- Arithmetic Operators
- Logical Operators
- Comparison Operator
- Special Operator
- Set Operation

Experiment 3 3 Hours

Database Querying - Simple queries, Nested queries, Sub queries & Joins

Experiment 4 3 Hours

Implement

- Group By & having clause
- Order by clause
- Indexing

Experiment 5 **4 Hours**

Create a student database table currently stored as a single table. Normalize these structures to meet the 3NF requirements and draw ER model Diagram

Experiment 6

Implementation of Database Backup & Recovery commands, Rollback, Commit & Savepoint. **5 Hours**

Experiment 7 **5 Hours**

Develop database for a BOOK PUBLISHING COMPANY

Total 60 Hours

References

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.
3. C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
5. G.K.Gupta,Database Management Systems, Tata McGraw Hill, 2011.

Online Resources

1. https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/
2. https://www.javatpoint.com/dbms-tutorial
3. https://onlinecourses.nptel.ac.in/noc22_cs91

22OCE01 ENERGY CONSERVATION AND MANAGEMENT 3 0 0 3

Course Objectives

- To develop an understanding and analyze the energy data of industries
- To carryout energy accounting and balancing
- To conduct energy audit and suggest methodologies for energy savings and
- To utilize the available resources in optimal ways

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Classify and characterize the energy resources.
2. Illustrate the concept of green building.
3. Outline the sustainable construction practices.
4. Understand the hydropower production and conservation of water.
5. Emphasis the significance of energy and resource recovery from waste materials.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1											1		
2	1	2					2					1		1
3	1	2					2					1		1
4	1	2					2					1		1
5	1	2					2					1		1

UNIT I **9 Hours**

INTRODUCTION TO ENERGY SCIENCE

Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment. Energy - Past & Present scenario of World; Renewable and Nonrenewable energy resources.

UNIT II **9 Hours**

ENERGY CONSERVATION IN BUILDINGS

Principles of Planning of buildings: orientation, energy efficiency, utility. Components of building-classification of buildings. Green building - LEED building assessment standard – LEED certification process - Building rating system - Building energy issues – Building energy design strategies – Energy Auditing.

UNIT III **9 Hours**

SUSTAINABLE CONSTRUCTION

Equipment use in excavations, foundation, concreting. Advanced Techniques in tunneling, under water construction, piling techniques, Innovations & efficiency in Highways, Railways & Harbours - linkages between economic and environmental outcomes

UNIT IV **9 Hours**

WATER CONSERVATION AND SUSTAINABILITY

Types of reservoirs and its functions – Hydropower production – Types of Turbines & selections of turbines & Energy calculations. Water losses from reservoirs and channels – Canal lining & its economic aspects. Water supply systems & Irrigation methods - Rain Water Harvesting methods & benefits.

UNIT V **9 Hours**

ENERGY RECOVERY FROM WASTE

Classification and sources of wastes- Factors affecting MSW generation – Waste management hierarchy - Energy recovery from wastes: Thermochemical methods for energy production - Details of incineration, gasification and pyrolysis & biochemical conversions - Landfill gas recovery system - Principles of fermentation - Concept of MFC - Trans-esterification process - Biofuel processing - Biomass gasification - Organic waste for hydrogen production.

Total: 45 Hours

Reference(s)

1. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
2. Charles. J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, Inc., New Jersey, 2008.
3. H. M. Raghunath, Irrigation Engieering, Wiley India (P) Ltd, 2011
4. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company
5. M. Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House, ISBN-10: 8173191409,1997.
6. Lal, P.M. Sarma, Priyangshu M, Wealth from Waste: Trends and Technologies, 3rd Edition, The Energy and Resources Institute, New Delhi, ISBN: 9788179934241, 2011.
7. W. McDonough, M. Braungart, Cradle to Cradle: Remaking the Way We Make Things, United States: North Point Press, ISBN-10: 0865475873, 2002.

22OEC02 MICROCONTROLLER PROGRAMMING 3 0 0 3

Course Objectives

- Understand Series of Microcontrollers in terms of architecture, Programming and Interfacing.
- Learn Programming of PIC series of microcontrollers and learn building of hardware circuits using PIC 16F series of Microcontrollers
- Learn the emerging trends in the design of advanced Microcontrollers.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Interpret the components and functionalities of 8051 Microcontrollers.
2. Develop microprocessor applications using the Assembly Language Program
3. Illustrate the working nature of PIC microcontroller on various versions
4. Illustrate the interfacing of different peripherals using PIC Microcontroller
5. Analyze the architecture and instruction set of ARM Microcontroller

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											2
2	1	3	1											2
3	1	1	2		1									2
4	1	1	2		3									2
5	1	1	3		2									2

UNIT I **9 Hours**

8-BIT MICROCONTROLLER

Introduction-Intel 8051 architecture-Counters and Timers-Serial Interface- Interrupts- Interfacing to external memory and 8255- Instruction set- Address modes.

UNIT II **9 Hours**

8051 ALP AND APPLICATIONS

Assembly language program- Timers and Counters programming- DAC- ADC- Sensor- Keyboard and LCD.

UNIT III **9 Hours**

PIC MICROCONTROLLER

PIC Microcontroller features- PIC Architecture, Program Memory, Addressing Modes, Instruction Set, Instruction Format- Byte-oriented Instructions- Bit-oriented Instructions- Literal Instructions- Control Instructions (CALL & GOTO)- Destination Designator. MPLAB overview: Using MPLAB, Toolbars, Select Development Mode and Device type, Project, Text Editor, Assembler, MPLAB operations.

UNIT IV **9 Hours**

PIC HARDWARE

Reset, Clock, Control registers, Register banks, Program Memory Paging, Ports, Interrupts, Timer and Counter, Watchdog Timer, Power up timer, Sleep mode, I2C bus- A/D converter.

UNIT V **9 Hours**

HIGH PERFORMANCE RISC ARCHITECTURE

ARM: The ARM architecture- ARM organization and implementation- The ARM instruction set- The THUMB instruction set- Basic ARM Assembly Language Program- ARM CPU Cores.

Total: 45 Hours

Reference(s)

1. Ayala, Kenneth, "The 8051 Microcontroller", Thomson, 3rd Edition, 2004.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, " The 8051 Microcontroller and Embedded Systems", Person Education, 2nd Edition, 2004.
3. John B.Peatman, "Design with Microcontrollers", Person Education", 1st Edition, 2004.
4. Steave Furber, "ARM system-on-chip architecture" Addison Wesley, 2nd Edition, 2000.
5. A.V.Deshmukh, "Microcontrollers: Theory and Applications", Tata Mc Graw Hill, 12th reprint, 2005.

22OEC03 PRINCIPLES OF COMMUNICATION SYSTEMS 3 0 0 3

Course Objectives

- To study the various analog and digital modulation techniques
- To study the various digital communication techniques
- To enumerate the idea of spread spectrum modulation
- To study the design concepts of satellite and optical communication

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Illustrate the process involved in Amplitude, Frequency and phase modulation systems.
2. Analyze the performance of different digital modulation /demodulation techniques.
3. Analyze Pulse Code Modulation scheme for the transmission of analog data in digital format.
4. Apply the concepts of spread spectrum modulation techniques to eradicate interference in wireless communication.
5. Analyze the system design of satellite and optical communication.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2											1
2	3	2												1
3	3	2												1
4	2	2	2											1
5	3	2												1

UNIT I **9 Hours**

FUNDAMENTALS OF ANALOG COMMUNICATION

Principles of amplitude modulation, AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM Voltage distribution, AM power distribution, Angle modulation. FM andPM waveforms, phase deviation and modulation index, frequency deviation and percent modulation,Frequency analysis of angle modulated waves. Bandwidth requirements for Angle modulated waves

UNIT II **9 Hours**

DIGITAL COMMUNICATION

Introduction, Shannon limit for information capacity, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) Minimum Shift Keying (MSK),Phase Shift Keying (PSK), BPSK, QPSK, 8 PSK Quadrature Amplitude Modulation (QAM), Bandwidth Efficiency,Comparison of various Digital Communication System (ASK - FSK - PSK - QAM).

UNIT III **9 Hours**

DIGITAL TRANSMISSION

Introduction, Pulse modulation, PCM , PCM sampling, sampling rate, signal to quantization noise rate,companding, delta modulation, adaptive delta modulation, differential pulse code modulation, pulse transmission, Intersymbol interference, eye patterns.

UNIT IV **9 Hours**

SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES

Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques, wireless communication, TDMA and CDMA in wireless communication systems, source coding of speech for wireless communications.

UNIT V **9 Hours**

SATELLITE AND OPTICAL COMMUNICATION

Satellite Communication Systems-Keplers Law,LEO and GEO Orbits, footprint, Link model-OpticalCommunication Systems-Elements of Optical Fiber Transmission link, Types, Losses, Sources and Detectors.

Total: 45 Hours

Reference(s)

1. Wayne Tomasi, Advanced Electronic Communication Systems, 6/e, Pearson Education, 2007.
2. Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons., 2001.
3. H.Taub,D L Schilling,G Saha ,Principles of Communication,3/e,2007.
4. B.P.Lathi,Modern Analog And Digital Communication systems, 3/e, Oxford University Press, 2007
5. Dennis Roddy, "Satellite Communications", Third Edition, Mc Graw Hill International Editions, 2001.
6. Gerd Keiser, Optical Fiber Communication, McGraw-Hill International, Singapore, 4th edition., 2011.

22OEI01 PROGRAMMABLE LOGIC CONTROLLER 3 0 0 3

Course Objectives

- To impart knowledge about automation and architecture of PLC
- To understand the PLC programming using timers, counters and advanced PLC functions
- To familiarize the student with PLC based applications

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Outline the fundamental Concepts of Automation
2. Conclude the architecture, interfacing and communication techniques of PLC
3. Execute the suitable PLC Programming languages
4. Attribute the various functions and instruction sets of PLC
5. Generate a suitable logical programming for given applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1		2	2		3						1	1
2	2	1		2	2		3							1
3	2	1		2	2		3						2	1
4	2	1		2	2		3						2	1
5	2	1		2	2		3						2	1

UNIT I **10 Hours**

INTRODUCTION TO AUTOMATION

Evolution of automation -Types of automation - Fixed, flexible and programmable automation - Batch process and continuous process - open loop system and closed loop system - Function of sensors - Proximity sensors: Capacitive and Inductive - Infrared and Laser Push-buttons and toggle switches - Actuators: Solenoid valve - servo motor - electromagnetic relays.

UNIT II **9 Hours**

ARCHITECTURE OF PLC

Components of PLC - sink and source I/O cards - Processor - Memory: Types of memory, Input and Output modules: Discrete, Analog -Scan time of PLC -Interfacing computer and PLC: RS232, RS485, Ethernet - Selection criteria for PLC.

UNIT III **8 Hours**

PLC PROGRAMMING

Programming languages - Ladder logic components: User and bit Instructions, branch instructions, internal relay instruction Boolean logic using ladder logic programming, Latching -Timers: On Delay timer, OFF Delay timer and Retentive timer - Counters: Up Counter and Down Counter.

UNIT IV **10 Hours**

ADVANCED PLC FUNCTIONS

Instructions in PLC: Program Control Instructions, Math Instructions, Data Manipulation Instructions: Data compare operations, Data transfer operations - Sequencer and Shift register instructions- Analog Instructions: PID Controller - Scaling Instructions.

UNIT V **8 Hours**

APPLICATIONS OF PLC

Case Studies: Bottle filling system - Pick and place robot - Car Parking - Traffic light control (4 ways with pedestrian signal) -Elevators - Pneumatic stamping system - alarm annunciator system.

Total: 45 Hours

Reference(s)

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2015.
2. Benjamin C Kuo, Automatic Control Systems, Prentice Hall of India, New Delhi, 2014.
3. John Park, Steve Mackay, Edwin Wright, Practical data communications for instrumentation and control, Newnes, Elsevier, 2015.
4. K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2014.
5. John W Webb and Ronald A Resis, Programmable Logic Controller, Prentice Hall of India Pvt. Ltd., New Delhi, 2013.

22OEI02 **SENSOR TECHNOLOGY** **3 0 0 3**

Course Objectives

- To impart knowledge about various sensors in multidisciplinary engineering domain
- To familiarize students with different applications and its material handling technology
- To understand the concept of sensing circuits and its static and dynamic characteristics

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Conclude the static and dynamic characteristics of measuring instruments
2. Compare the characteristics and working principles of Resistance, Inductance and Capacitance type sensors
3. Construct the interfacing and signal conditioning circuit for measurement system using different types of sensor
4. Analyze and select the suitable sensor for different industrial applications
5. Combine the modern technologies and smart materials to design various sensors

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											1
2	2	3	2	1	1									1
3	1	2	3	3	1									1
4	2	1	1	3	3									1
5	1	2	1	2	3									1

UNIT I **8 Hours**

SENSORS FUNDAMENTALS AND CHARACTERISTICS

Sensors: Principles of Sensing - Sensor Classification and terminology- Units of Measurements - Measurands- Sensor Characteristics: Static and Dynamic.

UNIT II **8 Hours**

PHYSICAL PRINCIPLES OF SENSING

Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements.

UNIT III **9 Hours**

INTERFACE ELECTRONIC CIRCUITS

Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.

UNIT IV **10 Hours**

SENSORS IN DIFFERENT APPLICATION AREA

Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors.

UNIT V **10 Hours**

SENSOR MATERIALS AND TECHNOLOGIES

Materials, Surface Processing- MEMS microsystem components- Microfluidics microsystem components - Nano Technology- Smart Materials.

Total: 45 Hours

Reference(s)

1. J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer, 2016.
2. D. Patranabis, Sensors and Transducers, 2nd Edition, Prentice Hall India Pvt. Ltd, New Delhi, 2009.
3. Guozhen Shen, Zhiyong Fan, “Flexible Electronics: From Materials to Devices”, 1st Edition, World Scientific Publishing Co, Singapore, 2015.
4. Horowitz, P., and W. Hill. The Art of Electronics. 2nd ed. Cambridge University Press, 1989.

22OEI03 FUNDAMENTALS OF VIRTUAL INSTRUMENTATION 3 0 0 3

Course Objectives

- Understand the basic components of Virtual Instrumentation system.
- Learn the developing VIs based on Lab VIEW software.
- To learn to develop applications based on Virtual Instrumentation system.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Outline the concepts of traditional instruments and virtual instruments
2. Conclude the overview of modular programming and the structuring concepts in VI programming
3. Attribute the procedure to install DAQ in various OS and its interfacing methods
4. Implement the VI toolsets for specific applications
5. Generate the applications using Virtual Instrumentation software

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1										
2	3	3	2	2	2					2	2	2		
3	2	2	2	1										
4	3	3	3	1	2					1	2	2		
5	3	2	2	1	2				-	1	2	2		

UNIT I **9 Hours**

INTRODUCTION

Virtual Instrumentation: Historical perspective - advantages - block diagram and architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II **9 Hours**

VI PROGRAMMING TECHNIQUES

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, State machine, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT III **9 Hours**

DATA ACQUISITION

Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards - Data acquisition cards with serial communication - VI Chassis requirements. SCSI, PCI, PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

UNIT IV **9 Hours**

VI TOOLSETS

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, windowing and filtering. Application of VI in process control designing of equipments like oscilloscope, Digital multimeter, Design of digital Voltmeters with transducer input Virtual Laboratory, Web based Laboratory.

UNIT V **9 Hours**

APPLICATIONS

Distributed I/O modules- Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

Total: 45 Hours

Reference(s)

1. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey,1997.
2. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newness, 2000.

22OEI04 OPTOELECTRONICS AND LASER INSTRUMENTATION 3 0 0 3

Course Objectives

- To enhance the student knowledge in fiber optics fundamentals and fabrication
- To be recognized with industrial applications of fibers
- To understand the fundamental concepts about lasers
- To identify and describe various fiber optic imaging and optoelectronic sensor applications

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. Attribute the properties of optical fibers, their light sources and detectors.
2. Implement the fiber-optic sensor for the measurement of various physical quantities.
3. Conclude the fundamentals of laser, types of laser and its working.
4. Outline the applications of laser for industrial applications.
5. Differentiate the use of laser instruments for various medical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	3	2	1	2										
3	3	2	1											
4	3	2	2	2										
5	3	2	2	2										

UNIT I **9 Hours**

OPTICAL FIBERS AND THEIR PROPERTIES

Introduction to optical fibers - Light guidance - Numerical aperture - Dispersion - Different types of fibers and their properties - Light Sources for fiber optics, Photo detectors, source coupling, splicing and connectors.

UNIT II **9 Hours**

INDUSTRIAL APPLICATION OF OPTICAL FIBERS

Fiber optics instrumentation system - optical fiber sensors, Measurement of pressure, temperature, current, voltage and liquid level - fiber optic communication set up - different types of modulators - detectors.

UNIT III **9 Hours**

LASER FUNDAMENTALS

Fundamental characteristics of lasers: laser rate equation - three level system - four level system - properties of laser beams - laser modes - resonator configuration - Q- switching and mode locking - cavity dumping - types of lasers: gas lasers, solid state lasers, liquid lasers and semiconductor lasers.

UNIT IV **9 Hours**

INDUSTRIAL APPLICATION OF LASERS

Lasers for measurement of distance and length, velocity, acceleration, atmospheric effects, sonic boom, pollutants - material processing: laser heating, melting, welding and trimming of materials - removal and vaporization - calculation of power requirements of laser for material processing.

UNIT V **9 Hours**

HOLOGRAM AND MEDICAL APPLICATIONS

Holography: basic principle, methods - holographic interferometry and application, holography for non-destructive - medical applications of lasers, laser and tissue interactive - laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

Total: 45 Hours

Reference(s)

1. John M. Senior, Optical Fiber Communications - Principles and Practice, Prentice Hall of India, 2010.
2. John F. Ready, Industrial Applications of Lasers, Academic Press, 2012.
3. Gerd Keiser, Optical Fiber Communication, Mc Graw Hill, New York, 2013.
4. S.C. Gupta, Textbook on Fiber Optics Communications and its application, Prentice Hall of India, 2012.
5. John Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2011.
6. R. P. Khare, Fiber Optics and Optoelectronics, Oxford University Press, 2011.

22OME01 DIGITAL MANUFACTURING 3 0 0 3

Course Objectives

- To understand the process of generating 3D Computer Aided Design (CAD) model by different method.
- To explain the constructional features and develop simple program for CNC lathe and Milling machines.
- To provide an exhaustive knowledge on various generic process and benefits of Additive Manufacturing.
- To familiarize about materials and process parameters of liquid and solid based AM techniques.
- To educate powder based methodology and emerging trends with case studies, applications of AM techniques.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Design a 3D model from the 2D data.
2. Develop a CNC program for simple components.
3. Generate stl file and manipulate parameters of AM machine
4. Select appropriate liquid or solid materials based AM process to the respective application
5. Select appropriate process to fabricate a functional/prototype for aerospace, automotive, electronics, manufacturing and medical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2		2								1	1
2	2	2	2		2								1	1
3	2	2	2		2								1	1
4	2	2	2		2									
5	2	2	2		2								1	1

UNIT I **9 Hours**

CAD MODELING

Introduction - Design process - Stages. CAD - Input and Output devices, Modeling methods - Wire frame modelling, Surface modelling, Solid modelling - Constructive Solid Geometry and Boundary Representation Techniques. CAD/CAM data exchange - IGES, STEP. Product Life cycle management (PLM).

UNIT II **10 Hours**

AUTOMATION AND CNC MACHINES

Introduction to Automation - Definition, types, reasons for automating. CNC Machines - Principles, types, features, advantages, applications. CNC Machine structure - Linear motion bearings, Recirculating ball bearings, drive system, and control system. CNC Lathe and Milling programming - Linear and circular interpolation, threading and drilling programs.

UNIT III **7 Hours**

ADDITIVE MANUFACTURING

Introduction - Impact of Additive Manufacturing (AM) and Tooling on Product Development - Distinction between AM and CNC Machining - The Generalized AM Process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing - AM Benefits - Classification of AM process

UNIT IV **8 Hours**

LIQUID AND SOLID MATERIAL BASED SYSTEMS

Stereo lithography Apparatus (SLA), Digital Light Processing (DLP), Fused Deposition Modelling (FDM) and Laminated Object Manufacturing (LOM) - Working Principle, Construction, Process, Materials and Applications

UNIT V **11 Hours**

POWDER BASED PROCESSES AND APPLICATIONS OF ADDITIVE MANUFACTURING

Selective Laser Sintering (SLS), Color Jet Printing (CJP), Electron Beam Melting (EBM) and Laser Engineered Net Shaping (LENS) - Working Principle, Construction, Process Variables, Materials and Applications. Reverse Engineering using 3D scanner. Application of Additive Manufacturing in Medical field, Manufacturing, Automotive industries, Aerospace and Electronics and Retail industries.

Total: 45 Hours

Reference(s)

1. Ibrahim Zeid, R.Sivasubramania, CAD/CAM Theory and Practice, Tata McGraw Hill, 2010.
2. M. Aditan, B.S. Pabala, CNC Machines, New age International, 2012.
3. C. K. Chua, K. F. Leong and C. S. Lim, Rapid prototyping: Principles and applications, Cambridge University Press, 2010.
4. D. T.Pham, S. S.Dimov, Rapid manufacturing, Springer-Verlag, London, 2001.
5. I. Gibson, D. W. Rosen, and B. Stucker, Additive Manufacturing Technologies 3D Printing, Rapid Prototyping and Direct Digital Manufacturing, Springer, 2015 http://www.springer.com/978-1-4939-2112-6

22OME02 INDUSTRIAL PROCESS ENGINEERING **3 0 0 3**

Course Objectives

- To impart the knowledge on production planning methodologies and layout design
- To learn about production planning and its control methods
- To provide the knowledge of work study, process charts and ergonomic condition
- To impart the knowledge on inventory control and material handling
- To learn about system analysis and different types of maintenance processes

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes (COs)

1. Select proper plant layout for the required production system
2. Plan the resources required for the production and to perform the control methods
3. Apply work study method, prepare charts to outline the process and develop ergonomic condition suitable for the processes.
4. Analyze the inventory required based on production needs and material handling
5. Perform system analysis and use different types of maintenance process for smooth operations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1		1									
2	3	3	1		2						2			
3	1	3	3		2									
4	2	3	1		2									
5	2	3	1		2									

UNIT I **9 Hours**

INDUSTRIAL ENGINEERING AND PRODUCTION SYSTEM

Industrial engineering - Concept, History and development, Applications, Roles of Industrial engineer- Production management, Industrial engineering versus production management, operations management. Plant layout, Criteria for good layout, Types of layout - Process layout, Product layout, Combination layout and fixed position layout, Flow (material movement) pattern, Workstation Selection and design.

UNIT II **10 Hours**

PROCESS PLANNING AND PRODUCTION CONTROL

Introduction to Process planning-Definition, Procedure, Process selection, Machine capacity, Process sheet.Process analysis - Group technology, classification and coding system, formation of component family - Production planning, loading, scheduling. Production control -dispatching, routing - Progress control bar, curve, Gantt chart, route and schedule chart.

UNIT III **8 Hours**

WORK STUDY AND ERGONOMICS

Work study - Definition, Need, Advantages, objectives of method study and work measurement, method study procedure, Process chart - symbols, outline process chart, flow process chart, principles of motion economy, ergonomics- applications of ergonomic principles in the shop floor- work benches-seating arrangement, Industrial physiology.

UNIT IV **10 Hours**

INVENTORY MANAGEMENT

Inventory control, classification, management, objectives, functions. Economic order quantity, Economic batch quantity, inventory models,ABC analysis, Material Requirement Planning(MRPI), Manufacturing Resource Planning (MRPII), Operating cycle, lean manufacturing, Supply chain management - Material handling.

UNIT V **8 Hours**

SYSTEM ANALYSIS AND MAINTENANCE

System concept - system analysis, systems engineering, value engineering, value control, types of values. Plant maintenance - objectives, importance. Maintenance engineer - duties, functions and responsibilities. Types - breakdown, scheduled, preventive and predictive - Plant maintenance schedule, Condition monitoring.

Total: 45 Hours

Reference(s)

1. Khanna O.P., Industrial Engineering and management, Dhanpat Rai Publications.,2010
2. Martand T.Telsang, Industrial Engineering and Production Management, S Chand Publishers,2006
3. Panneerselvam R., Production and operations management, Heritage Publishers, 2006
4. Ravi Shankar, Industrial Engineering and Management, Golgotia Publications Pvt. Ltd., New Delhi, 2009

22OME03 MAINTENANCE ENGINEERING 3 0 0 3

Course Objectives

- To understand the principles, objectives and importance of maintenance adopted in industry for successful progress.
- To introduce different maintenance categories, its merits and types of lubrication.
- To expose the idea of condition monitoring, methods and instruments used for allied measurements.
- To learn about failure analysis and repair methods for few mechanical elements.
- To promote computerization in maintenance and inventory management.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Explain the principles, objectives and importance of maintenance adopted in industry.
2. Select the suitable maintenance category and lubrication type.
3. Apply the appropriate methods and instruments for condition monitoring.
4. Analyze the failures of mechanical systems and select suitable repair methods.
5. Utilize computers in maintenance and inventory management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												2
2	2	2												2
3					2	2	1							2
4	1	2	1		2	2	2							2
5	2	2	2		1	1	1							2

UNIT I **9 Hours**

PRINCIPLES OF MAINTENANCE PLANNING

Basic principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound maintenance systems - Maintenance organization - Maintenance economics.

UNIT II **9 Hours**

MAINTENANCE CATEGORIES AND LUBRICATION

Maintenance categories - Comparative merits of each category - Preventive maintenance, Maintenance schedules, Repair cycle - Total Productive Maintenance - Principles and methods of lubrication.

UNIT III **9 Hours**

CONDITION MONITORING

Condition based maintenance - Cost comparison with and without Condition Monitoring - Methods and instruments for condition monitoring - Noise, vibration, wear and temperature measurement.

UNIT IV **9 Hours**

FAILURE ANALYSIS AND REPAIR METHODS

Failure analysis - Failures and their development - Role of Non Destructive Testing in failure analysis - Repair methods for bearings, cylinder block, fuel pump, shaft.

UNIT V **9 Hours**

COMPUTER AIDED MAINTENANCE MANAGEMENT

Approach towards Computerization in maintenance - computer-aided maintenance management system (CAMMS) - Advantages of CAMMS - spare parts and inventory centre performance reporting.

Total: 45 Hours

Reference(s)

1. Srivastava S.K, Maintenance Engineering, S Chand and Company, 2010.
2. Mishra R.C, Pathak K, Maintenance Engineering and Management, Second edition, Prentice Hall India Learning Pvt. Ltd., 2012.
3. Keith Mobley R, Lindley R. Higgins and Darrin J. Wikoff, Maintenance Engineering Handbook, Seventh edition, McGraw-Hill Professional, 2008.
4. Davies A, Handbook of Condition Monitoring: Techniques and Methodology, Springer, 2012.
5. Otegui Jose Luis, Failure Analysis, Fundamentals and Applications in Mechanical Components, Nineteenth edition, Springer, 2014.

22OME04 SAFETY ENGINEERING 3 0 0 3

Course Objectives

- To study the principles of safety management system.
- To introduce the provisions contained in the industrial laws.
- To provide knowledge on safety requirements for engineering industry.
- To learn safety requirement for chemical industry.
- To study the various safety measures adopted in construction industries.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Explain safety management system of an industry.
2. Implement the provisions of acts and rules in industries.
3. Implement and review the safety performance followed in various industries
4. Evaluate safety appraisal in chemical industries.
5. Generate safety reports on construction industries.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1					2	1		1						
2					1			3						
3	2											3		
4	2	3							2					
5					2					3				

UNIT I **8 Hours**

SAFETY MANAGEMENT

Concepts - Evolution, International Labour Organization (ILO), National Safety Council, Techniques - Job Safety Analysis (JSA), Safety survey, Safety inspection, Safety Sampling, Accident Reporting and Investigation - Concept of an accident, Accident causation models, cost of accident, investigation, Safety Performance Monitoring - Safety indices.

UNIT II **10 Hours**

SAFETY AND LAW

Factory Act 1948-Safety and Health chapters, Tamil Nadu Factories Rules- Safety and Health chapters, Environment and Pollution Laws, ,Building and other construction works act 1996, Electricity Rules.

UNIT III **10 Hours**

SAFETY IN ENGINEERING INDUSTRIES

Safety in machine shop,- Principles of machine guarding - Personal protective equipment- Safety in handling industrial gases - Safety in cold forming and hot working of metals- Safety in finishing, inspection and testing, heat treatment, electro plating, leak test, radiography.

UNIT IV **9 Hours**

SAFETY IN CHEMICAL INDUSTRIES

Safety in process design, unit operations, pressure vessel, heat exchanger, safety valves -Plant commissioning and inspection, pressure vessel, Plant maintenance and emergency planning, management of maintenance HAZOP study.

UNIT V **8 Hours**

SAFETY IN CONSTRUCTION INDUSTRY

Construction regulations, contractual clauses, permit to work, - Education and training-Hazards of construction and prevention- excavation, scaffolding, dismantling, road works, construction of high rise buildings - Working at heights,-Working on fragile roofs, work permit systems-Construction machinery, cranes, chain pulley blocks, earth moving equipment, conveyors- Manual handling, Safety in demolition work, - Safety in confined spaces

Total: 45 Hours

Reference(s)

1. Blake R.B., Industrial Safety, Prentice Hall, Incorporated, New Jersey,1973.
2. National Safety Council, Accident Prevention Manual for Industrial Operations, Chicago, 1988
3. Subramanian V., The Factories Act, 1948, with Tamil Nadu Factories Rules , 1950, Madras
4. Environmental Pollution Control Act, 1986
5. BOCW Act,1996, Madras Book agency, Chennai-1
6. Explosive Act, 1884, Eastern Book Company, Lucknow -266 001.

22OBT01 BIOFUELS 3 0 0 3

Course Objectives

- To understand and explore the scope of biofuels the most efficient renewable source of energy.
- To develop the expertise in the technology pertaining to their generation and employment in order to surrogate the existing conventional fuels and hence strives towards sustainabledevelopment
- To give way to the bolster green technology and incline towards more ecofriendly options.

Programme Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex
engineering problems reaching substantiated conclusions using first principles of mathematics,
natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO6 The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Apply the bio-resources that can be used for the production of biofuels.
2. Analyze the physical and chemical properties of the biodiesel.
3. Analyze the mechanisms of improvising the quality and performance of engines using biofuels
4. Analyze the bio-fuel conversion technologies and their environmental attributes
5. Evaluate the designing aspects of major unit processes/operations of an integrated bio-refinery

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	2				3							
2	2	1		3			1							
3	1	2		2			3							
4	2	3				2	3							
5	1	2				2	1							

UNIT I **9 Hours**

CLASSIFICATION AND RESOURCES

Introduction, biofuel as a renewable energy, classification of biofuels - First, second, third and fourth generation biofuels, different plant sources as biofuel feed stocks, Biogases, physical and chemical characteristics of vegetable oils - iodine number, hydroxyl, acid values, rancidity, hydrogenolysis and hydrolysis, Food vs energy.

UNIT II **9 Hours**

BIODIESEL

Definition, basics and chemistry of biodiesel, vegetable oils in biodiesel production, Trans esterification: Chemical methods, enzymatic methods and types of catalysts, separation and purification, physical properties and characterization of biodiesel - Cloud point, pour point, cold filter plugging point, flash point, viscosity and cetane number.

UNIT III **9 Hours**

QUALITY BIODIESEL AND ENVIRONMENT

Producing Quality Biodiesel, quality control, test methods, ASTM specifications. Oxidative andthermal stability, estimation of mono, di, triglycerides and free glycerol, engine performance test, blending of ethanol with biodiesel, blending of biodiesel with high speed diesel (HSD) and their combustion properties.

UNIT IV **9 Hours**

BIOETHANOL AND BIOGASES

Ethanol as a fuel, microbial and enzymatic production of ethanol from biomass - lignocellulose, sugarcane, sugar beet, corn, wheat starch, purification - wet and dry milling processes, saccharification-chemical and enzymatic. Production of bio methane and bio hydrogen.

UNIT V **9 Hours**

BIOREFINERIES

Definition and types of biorefineries, co-products of biorefineries-oil cake and glycerol, purificationof glycerol obtained in biodiesel plant; anaerobic and thermal gasification of biomass, economics of biorefineries.

Total: 45 Hours

Reference(s)

1. Caye Drapcho, John Nghiem and Terry Walker, Biofuels Engineering process technology,McGraw Hill Professional, 2008.
2. Mousdale, Biofuels, CRC Press, 2008
3. Ahindra Nag, Biofuels Refining and Performance, McGraw-Hill Professional, 2007.
4. Lisbeth Olsson, Biofuels (Advances in Biochemical Engineering/ Biotechnology), Springer,2007

22OFD01 **TRADITIONAL FOODS** **3 0 0 3**

Course Objectives

- Understand the importance of traditional foods and food habits
- Know the traditional processing of snack, sweet and dairy food products
- Infer the wide diversity and common features of traditional Indian foods and meal patterns.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Course Outcomes (COs)

1. Justify the processing methods of traditional foods in terms of its health benefits
2. Assess the production methods of traditional sweets, snacks and dairy products
3. Differentiate Traditional fermented foods products based on its raw material
4. Implement a large scale production of tradition foods for its increased consumption
5. Compare the health aspects of traditional foods with modern foods

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1													
2		1												
3	2	1	1											
4								2						
5								2						

UNIT I **9 Hours**

TRADITIONAL METHODS OF FOOD PROCESSING

Introduction - food culture -geographical features and food. Traditional methods of milling grains - rice, wheat and corn - equipment and processes as compared to modern methods. Equipment and processes for edible oil extraction- comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation - sun-drying, osmotic drying, brining, pickling and smoking.

UNIT II **9 Hours**

TRADITIONAL SWEETS, SNACKS AND DAIRY PRODUCTS

Production, formulation, preparation and processing of Indian traditional sweet and snack food products:- Rasgolla, Gulab jamun; formulation and preparation of namkeen, potato chips, banana chips. Acid coagulated and fermented dairy products- paneer, dahi, shrikhand, lassi - processing conditions, defects etc. Fat rich products- Butter, ghee and its processing.

UNIT III **9 Hours**

TRADITIONAL FERMENTED FOOD PRODUCTS

Idli, Soya sauce, fish pickle, dry fish, meat and vegetable fermented products. Various alcohol based products. Ways to increase nutritional quality of food such as enrichment, fortification, fermentation and mutual supplementation. Best cooking and processing methods to retain nutrients

UNIT IV **10 Hours**

COMMERCIAL PRODUCTION OF TRADITIONAL FOODS

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods -types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods - ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters

UNIT V **8 Hours**

HEALTH ASPECTS OF TRADIONAL FOODS

Comparison of traditional foods with typical fast foods / junk foods - cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

Total: 45 Hours

Reference(s)

1. Sen and Colleen Taylor, Food Culture in India, Greenwood Press, 2005.
2. Davidar, Ruth N. "Indian Food Science: A Health and Nutrition Guide to Traditional Recipes:" East West Books, 2001.
3. Steinkrus.K.H. Handbook of Indigenous Fermented Foods, CRC press, 1995.
4. Aneja. R.P, Mathur.BN, R.C. Chandan,and Banerjee.A.K. Technology of Indian Milk Products. Dairy India Year Book, 2009.

22OFD02 FOOD LAWS AND REGULATIONS 3 0 0 3

Course Objectives

- Introduce the concept of food hygiene, importance of safe food and laws governing it
- Learn common causes of food borne illness - viz. physical, chemical and biological and identification through food analysis
- Understand food inspection procedures employed in maintaining food quality

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Course Outcomes (COs)

1. Analyse the food safety strategies and nutritional quality of the food
2. Check the food regulatory mechanism and mandatory laws for food products
3. Determine the national and international regulatory agencies
4. Understand and apply the voluntary regulatory standards
5. Assess the implementation of food safety for a food processing industry

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1											
2		1				1	2	1						
3		1												
4	1	2												
5	1	2												

UNIT I **10 Hours**

INTRODUCTION

Introduction, concept of food safety and standards, food safety strategies. Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical hazards. Preventive food safety systems - monitoring of safety, wholesomeness and nutritional quality of food. Prevention and control of physical, chemical and microbiological hazards. Principles of food safety - Establishment: design and facilities - emergency preparedness - Maintenance cleaning and sanitation - personal hygiene - packaging and labelling - transportation - traceability - recall procedure - visitor policy. Adulteration: Intentional and unintentional - Preservatives - antioxidants, sweeteners, flavours, colours, vitamins, stabilizers - indirect additives - organic resides - inorganic residues and contaminants.

UNIT II **10 Hours**

FOOD LAWS

Indian and Food Regulatory Regime (Existing and new), PFA Act and Rules, Food Safety and Quality Requirements, Additives, Contaminants and Pesticide Residue. Food Safety and Standards Act, 2006, FSSAI roles and responsibilities, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR) WHO/FAO Expert Bodies (JECFA/ JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization.

UNIT III **10 Hours**

REGULATIONS

Introduction to OIE & IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export & Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Role of Agricultural and Processed Food Products Export Development Authority (APEDA), Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK. Nutritional Labelling, Health claims.

UNIT IV **10 Hours**

STANDARDS

Voluntary Quality Standards and Certification GMP, GHP, HACCP, GAP, Good Animal Husbandry Practices, Good Aquaculture Practices ISO 9000, ISO 22000, ISO 14000, ISO 17025, PAS 22000, FSSC 22000, BRC, BRCIOP, IFS, SQF 1000, SQF 2000. Role of NABL, CFLS.

UNIT V **5 Hours**

IMPLEMENTATION AND RISK ASSESSMENT

Implementation of food safety for a desired food processing industry. Risk assessment studies: Risk management, risk characterization and communication.

Total: 45 Hours

Reference(s)

1. Singal RS (1997). Handbook of indices of food quality and authenticity. Woodhead Publ. Cambridge, UK.
2. Shapton DA (1994). Principles and practices of safe processing of foods. Butterworth Publication, London. Winton AL (1999) Techniques of food analysis, Allied Science Publications New Delhi.
3. Pomeranze Y (2004). Food analysis - Theory and Practice CBS Publications, New Delhi.
4. Jacob MB (1999). The chemical analysis of foods and food products. CBS Publ. New Delhi

22OFD03 POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES 3 0 0 3

Course Objectives

- To understand the importance and different methods of post harvest handling and storage of fruits and vegetables.
- To gain knowledge on different preservation methods of fruits and vegetables
- To familiarize with the value added products from fruits and vegetables

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Implement the different post harvest handling practices for the storage of fruits and vegetables
2. Analyze the suitable preservation method (sugar, salt or dehydration) to produce value added products from fruits and vegetables
3. Evaluate the requirement of low temperature and irradiation methods to preserve specific fruits and vegetables
4. Apply the concentration and fermentation methods to preserve fruits and vegetables
5. Implement the canning method to preserve fruits and vegetables

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	2	1			1							
2	1	1												
3	1	2												
4	1		1											
5	2	1	1											

UNIT I **9 Hours**

POST HARVEST PRACTICES AND PROCESSING

Maturity indices for harvesting; pathological spoilage's during storage, ripening and control measures, Post-harvest handling, sorting & grading, packaging, storage, transportation, Methods of pre-cooling, post-harvest treatments to hasten and delay ripening; Methods of storage at farm level - cold storage, controlled/modified atmosphere storage, Quality management, export requirements, Nutritive value, nutraceutical properties

UNIT II **9 Hours**

PRESERVATION AND VALUE ADDITION

General principles and methods of fruit and vegetable preservation. Preservation using sugar: Principle and Preparation of jam, jelly, marmalade, squash, RTS, carbonated beverages, crush, nectar, cordial, fruit bar, preserves, candies and carbonated fruit beverages. Processing using salt: Principle - Brining - Preparation of pickles, chutney and sauces, ketchup.

UNIT III **9 Hours**

PRESERVATION BY LOW TEMPERATURE AND IRRADIATION

Preservation by low temperature: definition, principle, methods - Refrigeration, freezing. Methods of freezing-changes during freezing. Preparation of frozen foods. Minimal Processing of Fruits and Vegetables - techniques involved - Preservation by irradiation: definition- principle, application, irradiation unit.

UNIT IV **9 Hours**

PRESERVATION BY DRYING

Machineries involved in processing of fruits and vegetables products. Drying and dehydration: definition, principle, Types of driers: Solar, cabinet, spray drier, drum drier, fluidized bed drier. Preparation of product for dehydration. Dehydration principles and equipment. Preparation of fruits - powder production. Problems related to storage of dehydrated products.

UNIT V **9 Hours**

PRESERVATION BY CANNING

Canning: principles, Types of cans, packing of canned products-preparation of canned products - general considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit- spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations.

Total: 45 Hours

Reference(s)

1. S.Ranganna, HandBook of Analysis and Quality Control for Fruit and Vegetable Products, McGraw Hill Education (India) Private Limited, Chennai, 2017
2. N.W. Desrosier, the Technology of Food Preservation, CBS Publisher & Distributions, New Delhi, 1987.
3. R.P. Srivastava and S. Kumar, Fruit and Vegetable Preservation: Principles and Practices, Second Edition, International Book Distribution Co., Lucknow, 1998.
4. G. Lal, G. Siddappa and G.L. Tondon, Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi, 1986.
5. Chakraverty, A.S. Mujumdar, G.S.V. Raghavan and H.S. Ramaswamy, Handbook of Post-harvest Technology, Marcel Dekker Press, USA, 2001.
6. D.K. Salunkhe, and S.S. Kadam, Handbook of Fruit Science and Technology: Production, Composition and Processing, Marcel Dekker, New York, 1995.

22OFD04 CEREAL, PULSES AND OILSEED TECHNOLOGY 3 0 0 3

Course Objectives

- Understand the application of scientific principles in the processing technologies specific to the materials
- Understand the storage methods and handling techniques followed for cereals, pulses and oil seeds
- Develop the knowledge in the area of Cereals, pulses and oil seed processing and technology

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Identify the specific processing technologies employed for cereals
2. Analyse the composition of millets and their nutritional importance
3. Relate the compositional changes and processing methods of pulses and legumes
4. Create the competence in processing of oilseeds technology
5. Relate the storage processing of food grains with quality aspects

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		2		2								
2	1	2		2		1								
3	2	2		1		2								
4	2	3		2		2								2
5	2	2		2		3								

UNIT I **9 Hours**

CEREALS

Cereal Grains- Basic agricultural aspects, structure and composition; Storage, Insect control; Processing: Wheat- milling, (Atta and maida), quality aspects of flour, wheat proteins and their function, rheology of flour; wheat based baked products - Bread, Biscuit, Cakes, Extruded products, Pizza, Chapatis, malting and malt products; Rice-Milling, Parboiling, Quick cooking rice, Traditional Indian Products- Puffed Rice, flaked rice, Idli/Dosa/vada mixes and other savouries; Corn- Wet and dry milling, Corn Products - Corn flakes, Corn starch, canned corn products, puffed product; Oats-Milling, Oat Products - Steel cut,rolled oats, quick cooking; Traditional and Fermented cereal products.

UNIT II **9 Hours**

OTHER CEREALS AND MILLETS

Sorghum, Pearl Millet, Finger millet, Foxtail Kodo Millet - Basic agricultural millet, aspects, structure and composition; storage, insect control; processing - pearling, Milling, Malting, Malt based foods, flaked and fermented products; Traditional and Nutritional products based on finger millet.

UNIT III **9 Hours**

PULSES AND LEGUMES

Basic agricultural aspects, structure, composition, storage, insect control, processing Milling/splitting, dhal milling, products - puffed, flakes, flour, legume-based traditional products, flour based Indian sweets and savouries, soya milk, soy protein Isolate, soya paneer

UNIT IV **9 Hours**

OILSEEDS AND NUTS

Basic agricultural aspects structure, composition, Storage, Insect control; processing: traditional and modern methods of oil extraction, refining, bleaching, deodorizing, hydrogenation; oil blends; applications of different oils and fats in food processing & products.

UNIT V **9 Hours**

STORAGE AND HANDLING

Bag Storage - Advantages and Disadvantages, Cover Plinth Storage Structures, CAP storage (Cover and Plinth Storage). Protection against Rodents, Fungi, Pests and Mites. Fumigation Processes for bag storage piles. Bulk Storage in silos and large Bins. Conveyors and Elevators for feeding and discharging.

Total: 45 Hours

Reference(s)

1. Chakraverty, A.: Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Co, Calcutta, 1995.
2. Delcour, Jan A. and R. Carl Hoseney., Principles of Cereal Science and Technology, 3rd Edition, American Association of Cereal Chemists, 2010.
3. Karl Kulp, Handbook of Cereal Science and Technology, 2nd Rev. Edition, CRC Press, 2000.
4. N.L.Kent and A.D.Evans, Technology of Cereals (4th Edition) Elsevier Science (Pergaman),Oxford, UK, 1994.
5. Matz, Samuel A., The Chemistry and Technology of Cereals as Food and Feed, 2nd Edition,CBS, 1996.
6. Morris, Peter C. and J.H. Bryce., Cereal Biotechnology, CRC/Wood head publishing, 2004.

22OFT01 FASHION CRAFTSMANSHIP 3 0 0 3

Course Objectives

- To impart theoretical and practical knowledge about various handi-craft techniques
- To enhance innovative skills on hand crafts.
- To build confidence on doing handicrafts.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1: Demonstrate the knowledge and technical skills in software development.

Course Outcomes (COs)

1. Outline the classification, techniques and criteria for selecting raw materials for making various handicraft materials and produce textile based handicrafts. Produce various decorative and appealing products
2. Design and construct various wall hangings and fashion accessories.
3. Design and construct toys and accessories
4. Design and construct head accessories, home furnishings and paintings
5. Design and construct various decorative and appealing products for interiors

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	3				2		2	2		2	2	
2	3	2	3				1		2	3		2	2	
3	3	2	3				2		2	3		2	2	
4	3	2	3				2		2	3		2	2	
5	3	2	3				2		2	3		2	2	

UNIT I **9 Hours**

TECHNIQUES OF HANDICRAFT MATERIALS

Definition of Handicraft, Classification: Reusable, Non reusable, Raw materials used in various craft materials: printed, embroidered, stitched and handmade, Criteria for selection of raw materials: material types and end uses.

UNIT II **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - INTERIORS

Designing and Construction procedures for following various decorative and appealing products: Wall hangings - String Art on plywood, Pressed Flower Art frames.

UNIT III **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - ACCESSORIES

Designing and Construction procedures for following various decorative and appealing products: Handbags, Hats, footwear.

UNIT IV **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - ORNAMENTS

Designing and Construction procedures for following various decorative and appealing products: Stone necklace using Macrame Technique, Tribal Jewellery using woollen threads, Floral Jewellery using Resin Technique, Fabric Jewellery using Tie and Dye Technique.

UNIT V **9 Hours**

DECORATIVE AND APPEALING PRODUCTS - FANCY ITEMS

Designing and Construction procedures for following various decorative and appealing products: Jewellery Box, Utility Holder, Gift items. Lampshade decors from cardboard, Driftwood Frames for pictures and Mirrors.

Total: 45 Hours

Reference(s)

1. Handmade in India: A Geographic Encyclopaedia of India Handicrafts. Abbeville press; 1 edition (October 20,2009)
2. Encyclopaedia of Card making Techniques (Crafts), Search Press Ltd, illustrated edition, 2007
3. All about Techniques in Illustration, Barron Educational Series, 2001
4. Printing by Hand: A Modern Guide to printing with Handmade stamps, Stencils and Silk Screens, STC Craft/A Melanie Falick Book, 2008
5. Materials & Techniques in the Decorative Arts: An Illustrated Dictionary, University of Chicago Press, 2000
6. https://www.marthastewart.com/274411/fashion-crafts

22OFT02 INTERIOR DESIGN IN FASHION 3 0 0 3

Course Objectives

- To impart knowledge on interior design.
- To improve the design skills, sustainable with socially-conscious designs

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PSO1: Demonstrate the knowledge and technical skills in software development.

Course Outcomes (COs)

1. Interpret the elements of interior design concepts and resolve the personality requirements
2. Develop graphical representations of interior design concepts
3. Resolve the space planning requirements of residential home as per CPWD guidelines
4. Determine the aesthetic requirements of interior design components.
5. Appraise the roles and responsibilities of interior designer.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3		-	1							2	
2	3	2	3		2	3		2					3	
3	3	3	3		2	2		2					2	
4	3	3	3		2	3		2					2	
5	3	2			2			3					3	

UNIT I **9 Hours**

INTRODUCTION

Interior designing - definition, importance, requirements and types - Structural design, Decorative Design - Designing interiors, Good taste; Design themes, types and application. Personality of the Home - Art elements - Line: types, characteristics and importance; form: size and shape, characteristics; Colour - sources, qualities, emotional effects, colour wheel and schemes.

UNIT II **9 Hours**

GRAPHICAL PRESENTATIONS

3D composition; Isometric and Axonometric- Still life- Furniture Sketching- Object Drawing with color rendering - Interior elements, Lighting, plants. Perspective, Axonometric Isometric drawing. Orthographic Projection - Lifts and escalators.

UNIT III **9 Hours**

SPACE PLANNING

Space planning concepts- interiors, circulation. Definition, application of ergonomic principals in interiors. Residential house space planning case study- CPWD guidelines. Lighting for different locations and activities, measurement, ventilation and indoor air quality, noise control methods.

UNIT IV **9 Hours**

INTERIOR COMPONENTS

Application of colour in interiors; Texture - types and significance; Pattern: types and effects; Light - importance. Importance of Furniture Design for Interiors- Ancient Age / Middle Age / Contemporary. Doors, Windows, Staircase designs, False Ceiling, Partitions, Wall Panelling, Comics, Mosaic, Cladding- Flooring and Wall Cladding

UNIT V **9 Hours**

ROLES AND RESPONSIBILITIES OF INTERIOR DESIGNER

Role of an Interior Designer- Responsibility towards society and need of an Interior Designer to better the environment- Ethics and Code of Conduct- Responsibility towards client, contractor and supplier, Estimation. Professional Fees- Work of an Interior Designer- Making of portfolio, JD Annual Design Awards.

Total: 45 Hours

Reference(s)

1. Joanna Gaines, Homebody: A guide to creating spaces you never want to leave, Harper design, 2018.
2. Erin gates, Elements of Style: Designing a Home and a life, Simon and Schuster, 2014.
3. Simon Dodsworth, The Fundamentals of Interior Design, AVA publishing, 2009.
4. V. Mary. Knackstedt, The Interior Design Business Handbook: A Complete Guide to Profitability, Wiley, New Jersey; 2006.
5. M. G. Shah, C. M. Kale, and S.Y. Patki, Building Drawing with an Integrated Approach to Build Environment, Tata McGraw Hill, 2002.
6. Https://eclectictrends.com

22OFT03 SURFACE ORNAMENTATION 3 0 0 3

Course Objectives

- To familiarize the students about the various techniques of surface embellishment with relevance to garment embellishments.
- To aware of various types of embroidery and methods of producing it.
- To make the students confident about doing surface embellishment work

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Analyze the raw material requirements for surface ornamentation and its application
2. Implement hand embroidery stitches on fabric and show the stitch development procedure in diagrammatic representations
3. Apply the machine and computerized embroidery stitches
4. Analyze the surface embellishment techniques and its application
5. Assess the quality maintenance parameters of all embroidered products and analyze the 6 traditional embroidery techniques

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2					1						
2	2	3	2						2				2	2
3	2	3	2		3								2	2
4	2	2	2						2				2	2
5	2	2	2						2					2

UNIT I **9 Hours**

INTRODUCTION TO SURFACE ORNAMENTATION

Introduction, Definition, Need, Types, Raw materials, Importance of surface ornamentation, Selection of needle, thread and fabric for hand embroidery and machine embroidery. various methods of surface embellishment- embroidery and surface ornamentation.

UNIT II **9 Hours**

HAND EMBROIDERY

General rules for hand embroidery. Types of hand embroidery stitches-Running, Couching, Button hole, Satin, Long & Short, Wheat, Chain, Stem, Herringbone, Cross stitch, Knotted stitches, Fish bone, Fly stitch, Braids, Back, Hem, Seed, Needle weaving, Whip stitches.

UNIT III **9 Hours**

MACHINE EMBROIDERY

General rules for machine embroidery. Types of frames and methods of transferring the designs. Attachments to sewing machines for embroidery, Types of machine embroidery stitches- Eyelet work, Cut work, patch work, Mirror work, Applique, Shaded embroidery, Shadow work, Bead and Sequins work, Vermicelli, Zigzag, Granite stitch. Computerized embroidery machine- Concept of design and development, software used in embroidery machines, process of designing, method and types of stitch application, punching and digitizing.

UNIT IV **9 Hours**

EMBELLISHMENT TECHNIQUES

Materials used and Applications. Types of embellishment techniques- fabric painting-hand, Stencil-dabbing and Spraying. Dyeing and printing-advanced tie and dye techniques, batik and block printing. Trimmings and decorations-Laces, Pompons, Fringes, Tassels, Tucks, Show buttons, Crocheting.

UNIT V **9 Hours**

TRADITIONAL EMBROIDERIES OF INDIA AND CARE

Care and maintenance of embroidered articles-care and maintenance methods for embroidered apparel, pressing. Traditional Embroideries of India-Phulkari, Kasuti, Kashmiri embroidery, Kutch work, Chikkankari, Kantha.

Total: 45 Hours

Reference(s)

1. Ruth Chandler, Modern Hand Stitching-Dozens of stitches with creative free-form variations,2014
2. Sophie Long, Mastering the Art of Embroidery: Traditional Techniques and Contemporary Applications for Hand and Machine Embroidery, Heritage Publishers, London, 2013
3. Christen Brown ,Embroidered & Embellished, C&T Publishing, 2013
4. Sheila Paine, Embroidered Textiles, Thames and Hudson Publisher, UK, 1990.
5. Gail Lawther, Inspirational Ideas for Embroidery on Clothes & Accessories, Search Press Ltd, UK, 1993.
6. http://www.needlenthread.com/tag/hand-embroidery-stitches

22OPH01 NANOMATERIALS SCIENCE 3 0 0 3

Course Objectives

- Impart knowledge on Nanoscience
- Explore different techniques of producing nanomaterials
- Create expertise on the applications of nanomaterials in various fields

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Summarize the origin and advance of nanomaterials and its classification
2. Compare the different types of methods adopted for synthesizing nanomaterials
3. Analyze the characterization techniques for analyzing nanomaterials
4. Explain the physical properties exhibited by nanomaterials
5. Organize the nanomaterials developed for advanced technological applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	1	1							1		
2	3	2	2	1	1							1		
3	3	2	2	1	1							1		
4	3	2	2	1	1							1		
5	3	2	2	1	1							1		

UNIT I **9 Hours**

NANO SCALE MATERIALS

Introduction-Feynman's vision-national nanotechnology initiative (NNI) - past, present, future -classification of nanostructures, nanoscale architecture - effects of the nanometer length scale - changes to the system total energy, and the system structures- effect of nanoscale dimensions on various properties -differences between bulk and nanomaterials and their physical properties.

UNIT II **9 Hours**

NANOMATERIALS SYNTHESIS METHODS

Top down processes - mechanical milling, nanolithography and types based on radiations - Bottom up process physical method: physical vapour deposition, RF sputtering, CVD- chemical method: colloidal and sol-gel methods - template based growth of nanomaterials - ordering of nanosystems, self-assembly and self-organization.

UNIT III **9 Hours**

CHARACTERIZATION TECHNIQUES

General classification of characterization methods - analytical and imaging techniques - microscopy techniques - electron microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy - diffraction techniques - X-ray spectroscopy - thermogravimetric analysis of nanomaterials.

UNIT IV **9 Hours**

SEMICONDUCTOR NANOSTRUCTURES

Quantum confinement in semiconductor nanostructures - quantum wells, quantum wires, quantum dots, super lattices-epitaxial growth of nanostructures-MBE, metal organic VPE, LPE - carbon nano tubes- structure, synthesis and electrical properties -applications- quantum well laser- quantum efficiency of semiconductor nanomaterials

UNIT V **9 Hours**

NANOMACHINES AND NANODEVICES

Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS)-fabrication, actuators-organic FET- principle, description, requirements, integrated circuits- single electron transistor - - organic photovoltaic cells- spintronics

Total: 45 Hours

Reference(s)

1. Willam A. Goddard, Donald W.Brenner, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, 2012
2. Charles P. Poole Jr and. Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2007
3. Guozhong Cao, Y. Wang, "Nanostructures and Nanomaterials-Synthesis, Properties & Applications", Imperials College Press, 2011.
4. T. Pradeep, "NANO: The Essentials Understanding Nanoscience and Nanotechnology", McGraw - Hill Education (India) Ltd, 2012
5. Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley and Sons Ltd, 2006
6. Viswanathan B, AuliceScibioh M, "Fuel cells: Principles and Applications", University Press, 2009.

22OPH02 SEMICONDUCTOR PHYSICS AND DEVICES 3 0 0 3

Course Objectives

- Impart knowledge in physical properties of semiconducting materials
- Analyze the factors affecting the operation of semiconductor devices
- Apply the physics of semiconductors to develop semiconductor devices

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO2 Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Exemplify the band gap, drift and diffusion current densities due to carrier transport in semiconductors
2. Analyze the energy band diagram in thermal equilibrium and space charge width of PN junction
3. Illustrate the operation of Bipolar Junction transistor at different modes and different configurations
4. Illustrate the operation of metal oxide field effect transistor and their memory devices
5. Represent the working mechanism of opto-electronic devices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	1	1							1		1
2	3	2	2	1	1							1		1
3	3	2	2	1	1							1		1
4	3	2	2	1	1							1		1
5	3	2	2	1	1							1		1

UNIT I 9 Hours

ENERGY BANDS AND CARRIER TRANSPORT PROPERTIES

Energy Bands: Formation of energy bands - doping effects - energy levels - electron and hole concept in semiconductor. Carrier transport: Carrier drift-drift current density - conductivity- diffusion current density - total current density

UNIT II **9 Hours**

P-N JUNCTION

Basic structure and fabrication process of p-n junction - current - voltage characteristics - energy band diagram - equilibrium Fermi levels - depletion region - junction breakdown phenomena - zener - avalanche breakdown.

UNIT III **9 Hours**

BIPOLAR JUNCTION TRANSISTOR

The basic transistor action - operation in the active mode - current gain - static characteristics - carrier distribution in emitter, base and collector region - modes of operation - current - voltage characteristics of common base and emitter configuration - frequency response and switching of bipolar transistor

UNIT IV **9 Hours**

MOSFET

The ideal MOS diode - basic fundamentals and characteristics - types - CMOS and BiCMOS - CMOS inverter - MOSFET on insulator - thin film transistor (TFT) - silicon on insulators (SOI) devices - MOS Memory structures - DRAM and SRAM

UNIT V **9 Hours**

PHOTONIC DEVICES

Radiative transitions and optical absorption-light emitting diodes-organic LED - infrared LED - semiconductor laser - temperature effect - photo detector - photo diode - silicon and compound semiconductor solar cells - efficiency

Total: 45 Hours

Reference(s)

1. Donald A Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, 2012
2. S. M. Sze and M. K. Lee, "Semiconductor Devices, Physics and Technology", John-Wiley & Sons, 2015
3. Ben. G. Streetman and S. K. Banerjee , "Solid State Electronic Devices", Pearson Education Ltd, 2015
4. C. Kittel, "Introduction to Solid State Physics", John-Wiley & Sons, 2012
5. J. Millman and C. Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, 2010
6. Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006

22OPH03 APPLIED LASER SCIENCE 3 0 0 3

Course Objectives

- Impart knowledge on laser science
- Explore different strategies for producing lasers
- Create expertise on the applications of lasers in various fields

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Illustrate the transition mechanisms and the components of a laser system
2. Compare the different types of lasers based on pumping method, active medium and energy levels
3. Compute the rotation of earth, velocity and distance using lasers and apply the same for day today applications
4. Analyze the role of lasers in surgical and endoscopy applications
5. Apply the laser techniques in industrial applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	1								1		
2	3	2	2	1								1		
3	3	2	2	1								1		
4	3	2	2	1								1		
5	3	2	2	1								1		

UNIT I **9 Hours**

LASER FUNDAMENTALS

Introduction - principle - absorption and emission of light - thermal equilibrium - Einstein's prediction - Einstein's relations - A and B coefficients - condition for large stimulated emission - spontaneous and stimulated emission in optical region - light amplification - condition for light amplification - population inversion- Components of lasers - pumping methods - pumping mechanisms - optical resonator

UNIT II **9 Hours**

LASER BEAM CHARACTERISTICS AND TYPES

Characteristics of laser - Classification of lasers - principle, construction, working, energy level diagram and applications of molecular gas laser (CO2 laser) - liquid laser (dye laser) - excimer laser - Solid state laser (Nd:YAG laser) - semiconductor laser (homojunction laser).

UNIT III **9 Hours**

LASERS IN SCIENCE

Introduction - Harmonic generation (SHG) - Stimulated Raman emission - lasers in chemistry - laser in nuclear energy - lasers and gravitational waves - rotation of the earth - measurement of distance - Light detection And Ranging (LIDER) - velocity measurement - holography

UNIT IV **9 Hours**

LASERS IN MEDICINE AND SURGERY

Light induced biological hazards: Eye and skin - Eye laser surgery - photocoagulations - homeostasis - dentistry - laser angioplasty - different laser therapies - advantages & disadvantages - laser endoscopy.

UNIT V **9 Hours**

LASERS IN INDUSTRY

Applications in material processing: laser welding - hole drilling - laser cutting - Lasers in electronics industry: information storage - bar code scanner- Lasers in defence: laser based military weapons - laser walls.

Total: 45 Hours

Reference(s)

1. K. Thiyagarajan and A. K. Ghatak, "LASERS: Fundamentals and Applications", Springer, USA, 2015
2. M. N. Avadhanulu, "An Introduction to Lasers Theory and Applications", S. Chand Publisher, 2013
3. W. Koechner, M. Bass, "Solid State Lasers: a graduate text", Springer Verlag, New York, 2006
4. K. P. R. Nair, "Atoms, Molecules and Lasers", Narosa Publishing House, 2009
5. K. R. Nambiar, "Lasers: Principles Types and Applications", New Age International Publications, 2006
6. A. Sennaroglu, "Solid-State Lasers and Applications", CRC Press, 2006

22OPH04 **BIOPHOTONICS** **3 0 0 3**

Course Objective:

- To understand the light-matter interaction in biological cells or tissues by using the principles of optics and lasers.
- To apply the properties of biological cells or tissues in biomedical applications by various optical imaging, sensing and activation techniques.
- To analyze the concepts of Modern optical measurement techniques and devices in early detection of disease and cure them.

Programme Outcomes (POs)

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Use research–based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Infer the laws of optics and lasers to interpret the biological cells and tissues.
2. Identify the properties of different optical instruments in biological systems to represent their behavior in structure and design of detection engineering instruments.
3. Use laser tweezers techniques to infer the activities of cells (tissues) and explain the single molecule detection processes in medical diagnosis.
4. Outline the properties of ultra short laser pulses and tissue engineering to rectify the affecting factors in biological cells.
5. Compare the various types of bio-imaging methods to detect the infected cells and molecules in biological science.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	3	2	2	1									
2	2	3	2	2	1									
3	3	3	2	2	1									
4	4	3	2	2	1									
5	5	3	2	2	1									

UNIT I **9 Hours**

INTRODUCTION TO BIOPHOTONICS

Light as Photon Particles – Coherence of light - lasers – classification of lasers – Mechanisms of Non-linear Optics (NLO) processes associated with Biophotonics - Light scattering mechanisms: Rayleigh scattering, Miescattering, Brillouin Scattering, Raman Scattering -Different light sources – Quantitative description of light: Radiometry

UNIT II **9 Hours**

PHOTOBIOLOGY

Interaction of light with cells and tissues – Light – Tissue Interaction Variables – Light –Tissue Interaction Theory: Radiative Transport Theory – Photo process in biopolymers – In Vivo Photoexcitation – photo-induced physical, chemical, thermal and mechanical effects in biological systems – Optical biopsy – Single molecule detection

UNIT III **9 Hours**

BIONANO PHOTONICS

Laser Microtools, Semiconductor quantum dots for bioimaging, Metallic nanoparticles and nanorods for biosensing – Optical biosensors: Fibre-Optic, evanescent wave, surface Plasmon resonance (SPR) based biosensors – biomaterials for photonics – Principle and design of laser tweezers – laser trapping and dissection for biological manipulation.

UNIT IV **9 Hours**

TISSUE ENGINEERING WITH LIGHT

Basics of tissue optics: Light absorption and scattering in tissues, Wavelength effects and spectra– the therapeutic window, Light penetration in tissues – Absorbing agents in tissues and blood –Skinoptics, response to the UV radiation, Optical parameters of tissues – tissue welding – tissue contouring – tissue regeneration – Femto laser surgery – low level light therapy and photo dynamic therapy

UNIT V **9 Hours**

BIO-IMAGING TECHNIQUES AND ITS APPLICATIONS

An overview of optical imaging – Fluorescence Microscopy – Scanning Microscopy – In vivo Confocal Microscopy – Multi photon Microscopy – Optical Coherence Tomography (OCT) – Fluorescence Resonance Energy Transfer (FRET) imaging – fluorescence lifetime imaging Microscopy (FLIM) – Nonlinear optical imaging – Coherent Anti-stokes Raman Scattering –Bioimaging Applications.

Total: 45 Hours

Reference(s)

1. Introduction to Biophotonics, ParasN.Prasad, WileyInter-science, AJohnWiley & Sons, Inc., Publication (Class notes are developed mainly based on this book.)
2. Introduction to Biomedical Imaging, Andrew G.Webb, 2002, IEEE Press.
3. Biomedical Optics: Principles and Imaging, Lihong.V.Wang, Hsin.-I.Wu, 2007, Wiley Interscience 2007. & "An Introduction to Biomedical Optics", R.Splinterand B.A.Hooper, Taylor & Francis
4. Bioimaging Current Concepts in Light and Electron Microscopy, DouglasE.Chandler & Robert W.Roberson, Jones and Bartlett publishers.
5. Optical Imaging and Microscopy : Techniques and Advanced Systems, Peter Török and Fu-JenKao, 2004, Springer.

22OPH05 PHYSICS OF SOFT MATTER 3 0 0 3

Course Objectives

- To recognize the properties of soft matter and hard matter
- To understand the fundamental interactions of colloids and gels
- To explain the structure and phase behavior of liquid crystals and supramolecules
- To summarize the soft matter proprties of structures and components of life

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Identify the salient features of soft matter and hard matter
2. Exemplify the fundamental interactions and stability of colloids and gels
3. Illustrate the structure and properties of liquid crystals
4. Outline the aggregation and phase behavior of surfactants, polymers, copolymers and block copolymers
5. Analyze the soft matter behavior of nucleic acids, proteins, polysaccharides and membranes

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	1												
3	2	2												
4	2	2												
5	2	2												

UNIT I 9 Hours

CONDENSED MATTER

Intermolecular forces-Condensation and freezing-mechanical response: Hookean solid-Newtonian liquid-viscoelasticity. Glasses: relaxation time-viscosity- glass forming liquids. Soft matter: length scales-fluctuations and Brownian motion

UNIT II 9 Hours

COLLOIDAL DISPERSIONS AND GELS

Forces between colloidal particles: vander Waals forces-electrostatic double layer forces-steric hindrance-depletion interactions. Stability and phase behaviour: Crystallisation-strong colloids-weak colloids.Physical and chemical gels-classical theory of gelation-elasticity of gels

UNIT III **9 Hours**

LIQUID CRYSTALS

Liquid crystal phases-distortions and topological defects-electrical and magnetic properties-polymer liquid crystals-Fredricks transition and liquid crystal displays

UNIT IV **9 Hours**

SUPRAMOLECULAR SELF ASSEMBLY

Aggragation and phase separation-types of micelles- bilayers and vesicles. Phase behaviour of concentrated surfactant solutions-phase separation in polymers, copolymers and block copolymers

UNIT V **9 Hours**

SOFT MATTER IN NATURE

Components and structures of life-Nucleic acids-proteins-interaction between proteins-polysaccharides-membranes

Total: 45 Hours

REFERENCES

1. Richard A L Jones, Soft Condensed Matter, Oxford University Press, UK, 2002
2. Masao Doi, Soft Matter Physics, Oxford University Press, UK, 2013.
3. Ian W. Hamley, Introduction to Soft Matter, John Wiley & Sons, 2007
4. A. Fernandez-Nieves, A M Puertas, Fluids, Colloids and Soft materials: An Introduction to Soft Matter Physics, John Wiley & Sons, 2016
5. Maurice Kleman, Oleg D. Lavrentovich, Soft Matter Physics: An Introduction, Springer-Verlag, New York, 2003.

22OCH01 CORROSION SCIENCE AND ENGINEERING 3 0 0 3

Course Objectives

- Analyse the loss incurred due to corrosion in different sectors and terminologies related to corrosion
- Identify forms and types of corrosion with suitable mechanism
- Apply various methods of corrosion control, corrosion testing and monitoring

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Explain if corrosion can occur under specific operating conditions in a given equipment or construction and indicate regions of immunity, corrosion and passivity of a metal
2. Compare different corrosion types on metals when exposed to air, water and at high temperatures (> 100 C)
3. Identify the corrosion mechanism on steel, iron, zinc and copper metal surfaces
4. Calculate the rate of corrosion on metals using electrochemical methods of testing
5. Propose the correct materials, design and operation conditions to reduce the likelihood of corrosion in new equipment and constructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

UNIT I **9 Hours**

CORROSION

Importance of corrosion - spontaneity of corrosion - units of corrosion rate (mdd and mpy) - direct and indirect damage by corrosion - importance of corrosion prevention in industries - Pilling Bedworth ratio and its significance - passivation - area relationship in both active and passive states of metals - Pourbaix digrams of Mg, Al and Fe and their advantages and disadvantages

UNIT II **7 Hours**

TYPES OF CORROSION

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion-Catastrophic oxidation corrosion

UNIT III **9 Hours**

MECHANISM OF CORROSION

Hydrogen embrittlement - corrosion fatigue - filiform corrosion - fretting damage and microbes induced corrosion. Corrosion mechanism on steel, iron, zinc and copper metal surfaces

UNIT IV **10 Hours**

CORROSION RATE AND ITS ESTIMATION

Rate of corrosion: Factors affecting corrosion. Electrochemical methods of polarization: Tafel extrapolation polarization and linear polarization. Weight loss method - testing for intergranular susceptibility and stress corrosion. Non destructive testing methods: Visual testing - liquid penetrant testing - magnetic particle testing - Ultrasonic monitoring, and eddy current testing

UNIT V **10 Hours**

CORROSION CONTROL METHODS

Fundamentals of cathodic protection - types of cathodic protection(sacrificial anodic and impressed current cathodic protection). Stray current corrosion, problems and its prevention. Protective coatings: Metal coatings: Hot dipping (galvanizing, tinning and metal cladding) - natural inhibitors. Selection of suitable design for corrosion control

Total: 45 Hours

Reference(s)

1. Mouafak A. Zaher, "Introduction to Corrosion Engineering", CreateSpace Independent Publishing Platform, 2016.
2. E.McCafferty, "Introduction to Corrosion Science", Springer; 2010 Edition, January 2010.
3. R. Winstone Revie and Herbert H. Uhlig, "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, John Wiley & Science, 2008.
4. Mars G. Fontana, "Corrosion Engineering", Tata McGraw Hill, Singapore, 2008
5. David E.J. Talbot (Author), James D.R. Talbot, "Corrosion Science and Technology", Second Edition (Materials Science & Technology), CRC Press; 2nd Edition, 2007.

22OCH02 **POLYMER SCIENCE** **3 0 0 3**

Course Objectives

- Explain the properties of different polymers with its mechanism
- Select the appropriate polymerization techniques to synthesize the polymers
- Identify suitable polymers for various industrial applications

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Course Outcomes (COs)

1. Illustrate the types of mechanism of polymerization reactions and analyze the natural and synthetic polymers
2. Identify the suitable polymerization techniques to synthesize the high quality polymers
3. Identify the structure, thermal, and mechanical properties of polymers for different applications
4. Apply the polymer processing methods to design polymer products
5. Analyze the polymers used in electronic and biomedical applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	2												
4	1	1	2											
5	1	3	2											

UNIT I **10 Hours**

POLYMERS AND ELASTOMERS

Classification of polymers - Mechanism: Addition polymerization - free radical, cationic, anionic and co-ordination (Ziegler-Natta) polymerization - copolymerization - condensation polymerization (nylon-6,6) -ring opening polymerization (nylon-6). Elastomers: Natural rubber and synthetic rubber: styrene -butadiene rubber (SBR), butyl, neoprene, thiocol rubbers. High performance polymers: polyethers, polyether ether ketone (PEEK), polysulphones and polyimides

UNIT II **8 Hours**

POLYMERIZATION TECHNIQUES

Homogeneous and heterogeneous polymerization - bulk polymerization (PMMA, PVC) - solution polymerization - polyacrylic acid, suspension polymerization (ion-exchange resins) - emulsion polymerization (SBR) - advantages and disadvantages of bulk and emulsion polymerization. Melt solution and interfacial poly-condensation

UNIT III **8 Hours**

CHARACTERIZATION AND TESTING

Characterization of polymers by Infrared Spectroscopy (IR) and Nuclear Magnetic Spectroscopy (NMR) - Thermal properties: TGA and DSC - Testing tensile strength - Izod impact - Compressive strength - Rockwell hardness - Vicot softening point - water absorption

UNIT IV **9 Hours**

POLYMER PROCESSING

Moulding: Compression - injection - extrusion and blow mouldings. Film casting - calendering. Thermoforming and vacuum formed polystyrene - foamed polyurethanes. Fibre spinning: melt, dry and wet spinning. Fibre reinforced plastics fabrication: hand-layup - filament winding and pultrusion

UNIT V **10 Hours**

SPECIALITY POLYMERS

Preparation and properties of heat resistant and flame retardant polymers. Polymers for electronic applications: liquid crystalline, conducting and photosensitive polymers – E waste management. Polymer for biomedical applications: artificial organs, controlled drug delivery, Scaffolds in tissue Engineering –waste management.

Total: 45 Hours

Reference(s)

1. V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International (P) Ltd., New Delhi, 2021
2. Joel R. Fried, "Polymer Science and Technology", Prentice Hall of India (P). Ltd., 2014
3. R. J. Young and P. A. Lovell, "Introduction to Polymers", CRC Press, New York, 2011
4. F. W. Billmeyer,"Text Book of Polymer Science", John Wiley & Sons, New York, 2008
5. Barbara H. Stuart, "Polymer Analysis", John Wiley & Sons, New York, 2008
6. George Odian , "Principles of Polymerization", John Wiley & Sons, New York, 2004

22OCH03 ENERGY STORING DEVICES 3 0 0 3

Course Objectives

- Compare the energy density of commercialized primary and secondary batteries.
- Classify the fuel cells and compare their efficiency in different environmental conditions.
- Demonstrate the various energy storage devices and fuel cells.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Find the parameters required for operation of a cell to evaluate the capacity of energy storage devices.
2. Identify the electrodes, electrolyte and cell reactions of different types of primary, secondary batteries and infer the selection criteria for commercial battery systems with respect to commercial applications.
3. Differentiate fuel cells based on its construction, production of current and applications.
4. Compare different methods of storing hydrogen fuel and its environmental applications.
5. Classify the solar cell based on the materials used in it.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1												
2	2	3					1							
3	3	1												
4	2	2					1							
5	3	3					1							

UNIT I **6 Hours**

BASICS OF CELLS AND BATTERIES

Components - classification - operation of a cell - theoretical cell voltage - capacity - specific energy - energy density of lithium and lead acid battery - charge efficiency- charge rate - charge retention - closed circuit voltage - open circuit voltage current density - cycle life - discharge rate-over charge-over discharge

UNIT II **10 Hours**

BATTERIES FOR PORTABLE DEVICES AND ELECTRIC VEHICLES

Primary batteries: zinc-carbon - magnesium,and mercuric oxide - recycling/safe disposal of used cells. Secondary batteries: lead acid - nickel-cadmium - lithium ion batteries - rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide - lithium anode cell - photogalvanic cells. Battery specifications for cars and automobiles. Extraction of metals from battery materials.

UNIT III **10 Hours**

TYPES OF FUEL CELLS

Importance and classification of fuel cells: Description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells - phosphoric acid - solid oxide - molten carbonate and direct methanol fuel cells

UNIT IV **10 Hours**

HYDROGEN AS A FUEL

Sources and production of hydrogen: Electrolysis and photocatalytic water splitting. Methods of hydrogen storage: High pressurized gas - liquid hydrogen type - metal hydride. Hydrogen as engine fuel - features, application of hydrogen technologies in the future – limitations.

UNIT V **9 Hours**

ENERGY AND ENVIRONMENT

Future prospects of renewable energy and efficiency of renewable fuels - economy of hydrogen energy. Solar Cells: First, second, third and fourth generation solar cell - photobiochemical conversion cell.

Total: 45 Hours

Reference(s)

1. S.P. Jiang, Q. Li, Introduction to Fuel Cells, Springer, 2021.
2. M.M. Eboch, The Future of Energy, From Solar Cells to Flying Wind Farms, Capstone, 2020.
3. N. Eliaz, E. Gileadi, Physical Electrochemistry, Fundamentals, Techniques and Applications, Wiley, 2019.
4. J. Garche, K. Brandt, Electrochemical Power sources: Fundamentals Systems and Applications, Elsevier, 2018
5. A. Iulianelli, A. Basile, Advances in Hydrogen Production, Storage and Distribution, Elsevier, 2016.

22OGE01 PRINCIPLES OF MANAGEMENT 3 0 0 3

Course Objectives

- To develop cognizance about importance of management principles.
- Extract the functions and responsibilities of managers.
- To Study and understand the various HR related activities.
- Learn the application of the theories in an organization.
- Analyze the position of self and company goals towards business.

Programme Outcomes (POs)

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Students will be able to understand the basic concepts of Management.
2. Have some basic knowledge on planning process and its Tools & Techniques.
3. Ability to understand management concept of organizing and staffing.
4. Ability to understand management concept of directing.
5. Ability to understand management concept of controlling.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2		3		1	1
2									2		2		1	1
3									2		2		1	1
4									3		2		1	1
5									2		2		1	1

UNIT I **9 Hours**

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management Science or Art Manager Vs Entrepreneur-types of managers - Managerial roles and skills Evolution of Management Scientific, Human Relations, System and Contingency approaches Types of Business organization - Sole proprietorship, partnership, Company - public and private sector enterprises - Organization culture and Environment Current Trends and issues in Management.

UNIT II **9 Hours**

PLANNING

Nature and purpose of planning - Planning process - Types of planning – Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III **9 Hours**

ORGANISING

Nature and purpose – Formal and informal organization - Organization chart - Organization Structure Types - Line and staff authority - Departmentalization - Delegation of authority - Centralization and decentralization - Job Design - Human Resource - Management - HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career planning and management.

UNIT IV **9 Hours**

DIRECTING

Foundations of individual and group behaviour - Motivation-Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership-types and theories of leadership - Communication-Process of communication - Barrier in communication Effective communication-Communication and IT.

UNIT V **9 Hours**

CONTROLLING

System and process of controlling - Budgetary and non-Budgetary control techniques - Use of Computers and IT in Management control - Productivity problems and management - Control and Performance-Direct and preventive control - Reporting.

Total: 45 Hours

Reference(s)

1. Robbins S, Management, (13th ed.), Pearson Education, New Delhi, 2017.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management, Pearson Education, 7th Edition, 2011.
3. Robert Kreitner and Mamata Mohapatra, Management, Biztantra, 2008.
4. L. M. Prasad, Principles and Practice of Management. 7th Edition, Sultan Chand & Sons, 2007.
5. P. C. Tripathi and P. N. Reddy, Principles of Management, Fourth Edition, Tata McGraw Hill, 2008.

22OGE02 ENTREPRENEURSHIP DEVELOPMENT I 3 0 0 3

Course Objectives

- Learn the basics and scope of the Entrepreneurship
- Understand the generation of ideas of the Entrepreneurship
- Evolve the legal aspects of the business
- Learn to analyze the various business finance
- Learn the basics of the Operations Management

Programme Outcomes (POs)

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Analyze the role of entrepreneurship in economic development.
2. Explain the types of ideas that to be used for entrepreneurship development.
3. Examine the legal aspects of business and its association.
4. Examine the sources of business and its analysis.
5. Analyse the different modes of operation management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1						1	2		2				1	1
2						1	2		2				1	1
3						1	2		2				1	1
4						1	2		2				1	1
5						1	2		2				1	1

UNIT I **9 Hours**

BASICS OF ENTREPRENEURSHIP

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurship process. Role of entrepreneurship in economic development

UNIT II **9 Hours**

GENERATION OF IDEAS

Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractional, Reversal Method, Brain Storming, Analogies

UNIT III **9 Hours**

LEGAL ASPECTS OF BUSINESS

Contract act-Indian contract act, Essential elements of valid contract, classification of contracts, sale of goods act- Formation of contract of sale, negotiable instruments- promissory note, bills and cheques, partnership, limited liability partnership (LLP), companies act-kinds, formation, memorandum of association, articles of association.

UNIT IV **9 Hours**

BUSINESS FINANCE

Project evaluation and investment criteria (cases), sources of finance, financial statements, break even analysis, cash flow analysis.

UNIT V **9 Hours**

OPERATIONS MANAGEMENT

Importance- functions-deciding on the production system- facility decisions: plant location, plant layout (cases), capacity requirement planning- inventory management (cases)-lean manufacturing, Six sigma.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006

22OGE03 ENTREPRENEURSHIP DEVELOPMENT II 3 0 0 3

Course Objectives

- Evolve the marketing mix for promotion the product / services
- Handle the human resources and taxation
- Learn to analyze the taxation
- Understand the Government industrial policies and supports
- Preparation of a business plan

Programme Outcomes (POs)

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Examine the strategies and plans in marketing management.
2. Analyse the cases involved in human resource management.
3. Classify the direct and indirect taxes in business.
4. Analyze the supports given by government for improving the business.
5. Examine the various steps involved in preparing the business plan.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1						1	2		2				1	1
2						1	2		2				1	1
3						1	2		2				1	1
4						1	2		2				1	1
5						1	2		2				1	1

UNIT I **9 Hours**

MARKETING MANAGEMENT

Marketing environment, Segmentation, Targeting and positioning, Formulating marketing strategies, Marketing research, marketing plan, marketing mix (cases)

UNIT II **9 Hours**

HUMAN RESOURCE MANAGEMENT

Human Resource Planning (Cases), Recruitment, Selection, Training and Development, HRIS, FactoriesAct 1948 (an over view)

UNIT III **9 Hours**

BUSINESS TAXATION

Direct taxation, Income tax, Corporate tax, MAT, Tax holidays, Wealth tax, Professional taxCases). Indirect taxation, Excise duty, Customs, Sales and Service tax, VAT, Octroi, GST (Cases)

UNIT IV **9 Hours**

GOVERNMENT SUPPORT

Industrial policy of Central and State Government, National Institute-NIESBUD, IIE, EDI. State LevelInstitutions-TIIC, CED, MSME, Financial Institutions

UNIT V **9 Hours**

BUSINESS PLAN PREPARATION

Purpose of writing a business plan, Capital outlay, Technical feasibility, Production plan, HR plan, Marketsurvey and Marketing plan, Financial plan and Viability, Government approvals, SWOT analysis.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Philip Kotler., Marketing Management, Prentice Hall of India, New Delhi: 2003
3. Aswathappa K, Human Resource and Personnel Management - Text and Cases, Tata McGraw Hill:2007.
4. Jain P C., Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi: 2002.
5. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006.
6. http://niesbud.nic.in/agencies.html

22OGE04	NATION BUILDING, LEADERSHIP AND SOCIAL RESPONSIBILITY	3 0 0 3

Course Objectives

- To understand the importance of National Integration, Patriotism and Communal Harmony
- To outline the basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality
- To analyze the different types of responsibility role of play for the improvement of society

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Understand religo-cultural diversity of the country and its impact on the lives of the people and their beliefs
2. Acquire a sense of responsibility, smartness in appearance and improve self confidence
3. Develop the sense of self-less social service for better social & community life
4. Apply the importance of Physical and Mental health and structure of communication organization and various mode of communication
5. Acquire awareness about the various types of weapon systems in the Armed Forces.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1				1					3		
2	2		2				2					2		
3	2		1				1					2		
4	2		3				3					3		
5	2		1				1					2		

UNIT I **9 Hours**

NATIONAL INTEGRATION

Importance & Necessity, Factors Affecting National Integration, Unity in Diversity. Threats to National Security. Water Conservation and Rain Harvesting, Waste Management and Energy Conservation. Leadership Capsule-Traits-Indicators-Motivation-Moral Values-Honor Code-Case Studies: Shivaji, Jhansiki Rani, Case Studies–APJ Abdul kalam, Deepa Malik, Maharana Pratap, N Narayan Murthy Ratan Tata Rabindra Nath Tagore, role of NCC cadets in 1965 war.

UNIT II **9 Hours**

PERSONALITY DEVELOPMENT AND LEADERSHIP

Intra & Interpersonal skills - Self-Awareness- &Analysis, Empathy, Critical & creative thinking, Decision making and problem solving, Communication skills, Group Discussion – copping with stress and emotions, changing mindset, Public Speaking, Time Management, Social skills, Career counseling, SSB procedure and Interview skills.

UNIT III **9 Hours**

SOCIAL SERVICE, COMMUNITY DEVELOPMENT AND ENVIRONMENTAL AWARENESS

Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare. Protection of children & women safety, Road/ Rail Travel Safety, New initiatives, Cyber and mobile security awareness. Disaster management Capsule-Organization-Types of Disasters-Essential Services-Assistance-Civil Defence Organization

UNIT IV **9 Hours**

HEALTH, HYGIENE AND COMMUNICATION

Sanitation, First Aid in Common Medical Emergencies. Health, Treatment and Care of Wounds. Yoga-Introduction, Definition, Purpose, Benefits. Asanas-Padamsana, Siddhasana, Gyan Mudra, Surya Namaskar, Shavasana, Vajrasana, Dhanurasana, Chakrasana, Sarvaangasana, Halasanaetc. Obstacle Training Contact: Obstacle training - Intro, Safety measures, Benefits, Straight balance, Clear Jump, Gate Vault, ZigZagBalance, High Wall etc. COMMUNICATION: Basic Radio Telephony (RT) Procedure-Introduction, Advantages, Disadvantages, Need for standard- Procedures-Types of Radio Telephony Communication-Radio telephony procedure, Documentation.

UNIT V **9 Hours**

ARMED FORCES AND NCC GENERAL

Army, navy, Air force and Central armed policed forces- Modes of entry into army, police and CAPF-Naval expeditions & campaigns. History, Geography of Border / Coastal areas. EEZ maritime security & ICG. Modes of Entries in armed forces. Security challenges & role of cadets in Border management. Aims, Objectives and org of NCC- Incentives- Duties of NCC cadets- NCC Camps: types and conduct.

Total: 45 Hours

Reference(s)

1. Lt. Dr S Rajan and Capt. Dr R Latha, NCC Master, Dream Book Publishing, 2024.
2. R. Gupta, NCC National Cadet Corps A, B & C-Certificate Examination Book, 22nd edition, Ramesh Publishing House, 2022.
3. Singh and Neeraj, A Hand Book of NCC, Kanti Prakashan Publishing, 5th edition, 2021.
4. https://nccorissa.org/old/Doc/Ncc-CadetHandbook.pdf

22OBM01 OCCUPATIONAL SAFETY AND HEALTH IN PUBLIC HEALTH EMERGENCIES 3 0 0 3

Course Objectives

- Students will be able to know about Occupational safety and health (OSH)
- Students will be able to discuss about risks faced by emergency responders during disease outbreaks and other emergencies
- Students will be able to create awareness on necessary strategies for managing OSH in emergency situations

Programme Outcomes (POs)

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Practice the occupational safety measures by the scientific knowledge to overcome the risks faced by emergency responders
2. Apply appropriate strategies and tools in Occupational safety and healthcare
3. Analyse common risks for safety and health in emergencies
4. Adapt appropriate occupational safety practices in chemical accidents
5. Guide Occupational safety measures in radiation incidents

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		3	2	1				1				2		
2		2	2	2				1				2		
3		3	2	2				1				2		
4		2	2	2				1				2		
5		3	2	2				1				2		

UNIT I **9 Hours**

MANAGEMENT ASPECTS

Management system approach to occupational safety and health hazards and risks – rights, duties and responsibilities of employers and workers during outbreaks and emergencies – Emergency responders health monitoring and surveillance

UNIT II **9 Hours**

STRATEGIES AND TOOLS

International Health Regulations, 2005 – Incident command system for managing outbreaks and emergencies – Occupational safety and health controls – Strategies for infection prevention and control

UNIT III **9 Hours**

COMMON RISKS FOR SAFETY AND HEALTH IN EMERGENCIES

Vector-borne diseases, water and food-borne diseases, Vaccine-preventable diseases – Heat stress - Slips, trips and falls - Road traffic injuries – Ergonomic hazards - Violence – Psychological stress during outbreaks and injuries

UNIT IV **9 Hours**

OCCUPATIONAL SAFETY AND HEALTH IN CHEMICAL INCIDENTS

Emergencies caused by chemical incidents – occupational safety and health hazards and risks of chemicals – Personal Protective Equipment – Decontamination of emergency response personnel – medical surveillance of emergency responders

UNIT V **9 Hours**

OCCUPATIONAL SAFETY AND HEALTH IN RADIATION INCIDENTS

Sources and scenarios of radiation incidents – guidance for protection of emergency responders -Occupational health surveillance of persons occupationally exposed to radiation in emergencies

Total: 45 Hours

Reference(s)

1. Emergency responder health monitoring and surveillance. National Response Team technical assistance document. Atlanta (GA): National Institute for Occupational Safety andHealth; 2012.
2. Emergency response framework (ERF). Geneva: World Health Organization; 2013
3. Guidelines on occupational safety and health management systems, second edition.Geneva: International Labour Organization; 2009.
4. OSH management system: a tool for continual improvement. Geneva: International Labour Organization; 2011
5. OECD Environmental Outlook to 2050: the consequences of inaction. Paris: Organization for Economic Co-operation and Development; 2012.

22OBM02 **AMBULANCE AND EMERGENCY MEDICAL SERVICE MANAGEMENT** **3 0 0 3**

Course Objectives

- Understand the ambulance & transport management and allied services.
- Compare the ambulance design and equipment, transportation and corporate Profit.
- Carry-out various acts governing transport management.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Identify ambulance services, types and allied services
2. Formulate minimum ambulance rescue equipment and developing a transportation Strategy.
3. Understand the Emergency response team, Transportation interfaces, Transportation Service Characteristics& regulatory reforms involved.
4. Identify ambulance services, types and allied services
5. Formulate minimum ambulance rescue equipment and developing a transportation Strategy.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2	2													
3		2												
4	2	2												
5	2													

UNIT I **9 Hours**

INTRODUCTION

Introduction-transportation ambulance types-Advanced Life Support Ambulance-Basic Life Support Ambulance-Patient Transport Ambulance-Emergency services-Ambulances-Allied services-telephone management

UNIT II **9 Hours**

AMBULANCE DESIGN AND EQUIPMENT

Design and Equipment of Ambulances -Minimum Ambulance Rescue Equipment-Emergency drugs medicines Recruitment validation Training to handle in house Ambulance emergency procedures Checklist measures Roles of paramedics, midwives, community nurses, hospice workers in emergency handling via ambulance

UNIT III **9 Hours**

TRANSPORTATION REGULATION FOR EMERGENCY MEDICAL SERVICE

Crisis Management-Anxiety & Stress Management-the Emergency response team-police assistance- Information handling & processing-Establishing customer service levels - Developing and Reporting customer service standards - Impediments to an Effective customer Service strategy - Improving customer Service Performance Transportation

UNIT IV **9 Hours**

AMBULANCE PREVENTIVE MAINTENANCE

Legal obligations Switch Console Front, Main Electrical, Patient Compartment Climate Oxygen system On board Suction system 110/12 VOLT system, Modular Body, Medical Equipment - Cot & Stretcher, safety belts-driver(s), passenger, Patients-child restraint device-incubator

UNIT V **9 Hours**

THE MOTOR VEHICLE ACT

The Motor Vehicle Act, 1988- Rules of the road Regulations 1989- Overall Dimensions of Motor Vehicles (Prescription of conditions for exemption) Rules 1991-Use of Red light on the top front of the vehicle

Total: 45 Hours

Reference(s)

1. Fawcett,"Supply Chain Management", Pearson Education India, 01-Sep-2008 - 600 pages.
2. B. Feroz, A. Mehmood, H. Maryam, S. Zeadally, C. Maple and M. A. Shah, "Vehicle-Life Interaction in Fog-Enabled Smart Connected and Autonomous Vehicles," in IEEE Access, vol. 9, pp. 7402-7420, 2021, doi: 10.1109/ACCESS.2020.3049110.
3. R. Jin, T. Xia, X. Liu, T. Murata and K. -S. Kim, "Predicting Emergency Medical Service Demand With Bipartite Graph Convolutional Networks," in IEEE Access, vol. 9, pp. 9903-9915, 2021, doi: 10.1109/ACCESS.2021.3050607.
4. Les Pringle,"Call the Ambulance",Transworld Publishers, 2010.
5. Edward J. Bardi, John Joseph Coyle, Robert A. Novack"Management of Transportation", Thomson/South-Western, 2006

22OBM03 HOSPITAL AUTOMATION 3 0 0 3

Course Objectives

- Introduce the concepts of hospital systems and need for central monitoring
- Exemplify the power generation, utility and protection systems.
- Apply the distributed and central monitoring functions in hospital environment

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Identify the factors in central power generating and monitoring systems
2. Analyze the sensors and actuators for the automation systems
3. Classify the equipment types and its applications.
4. Apply software tools and digital computer for monitoring of parameters and medical data handling
5. Design central monitoring station for hospitals for control and surveillance applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2													
2		2												
3		2												
4		2												
5	3													

UNIT I **9 Hours**

AUTOMATION IN HEALTHCARE

Introduction to automation Role of automation in healthcare Remote Patient Monitoring Maximizing resources on patient care Reducing variability, Automating clinician and patient interactions through products.

UNIT II **9 Hours**

POWER GENERATION AND MEDICAL GAS PRODUCTION

Power generator, Battery : Maintenance and troubleshooting, energy conservation and monitoring system - Automation in dryer, compressor, air conditioning, lighting, heating systems.

UNIT III **9 Hours**

AUTOMATION IN PIPING

Monitoring of flow and pressure of medical gas System components Vacuum control units Automatic changeover system - Types of Outlets - Leakage test- Prevention and safety automation.

UNIT IV **9 Hours**

INSTRUMENTATION SYSTEMS

Optical sensors , Pressure Sensors - Ultrasonic Sensors - Tactile Sensors - Thermal sensors -Biosensor - Linear Actuators, Central monitoring station - Alarm system - Regulation and standards.

UNIT V **9 Hours**

APPLICATIONS

Business intelligence & executive dashboards - Radio-Frequency Identification (RFID)- based patient and asset tracking solutions - Tablet-based applications for bed side access to doctors/nurses - Healthcare CRM for patient relationship management - Patient kiosk, tele-health – HIS integration.

Total: 45 Hours

Reference(s)

1. Khandpur RS, Handbook of Biomedical Instrumentation, Prentice Hall of India, New Delhi, 3 rd edition, 2014.
2. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education India, Delhi, 4 th edition 2008
3. Curtis Johnson D Process Control Instrumentation Technology, Prentice Hall of India, 8th edition 2006
4. John V. Grimaldi and Rollin H. Simonds., Safety Management, All India Travelers Book seller, New Delhi, 1989
5. N.V. Krishnan, Safety in Industry, Jaico Publisher House, 1996.

22OAG01 RAINWATER HARVESTING TECHNIQUES 3 0 0 3

Course Objectives

- To enhance the awareness about water resources management and conservation.
- To acquire knowledge about water harvesting techniques and their implementation. To practice the design aspects of sustainable rainwater harvesting solutions for communities.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Assess the sources, availability and challenges in water resources management
2. Assess various water harvesting systems in practice
3. Execute design considerations for comparing surface runoff harvesting methods
4. Compare the characteristics and impacts of flood water harvesting techniques
5. Evaluate various rainwater harvesting methods for groundwater recharging

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1						3							
2	2	1												
3	1	1	3				2							
4	1	2	3				2							
5	1	1	3				2							

UNIT I **8 Hours**

WATER RESOURCES

Global water distribution – primary and secondary sources of water – technical, social and cultural aspects; Global challenges in water and climate – water scarcity – water pollution – Indian scenario; Water resources management – public participation – integrated approach; Water governance – water sharing plans – policy, schemes and concerns

UNIT II **10 Hours**

WATER CONSERVATION CHALLENGES

Principles of water harvesting for rural and urban – collection at micro and macro levels, flow control, storage and uses; Rainwater harvesting systems – traditional and contemporary – groundwater recharge; Water resources inventory – site analysis – database collection – water allocation principles based on demand and supply; Traditional water harvesting systems – practices in India – references in old texts – reasons for their deterioration – way forward; Watershed-based approach – project planning at micro and macro levels – community participation – rain centres.

UNIT III **9 Hours**

SURFACE RUNOFF HARVESTING

Short-term and micro-level harvesting techniques for runoff – terracing and bunding – rock and ground catchments; Long-term and macro-level harvesting techniques for runoff – farm ponds – percolation ponds and nala bunds; Design considerations – site selection – selection of runoff coefficients – computation of rainwater runoff volume – hydrograph analysis – cost estimation; Design of storage structures – storage capacity – selection of component – methods of construction

UNIT IV **9 Hours**

FLOOD WATER HARVESTING

Floods – causes of urban floods and droughts – characteristics of water spread – impacts; Flood water harvesting – permeable rock dams – water spreading bunds – flood control reservoir; Design considerations – computation of flood water quantity; Trenching and Diversion Structures – types – site selection – design criteria – most economic section – design consideration of ditch system

UNIT V **9 Hours**

GROUNDWATER HARVESTING

Rooftop rainwater harvesting – recharge pit – recharge trench – tube well – recharge well; artificial recharge – gully plug – dug well – percolation tank – nala bunds – recharge shaft; Groundwater harvesting – aquifer characteristics – subsurface techniques – infiltration wells – recharge wells – groundwater dams; Design of drainage system – types – design criteria – filter design – causes of failures

Total: 45 Hours

Reference(s)

1. Theib YO, Dieter P, Ahmed YH, Rainwater Harvesting for Agriculture in the Dry Areas, CRC Press, Taylor and Francis Group, London, 2012.
2. Lancaster, Brad. Rainwater Harvesting for Drylands and Beyond, Volume 1, 3rd edition, Rainsource Press. 2019.
3. Das M, Open Channel Flow, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
4. Michael AM, Ojha TP, Principles of Agricultural Engineering, Volume II, 4th Edition, Jain Brothers, New Delhi, 2003.
5. Suresh R, Soil and Water Conservation Engineering, Standard Publisher Distributors, New Delhi, 2014.
6. Singh G, Venkataramanan C, Sastry G, Joshi BP, Manual of Soil and Water Conservation Practices, CSWCR&TI, Dehradun, 1990

22OEE01 VALUE ENGINEERING 3 0 0 3

Course Objectives

- To understand the concept of value engineering in order to reduce cost of product or process or service.
- To implement creative and innovative techniques using FAST diagram.
- To study benefits of Value Engineering for various industries.

Programme Outcomes (POs)

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Apply the concepts of value and value engineering to prepare a job plan.
2. Analyze the cost and worth of a product/service using the principles of economics.
3. Evaluate the value of a product/service to take managerial decisions.
4. Apply the soft skills in understanding team building, team work and report writing.
5. Asses the functions and values of product/services in industries using case studies.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1											3	1	1	1
2										1	3	1	1	1
3											3	1	1	1
4										1	3	2	1	1
5										2	3	1	1	1

UNIT I **8 Hours**

INTRODUCTION TO VALUE ENGINEERING

Historical perspective of Value Engineering, Aims and objectives of Value Engineering, Concept of Value, Value Engineering concerned with Economic Value, Value Engineering Job plan.

UNIT II **9 Hours**

FUNCTIONAL ANALYSIS

Function-Cost-Worth analysis: Function Analysis System Technique (FAST); Review of principles of engineering economics

UNIT III **10 Hours**

EVALUATION OF VALUE ENGINEERING

Evaluation of function, Problem setting system, problem solving system, setting and solving management - decision - type and services problem, evaluation of value

UNIT IV **9 Hours**

HUMAN ASPECTS IN VALUE ENGINEERING

Team building; Life cycle costing; Managing Value Engineering Study; Value Engineering Report writing; Presentation Skill - Individual and Team Presentations; Implementation and follow-up.

UNIT V **9 Hours**

BENEFITS OF VALUE ENGINEERING

Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe Value Engineering Case studies in the Industries like Manufacturing; Construction; Health Care; Process.

Total: 45 Hours

Reference(s)

1. Anil Kumar Mukhopadhyaya, Value Engineering Mastermind - From Concepts to Certification, Response. Business Books from SAGE, Los Angeles / London / New Delhi / Singapore / Washington DC, 2014.
2. Anil Kumar Mukhopadhyaya, Value Engineering -Concepts, Techniques and Applications, Response Books, A Division of SAGE Publications, New Delhi / Thousand Oaks / London, 2003
3. R. D. Miles, Techniques of Value analysis & Engineering, McGraw Hill, 2000.
4. E. Midge Arthur, Value Engineering -A Systematic Approach, McGraw Hill Book Co., New York, 2000.
5. Zimmerman, Value Engineering - A Practical Approach, CBS Publishers & Distributors, New Delhi, 2000.

22OEE02 ELECTRICAL SAFETY 3 0 0 3

Course Objectives

- To provide knowledge on basics of electrical fire and statutory requirements for electrical safety
- To understand the causes of accidents due to electrical hazards
- To know the various protection systems in Industries from electrical hazards
- To know the importance of earthing
- To distinguish the various hazardous zones and applicable fire proof electrical devices

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Analyze the basic concepts in electrical circuit and hazards involved in it.
2. Analyze the electrical hazards in the workplace and its impacts.
3. Examine the operation of various protection systems from electrical hazards.
4. Analyze the various safety procedures involved in the industries.
5. Explore the different hazardous zones in Industries and their safety measures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1				2	1							
2	1	1				1	2	2						
3	1	1				2		2	1					
4	1	1				2	1							
5	1	1				2	1	2	1					

UNIT I **9 Hours**

INTRODUCTION

Objectives of safety and security measures - Hazards associated with electric current and voltage - principles of electrical safety - working principles of major electrical equipment - Typical supply situation - Indian electricity act and rules - statutory requirements from electrical inspectorate-International standards on electrical safety.

UNIT II **9 Hours**

ELECTRICAL HAZARDS

Primary and secondary hazards-shocks, burns, scalds, falls-human safety in the use of electricity- Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges- over current and short circuit current-heating effects of current- Lightning, hazards, lightning arrestor, - national electrical safety code ANSI.

UNIT III **9 Hours**

ELECTRICAL SAFETY EQUIPMENT

Fuse, circuit breakers and overload relays - safe distance from lines - capacity and protection of conductor joints and connections, overload and short circuit protection - earth fault protection. FRLS insulation - insulation and continuity test - system grounding - equipment grounding - earth leakage circuit breaker (ELCB) - ground fault circuit interrupter - electrical guards - Personal protective equipment.

UNIT IV **9 Hours**

ELECTRICAL SAFETY OPERATION AND MAINTENANCE

Role of environment in selection - protection and interlock - discharge rod and earthing devices - safety in the use of portable tools - preventive maintenance - installation – earthing, specifications, earth resistance, earth pit maintenance - Fire Extinguishers - CO2 and Dry Powder schemes.

UNIT V **9 Hours**

HAZARDOUS AREAS

Classification of hazardous zones-intrinsically safe and explosion proof electrical apparatus-increase safe equipment-their selection for different zones-temperature classification-grouping of gases-use of barriers and isolators-equipment certifying agencies – electrical safety standards. (IS, API and OSHA standards)

Total: 45 Hours

Reference(s)

1. Fordham Cooper, W., “Electrical Safety Engineering, Butterworth and Company”, London, Third Edition, 2013.
2. “Indian Electricity Act and Rules”, Government of India.
3. “Power Engineers”, Handbook of TNEB, Chennai, 2010.
4. “Accident prevention manual for industrial operations”, N.S.C., Chicago, 1982.
5. John Cadick, P.E., Mary Capelli-Schellpfeffer, Dennis K. Neitzel, Al Winfield, “Electrical Safety Handbook”, Fourth Edition, Tata Mcgraw Hill, 2014.

22OCB01 INTERNATIONAL BUSINESS MANAGEMENT 3 0 0 3

Course Objectives

- To enable the students to understand the fundamentals of international business
- To provide competence to the students on making international business decisions
- To enable the students to understand the financial and promotional assistance available for exporters

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PSO1: Demonstrate the knowledge and technical skills in software development.
PSO2: Develop practical competencies in Software and Hardware Design

Course Outcomes (COs)

1. Demonstrate the role and importance of digital marketing in today's rapidly changing business environment
2. Discover the techniques to help organizations to utilize social media for digital marketing
3. Analyze the key elements and campaign effectiveness of E-Mail marketing and mobile marketing
4. Evaluate the effectiveness of a digital marketing campaign using Google Analytics
5. Apply advanced practical skills to plan, predict and manage digital marketing campaign

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3						2		2				1	1
2	3						3		2				1	1
3	3						3		2				1	2
4	3						2		2				1	2
5	3						2		2				1	1

UNIT I **9 Hours**

INTRODUCTION

Definition, Drivers of International Business, Domestic Vs. International Business, Trade and Investment Theories: Interventionist Theories, Free Trade Theories, Theories Explaining Trade Patterns: PLC Theory, The Porter Diamond, Factor Mobility Theory.

UNIT II **9 Hours**

GLOBALIZATION

Globalization: Implications, Challenges - Protectionism: Tariff Barriers, Non-Tariff Barriers- Forms of Integration, Role of WTO and IMF in International Business, Economic, Political, Cultural and Technological Environments

UNIT III **9 Hours**

INTERNATIONAL BUSINESS STRATEGIES

Market Entry Strategies, Multinational Strategy, Production Strategy, Marketing Strategy, Human Resource Strategy.

UNIT IV **9 Hours**

FOREIGN EXCHANGE

Foreign Exchange Market – Functions, Theories of Exchange Rate Determination, Exchange Rate Forecasting, Convertibility of Currency, Risks associated with Foreign Exchange.

UNIT V **9 Hours**

EXPORTS AND ETHICS IN INTERNATIONAL BUSINESS

Exports – Risks, Management of Exports, Regulatory frameworks, Export financing, Countertrade, Ethics – Issues, Dilemma and Theory.

Total: 45 Hours

Reference(s)

1. John D Daniels, Lee Raudabaugh, and Sullivan, “International Business”, New Delhi: Pearson Education, 2018.
2. Charles W L Hill and Arun Kumar Jain, “International Business”, New Delhi: Tata McGraw Hill, 2017.
3. Francis Cherunilam, “International Business”, New Delhi: Prentice Hall of India, 2020.
4. Simon Collinson, Rajneesh Narula, Alan M. Rugman, “International Business”, New Delhi: Pearson Education, 2020.
5. K. Aswathappa, “International Business”, New Delhi: Tata McGraw Hill, 2020.