M.E. (Computer Science and Engineering) 2024 Regulations, Curriculum & Syllabi



BANNARI AMMAN INSTITUTE OF TECHNOLOGY An Autonomous Institution Affiliated to Anna University - Chennai • Approved by AICTE • Accredited by NAAC with 'A+' Grade SATHYAMANGALAM - 638401 ERODE DISTRICT TAMILNADU INDIA Ph: 04295-226000/221289 Fax: 04295-226666 Email: stayahead@bitsathy.ac.in Web: www.bitsathy.ac.in

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M.E – COMPUTER SCIENCE AND ENGINEERING

Vision of the Department

To excel in the field of Computer Science and Engineering, to meet the emerging needs of the industry, society and beyond.

Mission of the Department

- I. To impart need based education to meet the requirements of the industry and society.
- II. To equip students for emerging technologies with global standards and ethics that aid in societal sustainability.
- III. To build technologically competent individuals for industry and entrepreneurial ventures by providing infrastructure and human resources.

M.E. COMPUTER SCIENCE AND ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- I. Analyse, design, and develop creative products and solutions for real-world problems.
- II. Critically analyse the current literature in a field of study and ethically develop innovative and research-based methodologies to fill the gaps.
- III. Participate in lifelong multidisciplinary learning as skilled computer engineers, including working in teams, investigating and implementing research problems, and presenting technical reports.

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PROGRAMME OUTCOMES (POs)

The Graduate will be able to

- 1. An ability to independently carry out research / investigation and development work to solve practical problems.
- 2. An ability to write and present a substantial technical report/document.
- 3. Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.
- 4. Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.
- 5. Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.
- 6. Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.

POs	1	2	3	4	5	6
PEO I	Х	Х	Х	Х		Х
PEO II		Х	Х	Х	Х	Х
PEO III			Х	Х	X	Х

MAPPING OF PEOs WITH POs

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	ME COMPUTER Minimum Cı	SCIE redits 1	NCE A to be l	AND E Earned	NGIN : 71	EERING	-R2024			
		15	SEME	STER						
Course						Hours/	Maxi	mum M	arks	
Code	Course Title	L	Т	Р	С	Week	CA	SEE	Total	Category
24CS11	Research Methodology and IPR	2	0	0	2	2	40	60	100	ES
24CS12	Engineering Mathematics and Applications	3	0	0	3	3	40	60	100	BS
24CS13	Applications of Data Structures and Algorithms	3	0	0	3	3	40	60	100	PC
24CS14	Database Engineering	3	0	0	3	3	40	60	100	PC
24CS15	Network Technologies	3	0	0	3	3	40	60	100	PC
24CS16	Principles of Programming Languages	3	0	0	3	3	40	60	100	PC
24CS17	Applications of Data Structures Laboratory	0	0	4	2	3	60	40	100	PC
24CS18	Database Engineering Laboratory	0	0	4	2	3	60	40	100	PC
	Audit course I*	2	0	0	-	2	100	0	100	EEC
Total			0	8	21	25	-	-	-	-
II SEMESTER										
Course			Ŧ		G	Hours/	Maxi	mum M	arks	
Code	Course Title	L	T P		С	Week	CA	SEE	Total	Category
24CS21	Internet of Things	3	0	0	3	3	40	60	100	PC
24CS22	Machine Learning	3	0	0	3	3	40	60	100	PC
24CS23	Advanced Software Engineering	3	0	2	4	5	50	50	100	PC
24CS24	Cloud Computing Technologies	3	0	3	3	3	40	60	100	PC
	Program Elective I	3	0	0	3	3	40	60	100	PE
	Program Elective II	3	0	0	3	3	40	60	100	PE
24CS27	Machine Learning Laboratory	0	0	4	2	4	60	40	100	PC
24CS28	Mini Project	0	0	4	2	4	100	0	100	PC
	Audit course II*	2	0	0	-	2	100	0	100	EEC
	Total	20	0	10	23	30	-	-	-	-
~		III	SEMI	ESTER	2					
Code	Course Title	L	т	р	C	Hours/	Maxi	mum M	arks	Category
Coue	Course mile	Ľ			Week	CA	SEE	Total	Category	
	Program Elective III	3	0	0	3	3	40	60	100	PE
	Program Elective IV	3	0	0	3	3	40	60	100	PE
	Program Elective V	3	0	0	3	3	40	60	100	PE
24CS33	Dissertation Phase I	0	0	12	6	12	60	40	100	EEC
Total 9			0	12	15	21	-	-	-	-

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	IV SEMESTER									
Course	Course Title	т	т	р	С	Hours/ Week	Maxir	C (
Code		L	1	r			CA	SEE	Total	Category
24CS41	Dissertation Phase II	0	0	24	12	24	60	40	100	EEC
Total		0	0	24	12	24	-	-	-	-

ELECTIV	ELECTIVES									
PROFES	IONAL ELECTIVES									
Course		_			~	Hours/	Maxi	imum N	Iarks	Catagory
Code	Course Title	L	Т	Р	C	Week	CA	SEE	Total	Category
LIST OF	PROFESIONAL ELECTIVES			-	-			-	-	
24CS51	Agent Based Intelligent Systems	3	0	0	3	3	40	60	100	PE
24CS52	Soft Computing	3	0	0	3	3	40	60	100	PE
24CS53	Multicore Architecture and Programming	3	0	0	3	3	40	60	100	PE
24CS54	Data Science	3	0	0	3	3	40	60	100	PE
24CS55	Agile Methodologies	3	0	0	3	3	40	60	100	PE
24CS56	Software Quality Assurance	3	0	0	3	3	40	60	100	PE
24CS57	Digital Image Processing	3	0	0	3	3	40	60	100	PE
24CS58	Information Retrieval Techniques	3	0	0	3	3	40	60	100	PE
24CS59	Natural Language Processing	3	0	0	3	3	40	60	100	PE
24CS60	Deep Learning Techniques	3	0	0	3	3	40	60	100	PE
24CS61	Big Data Mining and Analytics	3	0	0	3	3	40	60	100	PE
24CS62	Data Visualization Techniques	3	0	0	3	3	40	60	100	PE
24CS63	Blockchain Technologies	3	0	0	3	3	40	60	100	PE
24CS64	Full Stack Web Application Development	3	0	0	3	3	40	60	100	PE
24CS65	Cyber Physical Systems	3	0	0	3	3	40	60	100	PE
24CS66	Mixed Reality	3	0	0	3	3	40	60	100	PE
24CS67	DevOps and Micro Services	3	0	0	3	3	40	60	100	PE
24CS68	Mobile and Pervasive Computing	3	0	0	3	3	40	60	100	PE
24CS69	Optimization techniques	3	0	0	3	3	40	60	100	PE
LIST OF	AUDIT COURSES I & II									
24XE01	English for Research Paper Writing	2	0	0	-	2	100	0	100	EEC
24XE02	Cost Management of Engineering Projects	2	0	0	-	2	100	0	100	EEC
24XE03	Stress Management	2	0	0	-	2	100	0	100	EEC
24XE04	Disaster Management	2	0	0	-	2	100	0	100	EEC
24XE05	Value Education	2	0	0	-	2	100	0	100	EEC

24XE06	Pedagogy Studies	2	0	0	-	2	100	0	100	EEC
24XE07	Business Analytics	2	0	0	-	2	100	0	100	EEC

SUMMARY OF CREDIT DISTRIBUTION

S.No	CATEGORY		CREDI SEMI	TS PE ESTER	R	TOTAL	CREDITS	Range of To	tal Credits
		Ι	II	III	IV	CKEDII	III 70	Min	Max
1	BS	3	-	-	-	3	4.22	2%	10%
2	ES	2	-	-	-	2	2.81	2%	10%
3	HSS	-	-	-	-	-	-	-	-
4	РС	12	12	-	-	24	33.80	30%	40%
5	PE	-	6	9	-	15	21.12	20%	30%
6	EEC	5	4	6	12	27	38.02	30%	40%
	Total	22	22	15	12	71	100	-	-

BS - Basic Sciences

ES - Engineering Sciences

HSS - Humanities and Social Sciences

- PC Professional Core
- PE Professional Elective

EEC - Employability Enhancement Course

CA - Continuous Assessment

ES - End Semester Examination

24CS11	RESEARCH METHO	DOLOGY AND IPR	L	T P	C		
			2	0 0	2		
	Pre-requisite	Assessment Pattern					
•]	Knowledge of research process.	Mode of Assessment	Wei	ghtage	(%)		
•]	Research ethics.	Continuous Internal Assessment		40			
9		Semester End Examinations		60			
Course	Objectives						
•	Understand the techniques for research probler	n formulation, analysis and solution.					
• ,	Analyze literature surveys and prepare reports	based on research ethics.					
•]	Develop research proposals and apply assessm	ent procedures to review.					
•]	Develop patents using the IPR & PCT guidelin	les.					
• ,	Adapt the licensing process for patents and ana	lyse the developments of IPR.					
Program	nme Outcomes (POs)	·					
PO1	An ability to independently carry out rese practical problems.	arch / investigation and development	work	to solv	/e		
PO2	An ability to write and present a substantial technical report/document.						
PO3	Students should be able to demonstrate Science and Engineering.	a degree of mastery over the area	of C	ompute	r		
PO4	Efficiently design, build and develop s centralized computing environments in varying	system application software for dia ng domains and platforms.	stribut	ed an	d		
PO5	centralized computing environments in varying domains and platforms. Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas						
PO6	Model a computer based automation s understanding of the tradeoffs involved in dig	system and design algorithms that gital transformation.	expl	ore th	e		
Course	Outcomes (COs)						
The stud	lents will be able to						
CO1	Formulate the research problems and identify	y the approaches to solve the problems.					
CO2 A	Analyze literature surveys and prepare report	s based on research ethics.					
CO3 [Develop research proposals and apply assessing	ment procedures to review.					
CO4 D	Develop patents using the IPR & PCT guideline	28.					
CO5	Adapt the licensing process for patents and a	nalyse the developments of IPR.					

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	3	2	2	3	2	3
2	3				1	3
3	3			1	1	2
4	3				1	1
5	3			1	1	1

Unit I INTRODUCTION TO RESEARCH PROBLEM

Meaning of research problem - Sources of research problem - Criteria characteristics of a good research problem- errors in selecting a research problem-scope and objectives of research problem-Approaches of Investigations of solutions for research problem-Data collection-Analysis-Interpretation-Necessary instrumentations.

Unit II LITERATURE REVIEW

Effective Literature studies approaches-analysis-Plagiarism-Research ethics- Review of the literature, Searching the existing literature, reviewing the selected literature, developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Unit III TECHNICAL WRITING/PRESENTATION

Effective technical writing-how to write report-paper-Developing a research proposal-Format of Research proposal-a presentation and assessment by a review committee.

Unit IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS(IPR)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: Technological research, Innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grant Patents, Patenting under Patent Cooperation Treaty(PCT).

UNIT V INTELLECTUAL PROPERTY RIGHT(IPR)

Patent Rights: Scope of Patent Rights, Licensing and transfer of Technology, Patent information and databases-Geographical Indications. New Developments in IPR: Administration of Patent system, IPR of Biological systems, Computer Software-Traditional knowledge - Case studies.

References

- 1. Wayne Goddard and Stuart Melville, Research methodology-An Introduction, 2nd Edition, Juta and Company Ltd, 2007.
- 2. Halbert, Resisting Intellectual Property, Taylor & Francis Ltd, 2007
- 3. Robert P.Merges, Peter S.Menell, Mark.A.Lemley, Intellectual property in new technological age, 2016.
- 4. T.Ramappa, Intellectual Property Rights under WTO, S.Chand, 2008.
- 5. Ranjit Kumar, 2nd Edition, Research Methodology: A Step by Step Guide for beginners, 2010.
- 6. C.R.Kothari, Gaurav Garg, Research Methodology, Methods and Techniques, 4th Edition, New Age International Publishers, 2018.

5

6 Hours

6 Hours

6 Hours

6 Hours

6 Hours

30 Hours

Total

24CS12	ENGINEERING MATHEMAT	ICS AND APPLICATIONS	L	TP	C							
			3	0 0	3							
	Pre-requisite	Assessment Patter	n									
•	Basic Statistics inference techniques.	Mode of Assessment	Wei	ghtage	e(%)							
•	Hypothesis testing and analysis of variance to	Continuous Internal Assessment		40								
	engineering problems.	Semester End Examinations		60								
Course	Objectives											
•	To acquire knowledge of vector spaces and its ap	pplications in Computer Science and	Engine	ering.								
•	To understand the basics of random variables, so of computers.	tandard distributions, and their applic	ations i	n the f	ield							
•	To apply testing of hypothesis to infer the outc	ome of experiments and the design	of expe	riment	s in							
	Computer Science and Engineering.											
Program	mme Outcomes (POs)											
PO1	An ability to independently carry out resear	rch / investigation and developmen	t work	to sol	ve							
	practical problems.	····· · ······························										
PO2	An ability to write and present a substantial technical report/document.											
PO3	Students should be able to demonstrate a	degree of mastery over the area	a of C	omput	er							
	Science and Engineering.											
PO4	Efficiently design, build and develop sy	stem application software for c	listribut	ed ar	nd							
	centralized computing environments in varying	g domains and platforms.										
PO5	Understand the working of current Indus	try trends, the new hardware an	rchitect	ıres,	the							
	software components and design solutions	for real world problems by Com	1munic <i>a</i>	ating a	ınd							
	effectively working with professionals in va	rious engineering fields and pursue	e resear	ch								
	orientation for a lifelong professional developm	nent in computer and automation area	nas.									
PO6	Model a computer based automation sy	stem and design algorithms that	ıt expl	ore tl	ne							
	understanding of the tradeoffs involved in digi	tal transformation.										
Course	Outcomes (COs)											
The stuc	dents will be able to											
CO1	Demonstrate the properties and applications of	of vector spaces in computer science a	ind Eng	ineerir	ıg.							
CO2	Understand the concept of decomposition of the matrices into the required form.											
000	Apply the concepts of probability distribution	s in an appropriate place of science a	nd engi	neering	Apply the concepts of probability distributions in an appropriate place of science and engineering.							
CO3	Identify the hypothesis to analyze the nature of the data.											
CO3 CO4	Identify the hypothesis to analyze the nature of	of the data.										

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	1	2	3			1
2	3		2	2		3
3			1		3	2
4	2	1	3	2	2	2
5	2	2	1		1	2

Real vector space	es - Subspaces - Linear dependence - Basis and dimension of a vector space - R	ank -Change
of basis - Inner p	roduct space - Norm - Gram-Schmidt process - Linear transformation.	
Unit II	EIGENVALUES AND EIGENVECTORS	9 Hours
Eigen values and	l eigenvectors - Diagonalization - Eigenvectors and linear transformations - Co	mplex Eigen
values - Discrete	dynamical systems - Iterative estimates for Eigen values - Singular value decomp	position - QR
decomposition.		
Unit III	PROBABILITY THEORY	9 Hours
Axioms of proba	bility - Addition and multiplication theorems on probability - Conditional prob	ability Bayes
theorem (problem	ns only) - Random variable: Continuous and discrete random variables Discrete	distributions:
Binomial and Po	isson - Continuous distributions: Normal, Exponential and Weibull - Simple p	problems and
properties.		
Unit IV	TESTING OF HYPOTHESIS	9 Hours
Company of the second	aling Mathada of compling Compling distributions and classifications. Star	adand Emman

Concepts of sampling - Methods of sampling - Sampling distributions and classifications - Standard Error -Tests of hypothesis: Tests of hypothesis about proportion, mean and their differences - Chi-square distributions: Test of goodness of fit and test of independence of attributes.

UNIT V DESIGN OF EXPERIMENTS AND CONTROL CHARTS

VECTOR SPACES

One way and two-way classifications - Completely randomized design - Randomized block design - Latin square design - 2X2 factorial design - Control Charts of Variable and Attributes.

References

Unit I

- D. C. Lay, Linear Algebra and its Applications, Addison Wesley, Massachusetts, Fourth edition, 1. 2012.
- Johnson R.A., Miller & Freunds: Probability and Statistics for Engineers, Pearson Education, 8th 2. Edition, 2013.
- Walpole R.E, Myers R.H, Myers R.S.L and Ye K, Probability and Statistics for Engineers and 3. Scientists, Pearsons Education, Delhi, 2002.
- 4. Lipschutz S and Schiller J, Schaums outline Series: Introduction to Probability and Statistics, McGraw Hill Publications, New Delhi, 1998.
- Ross. S, A first Course in Probability, 8th Edition, Pearson Education, New Jersey, 2010. 5.

7

9 Hours

9 Hours

45 Hours

Total

Pre-requisite Assessment Pattern • Introduction to Data Structures and Algorithms. Mode of Assessment 40 • Problem Solving Skills. Continuous Internal Assessment 60 • Basics of Graph Theory. Semester End Examinations 60 • To understand the usage of algorithms in computing. • To elarm and use hierarchical data structures and algorithms that is operations. • To select and design data structures and algorithms that is appropriate for problems. Programme Outcomes (POs) PO1 An ability to independently carry out research / investigation and development work to solve practical problems. PO2 An ability to write and present a substantial technical report/document. PO3 Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering. PO4 Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms. PO5 Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionali working segnithms that explore the understanding of the tradeoffs involved in digital transformation. C04 Design algorithms	24CS13	APPLICATIONS OF DATA STRUCTURES AND ALGORITHMS								ALGORITHMS	L 3	T P	C 3
Introduction to Data Structures Mode of Assessment Weightage(% Algorithms. Algorithms. Froblem Solving Skills. Semester End Examinations 60 Basics of Graph Theory. Semester End Examinations 60 Course Objectives 60 • To understand the usage of algorithms in computing. • To learn and use hierarchical data structures and its operations. • To select and design data structures and algorithms that is appropriate for problems. • To study about NP Completeness of problems. Programme Outcomes (POs) PO1 An ability to write and present a substantial technical report/document. PO3 Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering. PO4 Efficiently design solutions for real world problems. PO5 Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas. PO6 Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation. C01 Design data structures and algorithms to solve problems. <t< th=""><th></th><th></th><th>Pre-requ</th><th>isite</th><th></th><th></th><th></th><th></th><th></th><th>Assessment Pattern</th><th>0</th><th></th><th>0</th></t<>			Pre-requ	isite						Assessment Pattern	0		0
Algorithms. Continuous Internal Assessment 40 Senseter End Examinations 60 Senseter End Examinations 60 Course Objectives 50 • To understand the usage of algorithms in computing. 60 • To learn and use hierarchical data structures and its operations. 60 • To select and design data structures and algorithms that is appropriate for problems. 70 Programme Outcomes (POs) Port and use hierarchical data structures and algorithms that is appropriate for problems. PO1 An ability to virie and present a substantial technical report/document. PO3 Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering. PO4 Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms. PO5 Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems. PO6 Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation. CO3 Design data structures and algorithms to solve problems. CO4 Design one's own algorithm for an unknown problem. CO3 Design data	• I	ntroductio	n to	Data	Struct	ures	and I	Mode of	f Asses	sment	Wei	ghtage	e(%)
• Problem Solving Skills. Semester End Examinations 60 • Basics of Graph Theory. • To understand the usage of algorithms in computing. • To understand the usage of algorithms in computing. • To learn the usage of algorithms in computing. • To learn the usage of graphs and its applications. • To learn the usage of graphs and its applications. • To learn the usage of graphs and its applications. • To solve the Completeness of problems. • To study about NP Completeness of problems. • To study about NP Completeness of problems. • To study about NP Completeness of problems. • PO1 An ability to independently carry out research / investigation and development work to solve practical problems. • PO2 PO2 An ability to write and present a substantial technical report/document. • PO3 Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering. • PO4 PO4 Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms. • PO4 PO5 Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professional development in computer ad automation arenas. PO6 Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs in	A	Algorithms	S.				(Continu	ous Inte	ernal Assessment		40	
• Basics of Graph Theory. Course Objectives • To understand the usage of algorithms in computing. • To learn and use hierarchical data structures and its operations. • To select and design data structures and algorithms that is appropriate for problems. Programme Outcomes (POs) PO1 An ability to independently carry out research / investigation and development work to solve practical problems. P02 An ability to write and present a substantial technical report/document. P03 Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering. P04 Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms. P05 Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional warious engineering fields and pursue research orientation for a lifelong professional structures and apprintms that explore the understanding of the tradeoff's involved in digital transformation. C01 Design data structures and algorithms to solve computing algorithms to real-life problems. C02 Implement efficient data structures and apply them to solve problems. C03 Design algorithms using graph s	• F	Problem So	olving Skil	ls.			S	Semeste	r End E	Examinations		60	
Course Objectives • To understand the usage of algorithms in computing. • To learn and use hierarchical data structures and its operations. • To select and design data structures and algorithms that is appropriate for problems. • To study about NP Completeneess of problems. Programme Outcomes (POs) • To ability to independently carry out research / investigation and development work to solve practical problems. PO2 An ability to write and present a substantial technical report/document. PO3 Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering. PO4 Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms. PO5 Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional evelopment in computer and automation arenas. PO6 Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation. C01 Design data structures and algorithms to solve computing problems. C02 Design data structures and algorithms to solve problems. C03 Design algorithms using graph structure and various string-m	• E	Basics of C	Graph Theo	ry.									
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Unit I ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY 10 Hours ANALYSIS 10 Hours

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms Asymptotic analysis-Average and worst-case analysis-Asymptotic Notation-Importance of efficient algorithms- Program performance measurement.

Unit II HIERARCHICAL DATA STRUCTURES

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B -trees – Basic operations on B-Trees- Heap –Heap Implementation.

Unit III GRAPHS

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim-Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; All-Pairs Shortest Paths: The Floyd-Warshall Algorithm.

Unit IV ALGORITHM DESIGN TECHNIQUES

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.

UNIT V NP COMPLETE AND NP HARD

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.

References

- 1. S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
- 2. Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.
- 3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
- 4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.
- 5. Barbara A.Plog, Patricia J.Quinlan, MPH, CIH and Jennifer Villareal Fundamentals of Industrial Hygiene, 6th edition 2012, National Safety Council, 2012.
- 6. E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms", University Press, 2nd Edition, 2008.

10 Hours

9 Hours

9 Hours

9 Hours

45 Hours

Total

24CS14		DATABASE ENGINEERING										
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	I	Pre-requi	site						Assessment Pattern			
•]	ntroduction	to Databa	ses.			M	lode of	Assessi	ment	Wei	ightage	; (%)
•]	Basics of Rel	ational D	atabase	Manag	gement	C	ontinuo	us Inter	nal Assessment		40	
	Systems (RD	BMS).	• •	•11		Se	emester	End Ex	aminations		60	
	-undamental	Program	ming Sl	KIIIS.								
Course	Objectives											
•]	Exemplify th	e data mo	dels an	d to co	nceptua	lize a d	atabase	system	using ER diagrams.			
•]	• Interpret the concepts of parallel and distributed databases.											
• (Comprehend	the use of	f object	and ob	ject rel	ational	databas	es.				
• 1	Understand th	he spatial	, multin	nedia a	nd emer	rging da	atabase	technol	ogies.			
• 1	Explore abou	t the NoS	QL Da	tabases								
Progran	umme Outcomes (POs)											
PO1	An ability to independently carry out research / investigation and development work to solve											
DO3	practical problems.											
PO2	An ability to write and present a substantial technical report/document.											
POS	Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.											
PO4	Efficiently centralized	design, computin	build g envir	and onment	levelop s in var	syste ying do	m app omains a	licatior and plat	n software for dis tforms.	stribu	ted an	d
PO5	Understand software co	the wo	rking o ts and	of cur design	rent In soluti	dustry ons for	trends r real	, the world	new hardware archevelopping hardware by Comm	hitect nunica	ures, t ating a	he nd
	effectively	working	with p	rofessi	onals ir	n vario	us engi	neering	g fields and pursue	resear	rch	
	orientation	for a lifel	ong pro	fession	al deve	lopmen	it in con	nputer a	and automation arena	s.		
PO6	Model a	computer	based	l auto	mation	syster	m and	desig	n algorithms that	expl	ore th	ie
Course	understandi	ng of the	tradeor	IS INVO	lved in	digital	transfor	mation.				
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	Design a R	elational	Databa	se for a	in Enter	rprise	1	•	11-1	- 4 - 1		
CO2	Analyze th	re transac	$\frac{100}{doto}$ in	object	g, concu	irrency	control tional d	in para	and distributed d	atabas	ses.	
C03	Design an	d implem	uala III ent real	l-world	and Obj	ations v	with the		s. f Snatial Database	and		
	Multimedi	a Databas	se real	-woriu	applied	utons v	vitil the	use of	Spatial Database	anu		
CO5 Implement NoSQL database systems and manipulate the data associated with it.												
				-								
Articula	tion Matrix											
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CO. No.	POI	PO2	PO3	PO4	P05	PO6
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2	2	2		2	1	1
3	3	1	2	1		1
4	3	2	2	1	1	1
5	2	3	1	1		1

DATABASE SYSTEM CONCEPTS Unit I

Purpose of Database systems - Data Storage and Querying - Database architecture - Data models: Relational model - Entity relationship model: Constraints- Removing redundant attributes in entity sets - Entity relationship diagrams - Reduction to relational schemas - Entity relationship design issue - Extended E-R features - Normalization and database design.

Unit II PARALLEL AND DISTRIBUTED DATABASES

Parallel Databases - I/O Parallelism - Inter-Query and Intra-Query Parallelism-- Inter-Operation and Intraoperation Parallelism - Performance evaluation for Parallel DB Systems -Distributed Database Architecture - Distributed Data Storage - Distributed Transactions - Distributed Query Processing -Distributed Transaction Management - Load balancing tools for DDB - DDB Security.

OBJECT AND OBJECT RELATIONAL DATABASES Unit III

Concepts for Object Databases: Object Identity - Object structure - Type Constructors - Encapsulation of Operations - Methods - Persistence - Type and Class Hierarchies - Inheritance - ODMG Model - ODL -OQL - Object Database Conceptual Design.

Unit IV SPATIAL AND MULTIMEDIA DATABASES

Spatial database concepts, Spatial data types, and models, Spatial operators and queries, Indexing in spatial databases, Multimedia database concepts, Automatic Analysis of Images, Object Recognition in Images, Semantic Tagging of Images.

UNIT V **NOSQL DATABASES**

NoSQL - CAP Theorem - Sharding - Document based - MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment - Using MongoDB with PHP / JAVA/ Python - Cassandra: Data Model - Key Space - Table Operations - CRUD Operations - CQL Types -HIVE : Data types – Database Operations – Partitioning – HiveQL - OrientDB Graph database - OrientDB Features.

Tota	al	45 Hours
References		

- 1. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2016.
- 2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw Hill Education 2020.
- 3. Brad Dayley, "Teach Yourself NoSQL with MongoDB in 24 Hours", Sams Publishing, 2014.
- 4. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.
- 5. V.S.Subramanian, "Principles of Multimedia Database Systems", Harcourt India Pvt. Ltd., 2001.
- 6. C.J.Date, A.KannanandS.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
- 7. ShashankTiwari, "Professional NoSQL", Wiley, 2011.
- 8. David Lane, Hugh.E.Williums, Web Database Applications with PHP and MySQL, O'Reilly Media; 2nd edition, 2004.

11

9 Hours

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24CS15		NET	rwor	KING	TECH	NOLO	GIES			L	Т	P	C
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_	Pre-req	uisite				1 0		Assessr	nent Pattern				(0())
• Ba	isic Networking co	ncepts.			M	ode of A	Assessn	nent		Wei	ght	age	(%)
• N	etworking hardwar	e and soft	ware.			ntinuoi	is Inter	nal Ass	essment		4	10	
• Ba	isic Network Confi	guration.			Se	mester	End Ex	aminat	ions		e	0	
Course O	bjectives												
• To	o understand the ba	sic concep	pts of n	etwork	s.								
• To	explore various te	chnologie	es in the	e netwo	ork dom	ain.							
• To	o understand the pa	radigm of	SDN a	and NF	V.								
• To	• To study about 4G and 5G cellular networks.												
• To	To learn about Network Function and Orchestration.												
Program	rogramme Outcomes (POs)												
PO1	An ability to independently carry out research / investigation and development work to solve												
	ractical problems.												
PO2	n ability to write and present a substantial technical report/document.												
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer												
	Science and Engineering.												
PO4 Ef	ficiently design,	build an	d dev	elop s	ystem	applica	tion so	oftware	e for dist	ribute	d	ar	nd
	centralized comput	ing enviro	onments	s in var	ying do	mains a	and plat	forms.					
PO5 U1	derstand the wo	rking of	curren	nt Indu	ıstry tı	ends,	the	new h	nardware arc	hitect	ures	s, tł	he
1	oftware compone	nts and	design	solutio	ons for	real v	vorld p	problen	ns by Comm	nunica	ating	g ar	nd
	effectively workin	g with	profess	ionals	in var	ious e	ngineer	ing fi	elds and p	ursue	re	searc	2h
	prientation for a life	elong prof	essiona	al devel	opmen	t in com	iputer a	ind auto	omation arena	is.	1	1	
PO6 M	odel a compute	r based	auton	nation	systen	1 and	designation	n algo	orithms that	exp	lore	e ti	ne
			5 11100	veu in c	ingital t		mation.						
0 0	(00)												
Course O	utcomes (COs)												
The stude	its will be able to												
CO1	Understand the ad	vanced co	ncepts	of netw	vorking	, routin	g and s	witchin	ıg.				
CO2	Analyze the differ	ent types	of tech	nologie	s invol	ved in n	etwork	ing.					
CO3	Apply the concept	s of SDN	and N	FV arch	itecture	e to esta	ıblish a	networ	rk				
CO4	Analyze the impor	tance of 4	G and	5G tecl	nnologi	es for c	ommun	ication	l .				
CO5 Apply the mechanism of network automation and Orchestration for real world applications.													
Antionlet	on Matri-												
Aruculati													
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	1	2	2		1		1				

CO. 110.	101	102	105	104	105	100
1	1	3	2		1	
2	1	3	3	3		
3	1	3	3	2	2	2
4	1	2	2	1	2	1
5	1	3	1	1	1	2

Unit I **NETWORKING, ROUTING AND SWITCHING** 9 Hours

Advanced Networking Concepts: Overview of computer networks - Network topologies - Network protocols and communication models - OSI model and TCP/IP stack - Routing and Switching: Basics of routing algorithms - Switching techniques and VLANs - Introduction to routing protocols RIP, OSPF, BGP.

NETWORK TECHNOLOGIES Unit II

Introduction: Overview of networking technologies landscape - Historical perspective and evolution of networking - Emerging trends in networking - Internet of Things (IoT) Technologies: IoT architecture and components - Protocols used in IoT - Cloud Computing Technologies: Cloud service & Deployment models (IaaS, PaaS, SaaS) - Virtualization and hypervisor technologies.

Unit III SOFTWARE-DEFINED NETWORKING (SDN) & NETWORK FUNCTION VIRTUALIZATION (NFV)

SDN: SDN architecture and components - OpenFlow protocol - SDN use cases and applications, NFV: Introduction to NFV - NFV architecture and components - NFV use cases.

Unit IV **4G AND 5G TECHNOLOGIES**

Introduction to 4G: Evolution of Mobile Communication - Goals and Objectives of 4G - LTE (Long-Term Evolution) Technology: LTE Architecture and Components - LTE Physical Layer - LTE Radio Access Network (RAN) - 5G: Evolution from 4G to 5G - Key technologies enabling 5G - Applications and use cases of 5G.

UNIT V NETWORK AUTOMATION AND ORCHESTRATION

Introduction to network automation - Configuration management tools - Orchestration and its role in modern networks - Case Studies: Analysis of real-world implementations - Experience with a Globally-Deployed Software Defined WAN.

References

- Olivier Bonaventure, "Computer Networking: Principles, Protocols and Practice", 2016. 1.
- "Routing and Switching Essentials v6 Companion Guide", Cisco Networking Academy, 2017. 2.
- 3. Jeffrey S. Beasley and Piyasat Nilkaew, "Networking Essentials", 2022.
- 4. B. S. Soni, "Internet of Things (IoT): Technologies, Applications, Challenges and Solutions", 2020.
- 5. Ricardo Puttini, Zaigham Mahmood, Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", 2013.
- 6. Abhishek Ranjan, "Software-Defined Networking: Anatomy of OpenFlow", 2015.
- 7. Rajendra Chayapathi, Syed Hassan, Paresh Shah, "Network Function Virtualization (NFV) with a Touch of SDN", 2016.
- Johan Skold, Erik Dahlman, Stefan Parkvall, "5G NR: The Next Generation Wireless Access 8. Technology", 2018.
- 9. Jason Edelman, Matt Oswalt, and Scott Lowe, "Network Programmability and Automation", 2018.

13

9 Hours

9 Hours

45 Hours

Total

- 9 Hours
- 9 Hours

24CS16	PR	INCIPLE	ES OF	PROG	RAMN	1ING I	LANGU	JAGES)		L	T P	C
		• • •									3	0 0	3
	Pre-requ		•11		M			Assessr	nent Patte	ern	X 7 - •	1.4	$(0(\mathbf{x}))$
• Fui	idamental Program	nming Sk	ill. To doci	an and		ode of A	Assessi	nent	assmant	`	veig		(%)
• Das	elementation	of languag	ge desig	gii anu	Se	mester	Fnd Fx	aminat	ions			60	
Course Ob	iectives				50	mester		ammat	10115			00	
• To	understand and de	a criba av	ntox on	d some	ntics of	nrogra	mmina	longuo	70 5				
• 10 T			111 III	u sema		piogra	mming	langua	ges.				
• 10	understand data, c	lata types.	, and ba	asic stat	tements								
• To	understand call-re	turn archi	tecture	and wa	ays of i	mpleme	enting t	hem.		1			
• 10	 To develop programs in non-procedural programming paradigms 												
To develop programs in non-procedural programming paradigms. Programme Outcomes (POs)													
Programme Outcomes (POs)													
PO1 An ability to independently carry out research / investigation and development work to solve practical problems.													
PO2 A	PO2 An ability to write and present a substantial technical report/document.												
PO3 S	tudents should b	be able t	o dem	onstrat	e a de	egree o	of mas	tery ov	ver the a	area o	of C	Comput	er
PO4 Eff	Science and Engineering. 204 Efficiently design build and develop system application software for distributed and												
Ce	centralized computing environments in varying domains and platforms.												
PO5 Und	derstand the wor	rking of	curren	nt Indu	istry ti	rends,	the	new h	ardware	archit	ectu	ires, t	he
SO	software components and design solutions for real world problems by Communicating and												
effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas													
PO6 Mo	del a computer	r based	auton	nation	svsten	$\frac{1}{1}$ and	desig	n algo	orithms t	that of	expl	ore t	he
u	nderstanding of th	e tradeoff	s invol	ved in c	ligital t	ransfor	mation.	0			ľ		
Course Ou	tcomes (COs)												
The student	ts will be able to												
CO1	Describe syntax ar	nd semant	ics of r	rnoram	ming l	anoilao	25						
CO2	Explain data, data	types, and	l basic	stateme	ents of 1	progran	uming l	anguag	es				
CO3 1	Design and impler	nent subp	rogram	constr	ucts		0	00					
CO4	Apply object-orier	ited, conc	urrency	, and e	vent ha	ndling	progran	nming	constructs	S			
CO5 1	Develop program	ns in S	Scheme	e, ML	, and	Prolo	og and	l Und	lerstand	and	ado	pt ne	ew
	programming lang	uage											
Articulatio	on Matrix								1				
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	1					1					
		2	1		1		1	2					
		4		2	1	1	2	2					
		4					2	2					
		5	1	2	1		2	3]				

Unit I	SYNTAX AND SEMANTICS	9 Hours									
	· · · · · ·										
Evolution of pr	ogramming languages – describing syntax – context – free grammars	attribute									
grammars – desc	ribing semantics – lexical analysis – parsing – recursive-descent – bottom- up pars	sing.									
Unit II	DATA, DATA TYPES, AND BASIC STATEMENTS	9 Hours									
Names – variab	les - binding - type checking - scope - scope rules - lifetime and garba	ge collection									
-primitive data	types-strings-array types- associative arrays-record types- union types -	and boolean									
expressions - as	$\frac{1}{1}$ $\frac{1}$	and $\frac{1}{10000000000000000000000000000000000$									
- branching - gu	arded statements.	in norations									
11		0 Houng									
	SUBPROGRAMS AND IMPLEMENTATIONS	9 Hours									
Subprograms – d	esign issues – local referencing – parameter passing – overloaded methods – gene	eric methods									
- design issues I	for functions – semantics of call and return – implementing simple subprograms – blocks – dynamic scoping	grams –									
stack and dynam	ne local variables – nested subprograms – blocks – dynamic scoping.										
Unit IV	Jnit IV OBJECT-ORIENTATION, CONCURRENCY, AND EVENT 9 Hours										
	HANDLING										
Object-orientatio	n - design issues for OOP languages - implementation of object-oriented of	constructs –									
concurrency - set	emaphores – monitors – message passing – threads – statement level concurre	ency –									
exception handlin	ng – event handling.	-									
UNIT V	FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES	9 Hours									
Introduction to	ambda calculus fundamentals of functional programming languages.	Programming									
with Scheme –	Programming with ML – Introduction to logic and logic programming – H	Programming									
with Prolog – mu	lti-paradigm languages	g									
D 4	Total	45 Hours									
References											
1. Robert Wesley,2	W. Sebesta, "Concepts of Programming Languages", Eleventh Editio 2012.	n, Addison									
2. W. F. Cl Springer	ocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", F , 2003.	ifth Edition,									
3. Michael	L.Scott, "Programming Language Pragmatics", Fourth Edition, Morgan Kauf	mann,2009.									
4. R.KentD	ybvig, "TheScheme programming language", Fourth Edition, MIT Press, 2009.										
5. Richard	A. O'Keefe, "The craft of Prolog", MIT Press, 2009										

6. W.F.Clocksinand C.S.Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

24CS16	AP	PLICATI	ONS O	F DAT	A STR	UCTU	RES A	ND AL	GORITHMS	L	Т	P C
			-	L	ABOR	ATOR	Y			0	0	4 2
]	Pre-requis	ite					A	ssessment Pattern			
• 1	Proficiency i	n Programı	ning la	nguages	s.	Mo	de of A	ssessm	lent	Wei	ghta	<u>ge(%)</u>
• ไ	Understandir	ng of basic	Algori	thm des	sign	Co	ntinuou	s Intern	al Assessment		60)
t	echniques.					Ser	nester I	End Exa	minations		40)
• I t	Basic unders ools.	tanding of	Lab en	vironme	ent and							
Course	Objectives											
• 7	Fo develop a	pplications	using a	advance	ed data	structu	res.					
•	Fo enhance t	he knowled	lae on a	lgorith	mic an	alveie						
 To implement state-of-the-art algorithm design techniques for solving real world problems 												
• 10 implement state-or-the-art algorithm design techniques for solving real world problems.												
Progran	nme Outcon	nes (POs)										
PO1	PO1 An ability to independently carry out research / investigation and development work to solve											
PO2	An ability t	o write and	nreser	t a subs	tantial	technic	al reno	rt/docur	nent			
PO3	Students sh	hould be	able to	demo	nstrate	a deo	ree of	master	ry over the area of	of C	omn	uter
100	Science and Engineering.											
PO4	Efficiently design, build and develop system application software for distributed and											
	centralized computing environments in varying domains and platforms.											
PO5	Understand the working of current Industry trends, the new hardware architectures, the											
	software components and design solutions for real world problems by Communicating and											
	effectively	working v	vith pr	ofessio	nals in	variou	s engin	leering	fields and pursue r	resear	ch	
	orientation	for a lifelo	ng prof	essiona	l develo	opment	in com	puter ar	nd automation arenas			
PO6	Model a	computer	based	autom	nation	system	and	design	algorithms that	expl	ore	the
	understand	ing of the ti	adeoff	s involv	red in d	igital tr	ansforn	nation.				
Course	Jutcomes (COS)										
I ne stud	ents will be	able to										
CO1	Design an	d implemer	nt basic	and ad	vanced	data st	ructures	s extens	ively.			
CO2	Design alg	gorithms us	ing tree	e and gr	aph dat	ta struc	tures.					
CO3	Choose ap	ppropriate	data st	ructures	s and a	lgorith	ms, unc	lerstand	the ADT/libraries,	and	use	t to
	design alg	orithms for	a spec	ific pro	blem.							
Articula	tion Matrix											
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	1	1		1	1					
			1		1	-	2	1				
		2	1		1	2	2	1				
		3	1	1	1	1	2	1				
		5	1	1	1	1	2	1				
I Init I	F	vneriment	1								61	Hours
	152	-per mient	-								01	.ivui s
Impleme	nt the recurr	ence relation	on for th	ne recur	sive an	d non-r	ecursiv	e proble	ems.			
a) Find t	he nth term o	of a given r	ecurren	ce relat	ion.			_				
b) Write	a program	that use bo	th recu	rsive an	d non-i	recursiv	ve funct	ions for	implementing the	follo	wing	
searching	g methods:											
i) Linear	search											

ii) Binary searchc) Write a program to find merge sort analysis.

Unit II	Experiment 2	6 Hours							
Turn la manut (la a fai									
Implement the fo	nowing data structures: a) Lettist heaps b) Skew heaps								
Unit III	Experiment 3	3 Hours							
Create two binom	nial queue structures and perform merging of two binomial queues.								
Unit IV	Experiment 4	3 Hours							
Write a program	to perform the following:								
a) Create a binary	Viree of integers								
b) Haverse the b	mary tree using pre-order, in-order and post-order traversars								
UNIT V	Experiment 5	6 Hours							
		0 110 010							
Write a program	to perform the insertion and deletion operations in AVL Tree using a) Single Rota	tion b)							
Double Rotation.		,							
UNIT VI	Experiment 6	5 Hours							
a) Implement inso	ertion, deletion and search operations in Red-Black Tree								
b) Write a progra	m to implement B-Tree operations.								
LINUT VII	Experiment 7	5 Hours							
	Experiment /	5 Hours							
a) Implement D	iikstra's algorithm and Floyd Warshall's algorithm for solving single source	shortest							
nath problems	jksua s argonumi and rioyd warshan s argonumi for sorving single source	shortest							
b) Write a progra	m to detect Hamiltonian cycles in a Hamiltonian graph.								
UNIT VIII	Experiment 8	5 Hours							
a) Write a progra	m to implement graph coloring algorithms.								
b) Write a progra	m to find chromatic index of cyclic graphs.								
LINIT IV	E-movin out 0	5 11.0000							
	Experiment 9	5 Hours							
a) Solve rod cutti	ng problem using dynamic programming technique								
b) Implement the	Huffman coding algorithm to decode the given text.								
i i i i i i i i i i i i i i i i i i i									
UNIT X	Experiment 10	5 Hours							
	· –								
Simulate Tic-Tac	-Toe game using backtracking strategy								
	Total	60 Hours							
References									
I. Anany L	evitin, Introduction to the Design and Analysis of Algorithms, Third Edition	ı, Pearson,							
$\begin{array}{c} 2014. \\ 2 & \text{Alfred M} \end{array}$	Abo John E Honoroft Jaffrey D. Lillmon, Data Structures and Algorithms. Third	Edition							
2. Allieu V Pearcon	2015	Euruon,							
3. Thomas	H. Cormen, Charles E. Leiserson, Ronald L. Rivest Clifford Stein Introduction to)							
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to									

Algorithms, Third Edition, Prentice Hall of India, Reprint 2012.

- 4. Mark Allen Weiss, Data Structures and Algorithms in C++, Fourth Edition, Pearson, 2014
- 5. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms, University Press, 2008.
- 6. Adam Drozdek, Data Structures and Algorithms in C++, 4th Edition, Cengage Learning, 2013.

24CS17	,		DATA	BASE	ENGIN	EERI	NG LA	BORA	TORY	L T P C
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	Droficion	I Ie-Ieq		2 100 000			Mode	of Asse	Assessment I allel II	Weightage(%)
•	Pasia D	tabasa con	conte o	g langua	iges.	lling	Contin	IOUS IN	ternal Assessment	60
•	obille	adase con	cepts a	nu uata	i mode	ining _	Semest	er End	Examinations	40
•	Advance	d SOL tech	niques				Semest		Examinations	40
Course			inques.							
Course										
•	To study	and implem	nent the	basic S	SQL co	mmand	s.			
•	To imple	ment the da	tabase	design	in an O	bject or	iented of	latabas	e.	
•	To imple	ment distrib	outed da	atabases	s and pa	arallel d	latabase	es.		
Program	mme Out	comes (PO	s)							
PO1 An ability to independently carry out research / investigation and development work to solve										vork to solve
practical problems.										
PO2	An abıl	ity to write	and pre	sent a s	ubstant	al tech	inical re	eport/do	ocument.	
P03	Student Science	s should be and Engine	e able eering	to de	monstr	ate a	degree	of ma	astery over the area of	or Computer
PO4	Efficier	ntly design	, build	and	develo	op sys	tem a	pplicati	on software for dist	tributed and
DO5	centralized computing environments in varying domains and platforms.									
P05	Understand the working of current industry trends, the new nardware arcmitectures, the									
	softwar	e compone	ents an	a desig	gn solu	in vor	ion rea	i worit	ng fields and pursue r	unicating and
	orientat	ion for a lif	g with	professi	sionais	iii var	ont in c	ompute	ing menus and pursue i	esearch
PO6	Model		er bas	ad au	tomatic		tom a	ompute	yign algorithms that	evolore the
FUU	underst	a comput anding of th	e trade	offs ins	volved i	n digita	ltransf	iu ues ormatic	angoriumis utat	explore the
Course	Outcom			0115 1110	orveur	n uigita	ii transi	orman	л.	
The stuc	lents will	be able to								
CO1	Execu	te the basic	SOL co	omman	ds in O	RACLE	Ξ.			
CO2	Implei	nent a paral	lel and	distrib	ited dat	abase u	ising O	RACLE	Э.	
CO3	Devel	op an object	toriente	ed datal	base usi	ng Cas	e tools.			
CO4	Devel	p a NoSQI	_ Datab	ase to r	naintaiı	n data o	f an en	terprise	using MongoDB.	
Articula	ation Ma	trix							0 0	
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6		
		1	2	2	1	3	1	2		
		1	2	2	1	5	1	2		
		2	2	2		2	1	1		
		3	3	1	2	1		1		
4 3 2 2 1 1 1										
Unit I		Experime	ent 1							12 Hours
Working	g basic So	QL commar	ıds, Sin	gle Rov	w and C	iroup fu	unction	8		
Unit II		Experime	ent 2							6 Hours
		- aper inte								0 110010
Implem	ent Parall	el Database	e of Un	iversity	Couns	elling f	or Eng	ineering	g colleges and improve	the data access
from the	e database	es through p	aralleli	zation o	of vario	us oper	ations.			

Unit III Experiment 3 6 Hou Design a Distributed Database to store and retrieve data efficiently. Unit IV Experiment 4 6 Hou Create ODL schema to store the data and ODL Queries to access the data from Object Oriented Database. UNIT V Experiment 5 6 Hou MySQL Database Creation, Table Creation, Query								
Design a Distributed Database to store and retrieve data efficiently. Unit IV Experiment 4 Create ODL schema to store the data and ODL Queries to access the data from Object Oriented Database. UNIT V Experiment 5 MySQL Database Creation, Table Creation, Query								
Design a Distributed Database to store and retrieve data efficiently. Unit IV Experiment 4 6 Hou Create ODL schema to store the data and ODL Queries to access the data from Object Oriented Database. Image: Create ODL schema to store the data and ODL Queries to access the data from Object Oriented Database. UNIT V Experiment 5 6 Hou MySQL Database Creation, Table Creation, Query Image: Create ODL schema to store the data from Object Oriented Database.								
Unit IV Experiment 4 6 Hou Create ODL schema to store the data and ODL Queries to access the data from Object Oriented Database. Image: Creation Database UNIT V Experiment 5 6 Hou MySQL Database Creation, Table Creation, Query Image: Creation Database Creation Database								
Unit IV Experiment 4 6 Hour Create ODL schema to store the data and ODL Queries to access the data from Object Oriented Database. 0 UNIT V Experiment 5 6 Hour MySQL Database Creation, Table Creation, Query 0								
Create ODL schema to store the data and ODL Queries to access the data from Object Oriented Database. UNIT V Experiment 5 6 Hou MySQL Database Creation, Table Creation, Query 6 6								
UNIT V Experiment 5 6 Hou MySQL Database Creation, Table Creation, Query								
UNIT V Experiment 5 6 Hou MySQL Database Creation, Table Creation, Query								
MySQL Database Creation, Table Creation, Query								
MySQL Database Creation, Table Creation, Query								
UNII VI Experiment 6 6 Hou								
Spatial Database Query Processing using open source DB (MongoDB/MySQL etc)								
Spanar Database Query Hocessing using open source DD (MongoDD/MySQL etc)								
UNIT VII Experiment 7 6 Hou								
MongoDB - CRUD operations and Indexing								
UNIT VIIIExperiment 86 Hou								
Constant Table Operations COL Trans								
Cassandra - Table Operations, CQL Types.								
UNIT IX Experiment 9 6 Hou								
HIVE: Database Operations, Partitioning - HiveQL OrientDB Graph database - OrientDB Features.								
Total 60 Hou								
1. HIVE: Database Operations, Partitioning - HiveQL OrientDB Graph database - OrientDB Features								
Education/Addison Wesley, 2016. 2 Henry F. Korth, Abraham Silberschatz, and S. Sudharshan, Database System, Concents New								
Delhi: McGraw Hill. 2010.								
3. Vijay Kumar, Mobile Database Systems Wiley Series on Parallel and Distributed Computing,								
USA, Wiley-Interscience, 2006.								
4. C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Eighth Edition,								
Pearson Education, 2006.								

24CS21	21 INTERNET OF THINGS L										ΤI	P C
	D		• • •							3	0 0) 3
- D-	Pre	e-requ	isite				Jada at	F A goog	Assessment Pattern	Wai	abtoo	$\alpha(0/)$
• Ва	sics of Embe		systems	.			Tontinu	Ous Inte	smem ernal Assessment	wei	<u>2111ag</u> 70	e(70)
• Ne	tworking run	cation	and Io	Γ Proto	rols	5	Semeste	r Fnd F	yaminations		60	
Course Of	viectives	cation		1 1 1010			<i>cilieste</i>				00	
To To	yuu danatan d t	he def	::	مبدأ مأمه		ting of	Lат					
• 10	understand t	ne der	inition	and cha	racteris	stics of	101.					
• To in t	• To understand Software Defined Networks (SDN) and Network Function Virtualization (NFV) in the context of IoT.											
• To	• To explore various sensors and their applications in IoT.											
• To Io7	• To understand the basics of networking, explore a variety of sensors and computing in the context of IoT.											
• To	apply data a	nalytic	s tools	such as	Apach	e Hado	oop, Ch	ef, and	Puppet for IoT.			
Programm	ne Outcomes	s (POs)									
												1
POI	An ability to independently carry out research / investigation and development work to solve											
PO2 A	An ability to write and present a substantial technical report/document											
PO3 S	Students should be able to demonstrate a degree of mastery over the area of Computer											
S	Science and Engineering.											
PO4 E	fficiently de	sign,	build a	and de	velop	system	applic	cation	software for distri	ibute	1	and
c	centralized computing environments in varying domains and platforms.											
PO5 U	nderstand th	ne wo	rking o	of curr	ent Inc	lustry	trends,	the	new hardware arch	itectu	ires,	the
S	oftware com	nponen	its and	desigi	1 solut	ions to	or real	world	problems by Comm	unica	ting	and
e	rientation for	/Orking r a life	g With	protes	ssionals	alonma	arious	engine	and automation arenas	rsue	resea	arch
PO6 M	odel a con	nnuter	hase	$\frac{1}{1}$ auto	mation	svste	m and	d desi	on algorithms that	exn	ore	the
	nderstanding	g of the	tradeo	ffs invo	lved in	digital	transfo	ormation	1.	exp	.010	
	<i>L</i>					0						
Course Ou	itcomes (CO)s)										
The studen	ts will be abl	le to										
CO1	Identify and	analyz	e differ	ent con	nmunic	ation n	nodels a	ind prot	ocols used in IoT.			
CO2	Acquire prac	tical s	kills in	loT sys	tem ma	inagem	ent thro	ough va	rious protocols.			
CO3	Use Arduino	, Rasp	berry P	1 and co	ontrol d	ifferent	t hardw	are con	ponents.			1.00
04	Apply divers	se rang	ge of se	ensors a	long w	iin a so	ond gra	sp of n	etworking and comput	ing p	rincip	bles
CO5	Develop Wel	b Serv	ers and	REST	ul Web	APIs f	for IoT	applica	tions.			
Articulatio	on Matrix											
	Γ	CO .										
		NT	PO1	PO2	PO3	PO4	PO5	PO6				
		N0.										
	F	1	1	1	2	1	1	3	1			
	-	2	3	2	1	2	3	2				
	-	3	1	1	2	1	3	3				
		4	2	3	2	1	2	2				
		5	1	2	1	2	1	1				

Unit I INTRODUCTION TO IoT

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

Unit II IoT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEER.

Unit III IOT PHYSICAL DEVICES AND HARDWARE

Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C) – Controlling Hardware-Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors.

Unit IV SENSORS, NETWORKING AND COMPUTING

Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor- File Handling, Python Packages for IoT, IoT Physical Servers – Cloud Storage Models, Communication APIs.

UNIT V IoT CLOUDS AND DATA ANALYTICS

Introduction to Cloud Storage models and communication- APIs Web Server – Web server for IoT - RESTful Web API, Amazon Web Services for IoT, Apache Hadoop, Batch Data Analysis, Chef, Chef Case Studies, Puppet. Case studies: smart cities, smart home, connected vehicles, Industrial IOT.

Total	45 Hours
References	
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Uni- Press, 2015, ISBN: 9788173719547.	versities

- 2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
- 3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895.
- 4. Kamal, R.,"Internet of Things Architecture and Design Principles," 1st Edition, Mcgraw Hill, 2017.
- 5. Simone Cirani," Internet of Things- Architectures, Protocols and Standards", WILEY, 2018.
- 6. Alessandro Bassi," Enabling Things to Talk- Designing IoT solutions with the IoT Architectural Reference Model", Springer, 2013.

9 Hours

9 Hours

9 Hours

9 Hours

9 Hours

24CS22	MACHINE LEARNING								P				
	Pre-rea	nisite						sceccu	nent Pattern	3	U	0	
•	Mathematics for Ma	chine Lear	nino		M	ode of A	Assessn	nent		Wei	ghta	age(%	
•	Basics of Machine I	Basics of Machine Learning and Data Science							us Internal Assessment 4				
	Dusies of Machine L	curining un	la Data	belene	Ser	mester	End Exa	aminati	ons		6)	
Course	Objectives									1			
•	Understand the cond tackled by machine l	cepts and earning.	mathen	natical	founda	tions of	f mach	ine lear	ming and typ	bes of	pro	blems	
•	Explore the different	supervise	d learn	ing tech	nniques	includi	ng ense	mble n	nethods.				
•	Learn different aspec	Learn different aspects of unsupervised learning and reinforcement learning.											
•	Learn the role of probabilistic methods for machine learning.												
•	Analyze the advance	d learning	metho	ds.		· ·							
Program	mme Outcomes (PO	<u>s)</u>											
PO1	An ability to independently carry out research / investigation and development work to solve practical problems.												
PO2	An ability to write	and preser	nt a sub	stantial	technic	cal repo	rt/docu	ment.					
PO3	Students should b	e able to	demo	onstrate	a deg	gree of	maste	ery ove	er the area	of C	lomp	uter	
	Science and Engine	eering.											
PO4	Efficiently design	, build a ing enviro	and de	evelop s in vary	systen	n appl mains a	lication	softw forms	are for dis	stribut	ted	and	
PO5	Understand the w	vorking o	f curre	ent Inc	lustry	trends.	the 1	new ha	ardware arc	hitect	ures.	the	
	software compone	ents and	design	solutio	ons for	real v	world p	oroblem	s by Comm	nunica	ting	and	
	effectively workin	g with pr	ofessio	nals in	variou	ıs engii	neering	fields	and pursue	resear	rch		
	orientation for a lif	elong prof	essiona	l devel	opment	in com	puter a	nd auto	mation arena	s.			
PO6	Model a comput	er based	auton	nation	systen	n and	design	n algo	rithms that	expl	ore	the	
Course	Outcomes (COs)	le tradeorr	s mvorv	ved in d	iigitai ti	ansion	nation.						
The stuc	dents will be able to												
	Eormulate the nec	assity of n	natham	atical fo	undati	on for r	nachina	loornir	να				
C01	Implement superv	ised learni	ing aloc	rithms	for any	real lif	e annlia	ration	ig.				
CO3	Apply clustering	algorithm	$\frac{115}{5}$ for 1	ınlabele	ed data	sets an	d impl	ement	reinforcemen	t leai	rning	, for	
000	suitable problems								••••••			, 101	
CO4	Design and imple	ment proba	abilistic	c graphi	ical mo	dels for	machir	ne learn	ing.				
CO5	Analyze the advar	nced learn	ing alg	orithms	s and id	lentify t	the suit	able ap	plications for	[·] solvi	ing ı	ısing	
	these advanced lea	arning tech	nniques	•									
Articula	ation Matrix	[1	1	1	1						
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	1	2	1	3	1	1					
			2	2	1	2	1	2					
		2	2	3	1	2	1	2					
3 1 1 2 1 2													
		4	2	2				3					
		5	3	3	1	1	1	3					

INTRODUCTION AND MATHEMATICAL FOUNDATIONS 9

Machine Learning -Machine Learning Foundations – Design of a Learning system - Types of Machine Learning –Applications - Mathematical Foundations of Machine Learning - Random Variables and Probabilities -Probability Theory – Bayesian Conditional Probability - Decision Theory - Bayes Decision Theory - Information Theory.

Unit II SUPERVISED LEARNING

Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting - Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbors - Tree based Methods – Decision Trees –ID3 – CART - Ensemble Methods –Random Forest – Bagging and Boosting - Evaluation of Classification Algorithms.

Unit III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING 9 Hours

Clustering Algorithms – K-Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction – Principal Component Analysis – Recommendation Systems- EM Algorithm - Mixtures of Gaussians. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning.

Unit IV PROBABILISTIC GRAPHICAL MODELS

Graphical Models - Undirected Graphical Models - Markov Random Fields -Directed Graphical Models - Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks - Conditional independence properties - Inference –Learning - Generalization - Hidden Markov Models - Conditional random fields(CRFs).

UNIT V ADVANCED LEARNING

Sampling –Basic sampling methods –Monte Carlo. Exploration Strategies - Deterministic and Non-Deterministic Rewards and Actions Computational Learning Theory -Mistake Bound Analysis, Sample Complexity Analysis, VC Dimension. Occam Learning, Accuracy and Confidence Boosting.

References

Unit I

- 1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC, 2nd Edition, 2014.
- 2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
- 3. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
- 4. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
- 5. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman,"Mining of Massive Datasets", Cambridge University Press, Second Edition.
- 6. Tom Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
- 7. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
- 8. Stephen Marsland, "Machine Learning An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition, 2014.

9 Hours

9 Hours

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9 Hours

45 Hours

Total

24CS2	3		A	DVAN	NCED	SOFTV	VARE	ENGI	NEERI	NG	L T P C 3 0 2 4	
			Pre-reaui	site						Assessment Pattern	0 0 2 4	
•	Ba	asic Softwa	are Engine	ering (Concept	s.	M	lode of	Assess	ment	Weightage(%)	
٠	U	sage of bas	sic Softwar	e Deve	elopmer	nt Tools	s. C	ontinuo	us Inter	40		
	-				r		Se	emester	End Ex	kaminations	60	
Course	e O	bjectives									-	
•	То	o understar	nd the ratio	nale fo	r softw	are dev	elopme	ent proc	ess mo	dels.		
•	Та	ounderstar	nd why the	archite	ectural o	lesign (of softw	vare is i	mporta	nt		
•	• To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.											
•	To understand the basic notions of agile software development and devops tools.											
•	To understand the different stages of testing from testing during development of a software system											
Progra	amr	ne Outcor	nes (POs)		4905 01	testing	11011110	Joung a	anng a		ure system.	
PO1	1	An abilit practical pr	y to indep oblems.	penden	tly carr	y out 1	research	n / inve	estigatio	on and development	work to solve	
PO2	A	An ability to	o write and	l presei	nt a sub	stantial	techni	cal repo	ort/docu	ment.		
PO3		Students s	should be	able	to den	nonstra	te a d	egree	of mas	stery over the area	of Computer	
		Science and	d Engineer	$\frac{r_{1}}{1}$	1 1	1		1.	·	<u> </u>	·1 (1 1	
PO4	EI	ficiently (design, bi	uild ai	nd dev	elop s	ystem	applica	ation s	tforms	ibuted and	
PO5	I Ir	derstand	the work	ing of		$\frac{5 \text{ III } \text{val}}{\text{nt} \text{ Ind}}$	ustrv t	rends	$\frac{110}{10}$ the	new hardware arch	vitectures the	
		software c	component	s and	design	soluti	ons for	r real	world	problems by Comm	unicating and	
		effectively	working	with	profess	sionals	in va	rious e	enginee	ring fields and put	rsue research	
		orientation	for a lifel	ong pro	fession	al deve	lopmen	it in cor	nputer a	and automation arenas	3.	
PO6	М	odel a	computer	based	autor	nation	syster	n and	desig	n algorithms that	explore the	
	1	understand	ing of the	tradeof	fs invol	ved in	digital	transfor	mation			
Course	e O	utcomes (COs)									
The stu	ıdeı	nts will be	able to									
CO1		Identify a	ppropriate	proces	s mode	ls based	l on the	Projec	t requir	ements.		
CO2		Understar	id the impo	ortance	of havi	ng a go	od Sof	tware A	rchitec	ture.		
CO3		Use the in	mportant c	limensi	ons of	softwa	re depe	ndabili	ty, nam	nely, availability, relia	ability, safety,	
		security, a	and resilier	nce.			_			-	-	
CO4		Understar	nd the basi	c notio	ons of d	levelop	ing a so	oftware	by usi	ng Agile methodolog	y and Devops	
<u> </u>		tools.	10.0			1						
		Understar	id Softwar	e testin	g appro	aches.						
Articu	lati	on Matrix		DOI		DOA	701		DO (1		
			CO. No.	PO1	PO2	PO3	PO4	PO5	PO6			
			1	1	2		1	1	1			
				2	1	1		1				
			2	2	1	1	2	1	2			
			3	1	1		1		1			
			4	1		1	1		1			
			5	1	1			1		-		
			5	1	1			1				

Unit I SOFTWARE PROCESS & MODELING

Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Modelling – Principles –Requirements Engineering – Scenariobased Modelling – Class-based Modelling – Functional Modelling – Behavioural Modelling.

Unit II SOFTWARE DESIGN

Design Concepts – Design Model – Object Oriented Design using the UML Data Flow Diagrams- Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – Refactoring.

Unit III SYSTEM DEPENDABILITY AND SECURITY

Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering – Security Engineering – Security and Dependability Cybersecurity – Sociotechnical Resilience.

Unit IV AGILE METHODOLOGIES AND DEVOPS

Understanding Agile Values - The Agile Manifesto, Purpose Behind Each Practice. Individuals and Interactions Over Processes and Tools, Working Software Over Comprehensive Documentation - The 12 Principles of Agile Software - The Rules of Scrum - Daily Scrum, Feedback and the Visibility- Inspection-Adaptation Cycle, The Last Responsible Moment - Understanding DevOps - DevOps Lifecycle - DevOps Tools - Integrating Agile and DevOps - Continuous Integration and Continuous Deployment (CI/CD) - Case Studies.

UNIT V SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT

9 Hours

Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.

Total	45 Hours
EXPERIMENT 1	6 Hours
Program Analysis and Project planning. Thorough study of the problem – Identify project scope.	
Objectives, Infrastructure – PROJECT PLAN DOCUMENTATION	
EXPERIMENT 2	6 Hours
Software Requirement Analysis Describe the individual Phases / Modules of the project.	
EXPERIMENT 3	6 Hours
Data Modeling Use work products Data dictionary. Use case diagrams and activity diagrams, build and test class diagrams, Sequence diagrams, add interface to class diagramsDESIGN	
DOCUMENTATION	
EXPERIMENT 4	6 Hours
Software Development and Debugging Use technology of your choice to develop and debug the application-CODE DOCUMENTATION	
EXPERIMENT 5	6 Hours
Software Testing Perform validation testing, Coverage analysis, memory leaks, develop test case	

9 Hours

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Regul	lations	2024

1. 1	1	TECT CACE	DOCUMENTATION
nierar	chv and Site mo	nitor - TEST CASE	DUCUMENTATION

herateny and she monitor - TEST CASE DOCOMENTATION		
	Total	30 Hours
	Total	75 Hours
References		
	1 D	

- 1. Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and Bruce Maxim, McGraw-Hill 2019.
- 2. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.
- 3. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018.
- 4. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, Narosa Publishing House, 2018.
- 5. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd, 2018.
- 6. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.
- 7. Kim, Gene, Jez Humble, Patrick Debois, John Willis, and Nicole Forsgren. The DevOps handbook: How to create world-class agility, reliability, & security in technology organizations. IT Revolution, 2021.

24CS24	4 CLOUD COMPUTING TECHNOLOGIES L T P 3 0 2									P C 2 4					
]]	Pre-			As	sessment Pattern									
	ree	<u>quisite</u>								XX7~:~ h4-					
• (Inderstanding o	of basic	networ	king co	ncepts.	Mod	le of As	Intorno	nt 1 Assassment	Weighta					
• •	Basic knowledge of Cloud Computing and Cyber security principles						ester Er	nd Exar	ninations		40 60				
Course (Diectives	merpi				Sem					00				
• Т	o articulate th	e diffe	rences	hetwee	n denl	ovment	model	and s	ervice model of c	loud	romn	uting			
• T	To impart virtua loud environme	lization ents.	n techno	ologies,	, resour	ce man	agemer	nt techr	iques and scheduli	ing sc	cheme	es in			
• T v	• To enhance knowledge on different types of programming models to deploy web applications with security in the cloud.														
Program	me Outcomes	(POs)													
PO1Apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems of varying complexity.PO2Identify, formulate, critically analyse, and solve problems in the field of															
DOA	Comput	ter Sci	ence an	d Engir	neering,	consid	ering re	ecent an	d future trends.	1					
PO3	Design constrai Enginee	Design a system, component, or process to meet desired needs within realistic constraints such as economic, social and ethical in the field of Computer Science and Engineering.													
PO4	Use cur	Use current techniques, skills, and tools necessary for computing practice and													
	demons	trate ac	lvanced	l knowl	edge of	a selec	ted area	a withir	the Computer Scie	ence a	nd				
PO5	Demons	ering di strate a	scipline n ability	e. y to eng	age in l	ifelong	learnin	ig for pi	rofessional develop	ment	and				
PO6	Critical	lv anal	vse ex	isting	to acco literatu	e in a	a comi n area	of spe	aı. cialization and de	velon					
100	innovat	ive and	l resear	ch- orie	ented m	ethodol	logies to	o tackle	gaps identified.	velop					
<u> </u>		``													
Course (Dutcomes (COs	s)													
The stude	ents will be able														
CO1	Elaborate the	e com	oonents	of cl	oud co	mputir	ig to i	indersta	and how business	agil	ity i	n an			
	organization	can be o	created.	• • • •		-		1 1	· ·	-	-				
CO2 CO3	<u>Critique the c</u>	deploy	ncy of v	virtualiz	zation to	echnolo	gies in	cloud e	environments.		hama	s and			
005	resource man	agemer	nt.	i web	SCIVICC	s nom		ucintee	ture with schedulin	ig sei	neme	s anu			
CO4	Analyze cloue	d progr	amming	g mode	ls to sol	ve issu	es on cl	oud.							
CO5	Design a secu	ire clou	d to de	ploy an	applica	tion ba	sed on o	differen	t security concerns	•					
Articulation Matrix															
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6							
		1				2	2	1							
		2	2	3	1			1							
		3	3		3		1	3							
		4				2		3							
		5	3	2											

Unit I INTRODUCTION - CLOUD INFRASTRUCTURE

Cloud computing - Cloud computing delivery models and services - Ethical issues - Cloud vulnerabilities - Cloud computing at Amazon - Cloud computing the Google perspective - Microsoft Windows Azure and online services - Open-source software platforms for private clouds.

Unit II CLOUD VIRTUALIZATION TECHNOLOGIES

Introduction - Virtualization Defined-Virtualization Benefits - Server Virtualization-Virtual Machine -Virtualization technologies-Hardware Virtualization- OS Virtualization Virtualization for x86 Architecture - Paravirtualization - Virtual Infrastructure Requirements - Server Virtualization Sustainability Assessment.

Unit III CLOUD RESOURCE MANAGEMENT AND SCHEDULING

Policies and Mechanisms for Resource Management - Stability of a Two-Level Resource Allocation Architecture - A Utility-Based Model for Cloud-Based Web Services - Resource Bundling: Combinatorial Auctions for Cloud Resources - Scheduling Algorithms for Computing Clouds - Fair Queuing - Start – Time Fair Queuing - Borrowed Virtual Time.

Unit IV CLOUD PROGRAMMING MODEL

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job -Developing Map Reduce Applications - Design of Hadoop file system-Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.

UNIT V CLOUD SECURITY

Cloud Infrastructure security: network, host and application level-aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud -Cloud Security and Trust Management.

	Total	45 Hours
	2004	
Deferences		

References

- 1. Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2021.
- 2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011.
- 3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill, 2003.
- 4. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
- 5. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

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						1				0	0	4 2
	P	re-req	uisite					<u> </u>	Assessment Pattern			(0())
•]	Fundamental	Prograi	mming	Skills.		Ŀ	Mode (of Asses	ssment	Wei	ghta	<u>ge(%)</u>
• 1	Minimal expe	erience	with n	nachine	learnin	ng 🤤	Continu	ious Int	ternal Assessment		60	·
	rameworks.						Semest	er End	Examinations		40	
Course	Objectives											
• 1	Understand th	e imple	ementat	ion pro	cedures	s for the	e machi	ne leari	ning algorithms.			
• 1	Use tools to se	olve the	e classit	fication	proble	ms usin	g mach	ine lear	rning techniques.			
•]	Implement sta	ate-of-tl	he-art a	lgorithi	n desig	n techn	iques fo	or real l	ife applications.			
Program	nme Outcom	es (PO	s)									
PO1	An ability	to inde	ependen	tly car	ry out	researc	h / inv	vestigati	ion and development w	/ork	to s	olve
DO1	practical pro	oblems.	and nea	cont o c	whatant	iol tooh	ni 0.01 m	mont/de	aumont			
PO2 PO3	Students sh	ould b	and pre	to de	monstr	ate a	dogroo	of ma	ocument.	f C	omn	utor
105	Science and	Engine	ering.	to de	monsu	ate a	uegree	01 1116	istery over the area (лС	omp	1101
PO4	Efficiently	design.	build	and	develo	op svs	tem a	pplicati	on software for dist	ribut	ed	and
_	centralized of	comput	ing env	ironme	nts in v	arying	domain	s and p	latforms.			
PO5	Understand	the w	vorking	of cu	ırrent	Industr	y tren	ds, the	e new hardware arch	itectu	ıres,	the
	software co	ompone	ents and	d desig	gn solu	tions f	for real	l world	l problems by Commu	inica	ting	and
	effectively	workin	g with	profess	sionals	in vari	ous en	gineeri	ng fields and pursue re	esearc	ch	
	orientation f	or a life	elong p	rofessio	onal dev	velopme	ent in c	ompute	r and automation arenas		~ # ~	410 0
POo	understandi	ng of th	er bas ne trade	offs inv	omatio	n sysi n dioita	em ar 1 transf	ia des	agn algorithms that	expl	ore	the
Course	Outcomes (C	Os)		0110 111	011001							
The stud	ents will be a	ble to										
CO1	Implement	the sup	pervised	l learni	ng algo	orithms	for cla	assifica	tion of labeled dataset	s and	ł	
	compute ac	ccuracy	of the	classifie	ers.							
CO2	Design Bay	yesian r	network	for cla	ssifying	g the m	edical d	lata.				
CO3	Apply clus	tering a	lgorith	ms for a	<u>classify</u>	ing the	unlabe	led data	isets.			
<u>CO4</u>	Select appr	opriate	algorit	hms/ te	chnique	es to so	lve con	nputing	problems in real-world.			
Antioulo	tion Matrix											
Arucuia	uon Matrix											
		CO.]			
		No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1.00										
		1	1	2	1	3	1	1				
		2	2	2	1	2	1	2				
		2	2	3	1	2	1	2				
		3	1	1	2	1		2	-			
		_										
		4	2	2				3				
T T • / -		<u> </u>									~ -	
Unit I	Ex	perime	ent l								31	iours
Implana	nt and doma	notroto	tha EN	JD C al	aorithe	n for fi	ndina f	ha maa	t anacifia hypothesis ha	ad a	n o	aiven
set of tra	ining data car	nsuale nnlee 1	uie rii Read th	e traini	igorium no data	from a	CSV f	ne mos ile	i specific hypothesis da	seu (л а	given
	annig uata sal	inpico. I	ixeau ill	e uann	ng uata	nom a	.0011					

Unit II	Experiment 2	6 Hours
For a given set of Elimination algorithm	of training data examples stored in a .CSV file, implement and demonstrate the rithm to output a description of the set of all hypotheses consistent with the training	Candidate- g examples.
Unit III	Experiment 3	9 Hours
Write a program appropriate data	n to demonstrate the working of the decision tree based ID3 algorithm set for building the decision tree and apply this knowledge to classify a ne	n. Use an w sample.
Unit IV	Experiment 4	3 Hours
Write a program Compute the acc	to implement the naïve Bayesian classifier for a sample training data set stored as uracy of the classifier, considering few test data sets.	a .CSV file.
UNIT V	Experiment 5	6 Hours
Assuming a set o this task. Built-in and recall for you	f documents that need to be classified, use the naïve Bayesian Classifier model to a Java classes/API can be used to write the program. Calculate the accuracy, pre- ar data set.	perform cision,
UNIT VI	Experiment 6	3 Hours
Write a program demonstrate the of ML library classe	to construct a Bayesian network considering medical data. Use this model to diagnosis of heart patients using standard Heart Disease Data Set. You can use Java es/API.	/Python
UNIT VII	Experiment 7	9 Hours
Apply EM algori clustering using l of clustering. Yo	thm to cluster a set of data stored in a .CSV file. Use the same data set fo k-Means algorithm. Compare the results of these two algorithms and comment on t u can add Java/Python ML library classes/API in the program.	r he quality
UNIT VIII	Experiment 8	6 Hours
Write a program wrong prediction	to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both os. Java/Python ML library classes can be used for this problem.	correct and
UNIT IX	Experiment 9	9 Hours
Implement the no appropriate data	on-parametric Locally Weighted Regression algorithm in order to fit data points. Se set for your experiment and draw graphs	elect
UNIT X	Experiment 10	6 Hours
Case Study of Di	sease Prediction on google Colab.	
	Total	60 Hours
References	Marsland "Machine Learning: An Algorithmic Perspective" Chapman & Hall/	'BC
2. Kevin P. 3. EthemAl	Marshand, Machine Learning: An Argonumic Perspective, Chapman & Hall/C ion, 2014. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012. paydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.	NU,

- 4. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
- 5. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman,"Mining of Massive Datasets", Cambridge University Press, Second Edition.
- 6. Tom Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
- 7. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
- 8. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition, 2014.

	8				MINI P	ROJE	ССТ			L	T 1	P C
										0	0 4	2
	Р	re-requi	site						Assessment Pattern	T		
٠	Develop skill	s to iden	tify ar	d conv	vert a rea	l- N	Iode of	Assess	sment	Wei	ghtag	e(%)
	world problem	n into a t	echnica	al probl	em	C	ontinuo	ous Inte	rnal Assessment		100	
0						S	emester	r End E	xaminations			
Course	Objectives											
•	To develop sk	ills to id	entify a	and con	vert a rea	al-wor	ld prob	lem int	o a technical problem.			
•	To teach use of	of new to	ols and	l techni	ques requ	uired t	to carry	out the	e project.			
•	To teach use of	of new to	ols and	l techni	ques requ	uired	to carry	out the	e project.			
•	To make fami	liar in de	velopi	ng the p	proof of c	concep	ot.					
•	To provide gu	idelines	to pren	are star	ndard pro	niect re	enort					
	10 provide 84		to prop		ionio pro		-porti					
Progra	mme Outcomes (POs)											
	A	4	1	(1			1. /				4	1
POI	An ability	to inde	pender	itly car	ry out re	esearc	n / inv	estigati	on and development	work	to so	orve
PO2	practical problems.											
PO3	Students sh	ould be	$\frac{a \text{ prose}}{a \text{ ble}}$	to de	monstrate		legree	of ma	stery over the area	of C	Comp	ıter
	Science and	Enginee	ring.				0		,		ľ	
PO4	Efficiently de	esign, b	uild a	nd de	velop sy	stem	applic	ation	software for distr	ibute	d	and
	centralized of	computin	g envi	onmen	ts in vary	ying d	omains	and pla	atforms.			
PO5	Understand the	he work	ting o	f curre	ent Indu	stry	trends,	the	new hardware arch	itect	ires,	the
	software co	mponent	ts and	design	1 solutio	ons to	r real	world	problems by Comm	unica	ting	and
	orientation f	or a lifel	ong pr	profession	ssionais nal develu	nn va Onmei	u ious	mnuter	and automation arenas	sue	lesea	
PO6	Model a co	mputer	based	auto	mation	svste	m and	1 desi	gn algorithms that	exp	lore	
	understandi	ng of the	tradeo	ffs invo	olved in d	ligital	transfo	rmatior).	r		the
		0										the
	0 (0											the
0	Outcomes (C	()s)										the
Course	denis will be a	0.5) h1a 4a										the
Course The stu		ble to										the
Course The stu CO1	Develop the	ble to	ns for t	he real	-world pr	oblem	1.		1			the
Course The stu CO1 CO2	Develop the Identify the	ble to e solution suitable	ns for t	he real- gies and	-world pr l method	oblem ologie	n. es to car	Ty out 1	the project.			
Course The sture CO1 CO2 CO3 CO4	Develop the Identify the Use of requ	ble to e solution suitable iired new	ns for t strateg tools	he real- gies and and tec	-world pr l method hniques t	oblem ologie	n. es to car y out th	ry out f ne proje	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5	Develop the Identify the Use of requ Test and va	ble to e solutio suitable ired new lidate th	ns for t strateg tools e devel	he real- gies and and tec oped p	-world pr l method hniques t roof of co with dem	oblen ologie o carr	n. es to car y out th t. otion	ry out t ne proje	the project.			the
Course The stu CO1 CO2 CO3 CO4 CO5	Develop the Identify the Use of requ Test and va Prepare a st	ble to e solutio suitable ired new lidate th andard p	ns for t strates tools e devel oroject	he real- gies and and tec oped p report	-world pr l method hniques t roof of co with dem	oblen ologie o carr oncep onstra	n. es to car y out th t. ution.	ry out 1 ne proje	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5 Articul	Develop the Identify the Use of requ Test and va Prepare a st ation Matrix	ble to e solution suitable ired new lidate th candard p	ns for t strateg tools e devel project	he real- gies and and tec oped p report	-world pr l method hniques t roof of co with dem	oblem ologie to carr oncep onstra	n. es to car y out th t. ttion.	ry out t te proje	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5 Articul	Develop the Identify the Use of requ Test and va Prepare a st ation Matrix	ble to e solutio suitable ired new lidate th tandard p	ns for t strateg tools e devel project PO1	he real- gies and and tec oped p report v	-world pr l method hniques t roof of co with dem	oblem ologie co carr oncep onstra	n. es to car y out th t. ution.	ry out t ne proje	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5 Articul	Develop the Identify the Use of requ Test and va Prepare a st ation Matrix	ble to e solution e suitable uired new lidate th tandard p CO. No.	ns for t strateg tools e devel project PO1	he real- gies and and tec oped p report v PO2	-world pr l method hniques t roof of co with dem	ologie o carr oncep onstra PO4	n. es to car y out th t. ttion. PO5	ry out t te proje PO6	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5 Articul	Develop the Identify the Use of requ Test and va Prepare a st	ble to e solutio e suitable ired new lidate th tandard p CO. No. 1	ns for t strateg / tools e devel project PO1 1	he real- gies and and tec oped p report v PO2 2	-world pr 1 method hniques t roof of cc with dem PO3	roblem ologie to carr oncep onstra PO4 1	n. es to car y out th t. ttion. PO5 1	ry out the proje	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5	Develop the Identify the Use of requ Test and va Prepare a st	ble to e solution e suitable ired new lidate th tandard p CO. No. 1 2	ns for t strateg tools e devel project PO1 1 2	he real- gies and and tec oped p report v PO2 2 1	world pr l method hniques t roof of co with dem	roblem ologie to carr oncep onstra PO4 1 1	n. es to car y out th t. ution. PO5 1 1	rry out t ne proje PO6 2 1	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5 Articul	Develop the Identify the Use of requ Test and va Prepare a st ation Matrix	ble to e solution e suitable ired new lidate th tandard p CO. No. 1 2 3	ns for t strateg / tools e devel project PO1 1 2 1	he real- gies and and tec: oped p report v PO2 2 1 1	-world pr l method hniques t roof of co with dem PO3	roblem ologie to carr oncep onstra PO4 1 1 2	n. es to car y out th t. ttion. PO5 1 1 2	rry out t ne proje PO6 2 1 2	the project.			
Course The stu CO1 CO2 CO3 CO4 CO5 Articul	Develop the Identify the Use of requ Test and va Prepare a st ation Matrix	CO. No. 1 2 3 4	ns for t strateg tools e devel project PO1 1 2 1 2	he real- gies and and tec oped p report v PO2 2 1 1 1	-world pr 1 methods hniques t roof of cc with dem PO3 1	roblem ologie to carr oncep onstra PO4 1 1 2 2	n. ss to can y out th t. ttion. PO5 1 1 2 1	PO6 2 1 2	the project.			

Total 40 Hours

24CS33	24CS33 DISSERTATION PHASE I L T 0 0											P	C
	Pre-	reauisi	te					Δ	ssessment Patterr	ין	U	14	0
• D(evelop skills to	identit	fv and	convert	a real	- Mo	de of A	ssessm	ent	We	eighta	age(°	%)
w W	orld problem in	to a tec	hnical i	problem) a rear	Cor	tinuou	s Intern	al Assessment		6	0	
	ond prochem in		Innoui	p1001 0 11	•	Sen	nester E	End Exa	minations		4	0	
Course O	bjectives									I			
• T(o develop skills	s to iden	tifv and	d conve	rt a rea	l world	proble	m into a	a technical problem	ı.			
• To	o provide know		n meth	odology	of car	rvingo	ut proje	et in nh	ases				
• 10	b provide kilow	neuge 0		ouology		i ynng O	ut proje	et in pi					
• 10	o teach use of h	iew tool	s and te	ecnnique	es requ	irea to	carry o	ut the p	roject.				
• To	o make familia	r in deve	eloping	the pro	of of c	oncept.							
• To	o provide guide	elines to	prepar	e standa	ırd proj	ect rep	ort.						
Program	ne Outcomes ((POs)											
PO1	An ability to	indepe	ndently	y carry	out res	search	/ inves	tigation	and development	wor	k to	solve	e
	practical proble	ems.		1 .	. 1.	1 .	1 .	/ 1					
PO2 A	An ability to wr	ite and j	present	a substa	antial te	echnica	l report	/docum	ient.	f	C		_
PO3	Students shou Science and En	la be	able to	o aemo	nstrate	a deg	gree of	maste	ery over the area	a or	Com	pute	r
PO4 Ef	Science and Engineering.												
	centralized con	puting	enviror	ments i	in varyi	ing don	nains ar	nd platf	orms.	liiout	eu	un	•
PO5 Ur	nderstand the	workin	ng of	current	Indus	try tre	nds, t	he n	new hardware are	chitec	tures	, the	ē
5	software comp	onents	and d	lesign s	solutior	ns for	real w	orld p	roblems by Com	munic	cating	anc	1
6	effectively wo	orking v	with p	rofessio	onals i	n vari	ous en	gineeri	ng fields and p	ursue	res	earch	1
(prientation for a	a lifelon	ig profe	essional	develo	pment	in com	puter an	nd automation aren	as.			
PO6 M	odel a com	puter l	based	automa	tion	system	and	design	algorithms tha	t ex	plore	the	3
l	understanding	of the tra	adeoffs	involve	ed in di	gital tra	ansform	hation.					
Course O	utcomes (COs)											
The studer	ts will be able	to											
CO1	Develop the so	olutions	for the	real wo	orld pro	blem.							_
CO2	Identify the su	itable st	trategie	s and m	ethodo	logies	o carry	out the	e project.				_
CO3	Use of require	d new to	$\frac{1}{1}$	d techni	iques to	o carry	out the	project.	•				_
C04 C05	Test and valid	ate the c	ievelop	bed proo	$\frac{101000}{100000000000000000000000000000$	ncept.	- n						_
005		uaru pro	ject le	pon wit		mstrati	л.						
Articulati	on Matrix												
		CO.		DOJ			DO5						
		No.	rui	PO2	rus	rU4	r05	rU0					
		1	1	2	1	1	1	2					
		2	2	1		1	1	1					
		- 3	- 1	1		2	2	2					
		 	1 2	1		2	ے 1						
		4	2	1		2	1						
		5	1	2		1							
									То	tal	120	Hou	rs

24CS41			DISS	ERTAT	ΓΙΟΝ Ι	PHASE	II			L T P C		
	Drea reagen	iai4a						• • • • • •	mant Dattann	0 0 24 12		
• 1	Pre-requ	isite or	daan	out o no	No1	Inde of	? A 55050	Assess	ment Pattern	Weightage(%)		
• 1	vorld problem into a t	nilly an	a conv	ert a re	$\frac{1}{C}$	ontinu	nis Inte	rnal As	sessment	60		
`	world problem into a t		ii piooi	CIII	S	emeste	r End E	xamina	tions	40		
Course	Objectives											
• [Γo develop skills to id	lentify a	and con	vert a r	eal wor	ld prob	lem int	o a tech	nical problem.			
• 「	Fo provide knowledge	e on me	thodolo	ogy of c	arrving	r out pre	oiect in	phases	1			
•	Fo teach use of new to	ols and	l techni	nues re	anired	to carry	$v_{\rm out}$ the	prices.	t			
	Fo maka familiar in d	ovoloni	ng tha t	roof of	Fooncor	nt	outur	projec				
• .		evelopi	ng the j	1 1	·	μ.						
•	l o provide guidelines	to prep	are stai	ndard p	roject r	eport.						
Progran	nme Outcomes (POs))										
PO1	Apply mathematical	found	ations	algorit	hmic	orincipl	es. and	l comn	uter science f	heory in the		
	modelling and desig	n of coi	nputer-	based s	ystems	of vary	ving con	nplexit	y.			
PO2)2 Identify, formulate, critically analyse, and solve problems in the field of Computer Science											
	and Engineering, con	nsiderir	ng recer	nt and f	uture tr	ends.						
PO3	Design a system, component, or process to meet desired needs within realistic constraints such as aconomic social and ethical in the field of Computer Science and Engineering											
P O4	such as economic, social and ethical in the field of Computer Science and Engineering.											
104	advanced knowledge	e of a se	elected	area wi	thin the	e Comp	uter Sci	ing pra	d Engineering	discipline.		
PO5	Demonstrate an abili	ity to er	ngage in	n lifelor	ng learn	ing for	profess	sional d	evelopment and	function		
	effectively on teams	to acco	mplish	a comr	non goa	al.	-		-			
PO6	Critically analyse e	xisting	literatu	ire in a	an area	a of sp	ecializa	ation a	nd develop in	novative and		
DCO1	research- oriented m	ethodo	logies t	o tackle	e gaps 10	dentifie	d.					
PSO1 PSO2	-											
1502												
Course	Outcomes (COs)											
The stud	ents will be able to											
<u>CO1</u>	Develop the solution	ons for t	he real	-world j	problem	1.		1	4			
C02	Use of required nor	strateg	gies and	1 metho	to carr	$\frac{1}{2}$ s to cal	ry out l	ne proj	ect.			
CO3	Test and validate th	e devel	oped n	roof of	concen	<u>y our u</u> t.	ie proje	с ι.				
CO5	Prepare a standard	project	report v	with der	monstra	ation.						
Articula	tion Matrix		*									
		CO.	DO1	DOA	DOC	DO 4	DO .	DOC				
		No.	POI	PO2	P03	P04	P05	PU6				
		1	1	2	1	1	1	2				
		2	2	1		1	1	1				
		3	1	1		2	2	2				
		4	2	1		2	1					
		5	1	2		1						
			-		l	-						
									Tota	1 240 Hours		

24CS51	AGENT BASED INTE	LLIGENT SYSTEMS	L	TI	P C
			3	00) 3
	Pre-requisite	Assessment Pattern			
٠	Fundamentals of Artificial Intelligence.	Mode of Assessment	Wei	ghtag	e(%)
٠	Operating Systems and Networking.	Continuous Internal Assessment		40	
•	Introduction to Multi-Agent Systems.	Semester End Examinations		60	
Course	Objectives				
•	To introduce the fundamental concepts of a	artificial intelligence.			
•	To explore the different paradigms in know	vledge representation and reasoning.			
•	To solve the problem using artificial intelligence	ce and machine learning algorithms.			
•	To introduce the notions of AI ethics and Expl	ainable AI.			
Program	mme Outcomes (POs)				
PO1	Apply mathematical foundations, algorithmi modelling and design of computer-based syst	c principles, and computer science theor tems of varying complexity.	y in t	he	
PO2	Identify, formulate, critically analyse, and so and Engineering, considering recent and futu	olve problems in the field of Computer retrends.	er Sc	eience	
PO3	Design a system, component, or process to such as economic, social and ethical in the fi	meet desired needs within realistic clied of Computer Science and Engineering	consti g.	aints	
PO4	Use current techniques, skills, and tools nec advanced knowledge of a selected area within	cessary for computing practice and demo n the Computer Science and Engineering	onstra discij	te pline.	
PO5	Demonstrate an ability to engage in lifelong l effectively on teams to accomplish a common	learning for professional development and n goal.	l func	ction	
PO6	Critically analyse existing literature in an are research- oriented methodologies to tackle ga	ea of specialization and develop innovation approximation approxima	ve an	d	
	·				
Course	Outcomes (COs)				
The stu	dents will be able to				
C01	Apply the searching techniques, heuristic problems.	e algorithms and game playing to sol	ve re	eal tii	ne
CO2	Analyze the logical inference in first	order logic and the logical language	to	expre	200

002	Analyze the logical inference in first order logic and the logical language to express
	knowledge about complex worlds.
CO3	Examine basic ideas of planning types and monitoring for the successful completion of the plan.
CO4	Apply utility theory and probability theory for handling uncertain worlds.
CO5	Examine the ethical considerations of Artificial Intelligence and interpret the concepts of
	explainable Artificial Intelligence.

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	1	2	1	3	1	1
2	2	3	1	2	1	2
3	1	1	2	1		2
4	2	2				3
5	1		2	1		1

Unit I INTELLIGENT AGENTS AND SEARCH TECHNIQUES 9 Hours

Definitions - Intelligent agents: Nature of environment-Structure of agents-problem solving- Searching: uninformed search strategies-Searching with partial information -Heuristics: Local search algorithms - Constraint satisfaction problems: Backtracking search - Game playing: Optimal decisions-Alpha, Beta pruning.

Unit II KNOWLEDGE REPRESENTATION AND REASONING

9 Hours

9 Hours

Logical Agents: Propositional logic-Reasoning patterns in propositional logic-Agent based propositional logic-First order logic: Syntax and semantics-First order inference: Unification- Chaining- Resolution strategies-Knowledge representation: Objects-Actions-Events- Techniques.

Unit III PLANNING AGENTS

Planning problem: STRIPS- State space search-Partial order planning-Graphs-Hierarchical network planning-Nondeterministic domains-Conditional planning-Execution monitoring and replanning- Continuous planning-Multi agent planning.

Unit IV AGENTS AND UNCERTAINTY

Acting under uncertainty - Probability notation-Baye's rule and use -Probabilistic reasoning: Bayesian networks-Other approaches-Time and uncertainty: Temporal models-Simple decisions: Utility theory - Decision network - Complex decisions: Value iteration-Policy iteration.

UNIT V AI ETHICS AND RESPONSIBLE AI

Ethical considerations in AI development and deployment – Discrimination, bias and fairness-Algorithmic decision making- Interpretable versus explainable models - Newly emerging paradigms - Case studies and discussions on ethical dilemmas in AI.

References

- 1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson Education Limited, 2016.
- 2. Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Tata McGraw Hill, 2019.
- 3. M. Tim Jones, Artificial Intelligence: A Systems Approach, Jones and Bartlett Publisher, 2010.
- 4. Animesh Mukherjee, AI and Ethics AI and Ethics, A computational perspective, IOP Science, 2023.
- 5. David L. Poole, Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, Second Edition, 2017.
- 6. Sohom Ghosh, Dwight Gunning, Natural Language Processing Fundamentals, Packet Publisher, 2019.

37

9 Hours

9 Hours

45 Hours

Total

24CS52				SOF	T COM	IPUTI	NG			L	T]	P C	
	Pre	-reauisit	P					Δ	sessment Pattern	3	U	0 3	
•	Fundamentals o	f Artificie	al Intell	igence		Mod	e of As	sessme	nt	Wei	ohtac	ge(%)	
	hasic knowledg	e of Neu	iral Ne	tworke	and	Con	tinuous	Interna	1 Assessment	··· ci	<u></u>	50(70)	
	Fuzzy Logic			tworks	ana	Sem	ester E	nd Exar	ninations		60		
Course	Objectives					bein			limations				
Course		1 0					•						
•	To conceptualiz	e the fund	ctioning	g of the	human	brain u	ising ne	eural ne	tworks.				
•	To analyze and problems effection	integrate	e soft efficiei	compuntly.	ting an	d optii	nizatio	n techr	niques in order to	solv	e		
•	To analyze and problems effect	integrate	e soft d efficie	computer com	ting an	d optii	nizatio	n techr	niques in order to	solv	e		
Program	nme Outcomes	(POs)											
PO1	An ability to practical probl	independ ems.	lently o	carry o	ut rese	arch /	investi	gation a	and development v	vork	to so	olve	
PO2	An ability to w	vrite and j	present	a subst	antial to	echnica	l report	/docum	ient.				
PO3	3 Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.												
PO4	Efficiently design, build and develop system application software for distributed and												
104	centralized computing environments in varying domains and platforms.												
PO5	centralized computing environments in varying domains and platforms. Understand the working of current Industry trends, the new hardware architectures the												
	software com	ponents	and de	esign s	olution	s for 1	eal wo	orld pr	oblems by Comm	unica	ting	and	
	effectively we	orking wi	ith prot	fession	als in v	various	engine	ering f	ields and pursue r	esear	ch		
	orientation for	a lifelong	g profes	ssional	develop	oment i	n comp	uter and	d automation arenas				
PO6	Model a con	mputer l	based	automa	ation s	ystem	and	design	algorithms that	expl	ore	the	
	understanding	of the tra	deoffs	involve	ed in dig	gital tra	nsform	ation.	-				
Course	Outcomes (CO	s)											
The stuc	lents will be able	e to											
CO1	Classify the s	oft comp	uting te	chniqu	es and t	he func	tionalit	ties of a	rtificial neural netw	orks.			
CO2	Compare the	supervis	ed and	unsup	ervised	learnir	ng netw	vorks a	nd illustrate the arc	chitec	ture	and	
	working prine	ciples of 1	neural r	network	cs.		U						
CO3	Analyze the	concept	of fuz	zy log	gic and	desig	n an e	expert	system by applyin	ig th	e fuz	zzy	
CO4	Analyze the	features a	ind one	rators i	n genei	ic aloo	rithms	and apr	ly the genetic algo	rithm	for	real	
	time problem	15414165 d	ing ope	141015 1	in gener	ie uigo		and app	i, the genetic argo				
CO5	Apply the h	vbrid sof	t com	outing	technio	ues in	multi	spectra	al image fusion m	lodel	ing s	and	
	optimization	of traveli	ng sales	sman p	roblems	5.		.1			8 4	-	
Articula	ation Matrix												
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	2	2	1	2	1	1					
		1	2	2	1	3	1	1					
		2	2	3	1	2	2	2					
		3	1	2	2	1		2					
		4	2	1				3					
		5	2		2	1		3					
				I	1		I	1	I				

Introduction to	Soft Computing- Difference between soft computing and hard computing	g - Various
types of soft c	computing techniques - Applications of soft computing - Biological N	leuron-Nerve
structure and syn	apse - Artificial Neuron and its model - Activation functions - Neural netw	vork
architecture - sing	le layer and multilayer feed forward networks – McCullochPitt's neuron model.	
Unit II	NEURAL NETWORKS	9 Hours
	· · · · ·	
Supervised Learn	ing Networks: Perceptron Networks - Adaptive Linear Neuron- Multiple Ad	daptive
Linear Neuron - E	Back-propagation Network. Unsupervised Learning Networks: Counter propagati	on network -
architecture & fur	nctioning – Adaptive Resonance Theory - Architecture & functioning.	
Unit III	FUZZY SYSTEMS	9 Hours
Introduction to F	uzzy logic - Crisp sets - Fuzzy sets - Crisp relations - Fuzzy relations - Fuz	zy
membership func	tions - Operations on Fuzzy sets - Fuzzification - Defuzzification techniques	-Fuzzy logic
controller design	- Applications of Fuzzy logic.	
Unit IV	GENETIC ALOGORITHMS	9 Hours
Genetic algorith	ns: Basic concepts - Encoding, Fitness function, Reproduction- Encod	ing- Binary,
Genetic algorithi Octal, Hexadecin	ns: Basic concepts - Encoding, Fitness function, Reproduction- Encod nal, Permutation, Value, Tree Encoding - Selection - Roulette wheel,	ing- Binary, Boltzmann,

Genet Octal. Random, Tournament, Rank, and Steady state selections - Crossover - Mutation- Convergence of GA -Applications of GA.

UNIT V HYBRID SOFT COMPUTING TECHNIQUES

INTRODUCTION

Neuro-fuzzy hybrid systems - Genetic neuro hybrid systems - Genetic fuzzy hybrid and fuzzy genetic hybrid systems - Applications: A fusion approach of multispectral images with SAR - optimization of traveling salesman problem using genetic algorithm approach.

References

Unit I

- J.S.R. Jang, C.T. Sun and E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI / Pearson 1. Education, 2015.
- 2. S. Rajasekaran and G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications, Prentice-Hall of India Pvt. Ltd., 2017.
- 3. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education India, 2013.
- 4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, 3rd Edition, Wiley Publisher, 2018.
- 5. Timothy J.Ross, Fuzzy Logic with Engineering Application, McGraw Hill, 2016.

9 Hours

9 Hours

45 Hours

Total

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Course	Objective	8								1		
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				s 11 pai		u muni		u progr	anning.			
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•	l'o develop	o multicor	e progra	ams and	l design	i paralle	el soluti	ons.				
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Trogram		onies (1 C	5)									
PO1	An abili	to inde	nender	tly car	TV OUT	researc	h / inv	estinati	ion and development w	ork	to er	alve
	practical	problems	-pendel	illy cal	iy Out	researc	/11 / 1111	congati	ion and development w	NIO	10 50	7140
PO2	An ability	y to write	and pre	sent a s	ubstant	ial tech	nical re	port/do	cument.			
PO3	Students	should b	e able	to dem	onstrate	e a deg	ree of	mastery	v over the area of Con	nput	er	
	Science a	nd Engin	eering.			C		•		•		
PO4	Efficient	ly design	, build	l and	develo	op_sys	tem a	pplicati	on software for dist	ribut	ed a	and
	centralize	ed comput	ing env	ironme	nts in v	arying	domain	s and pl	latforms.			
PO5	Understa	nd the v	vorking	of cu	urrent	Industr	y tren	ds, the	e new hardware arch	itect	ures,	the
	software	compone	ents an	d desig	gn solu	itions 1	tor rea	l world	i problems by Comm	unica	ating	and
	orientatio	on for a lif	elong p	rofessio	sional dev	iii vai velopme	ent in co	omputer	r and automation arenas.	sear		
PO6	Model a	computer	based	automa	ation sy	stem a	nd desi	gn algo	orithms that explore the	e		
	understar	nding of th	ne trade	offs inv	volved i	n digita	ıl transf	ormatic	on.			
Course	Outcomes	(COs)										
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	Identify	the issues	in proc	rommi	and ide	$\frac{1101 \text{ Pro}}{1101 \text{ Pro}}$		racteris	tics and challenges.			
C02	Write pr	ograms up	sing On	enMP a	ing raia		CESS015	•				
CO3	Design 1	ografiel pr	ogramn	ning sol	utions 1	to com	non pro	blems.				
CO5	Compar	e and cont	trast pro	gramm	ing for	serial r	rocesso	ors and	programming for paralle	l pro	cesso	ors.
Articula	tion Mat	ix	1	0	0	1				I		
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Unit I	MULTI-CORE PROCESSORS	9 Hours
Single core to	Multi-core architectures - SIMD and MIMD systems - Interconnection	networks -
Symmetric and	1 Distributed Shared Memory Architectures - Cache coherence - Performan	nce Issues –
Parallel progra	n design.	
T		0.11
	PARALLEL PROGRAM CHALLENGES	9 Hours
Performance – primitives (mu threads (condit	Scalability – Synchronization and data sharing – Data races – Synchronizati texes, locks, semaphores, barriers) – deadlocks and livelocks – communication be on variables, signals, message queues and pipe	ion etween
Unit III	SHARED MEMORY PROGRAMMING WITH OpenMP	9 Hours
Library function	ns – Handling Data and Functional Parallelism – Handling Loops – Performance	onstructs –
Unit IV	DISTRIBUTED MEMORY PROGRAMMING WITH MPI	9 Hours
MPI program	execution - MPI constructs - libraries - MPI send and receive - Point-to-point	and
Collective com	munication – MPI derived datatypes – Performance evaluation.	
UNIT V	PARALLEL PROGRAM DEVELOPMENT	9 Hours
Case studies -	n-Body solvers – Tree Search – OpenMP and MPI implementations and com	parison.
D . f	Total	45 Hours
Kelerences		
1. Peter S	S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsev	ier, 2021.
2. Darryl Pearso	Gove, "Multicore Application Programming for Windows, Linux, and Oracle S n, 2011.	olaris,
3. Michae	el J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw	v Hill,2003.
4. Victor Strateg	Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts ies in Multicore Application Programming, Morgan Kaufmann, 2015.	and

24CS54			D	ATA S	CIEN	CE				L 3	TP
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Pro	bability and Stati	stics.	nu, cu	icuius,	Co	ntinuou	s Interi	nal Asso	essment		40
• Ba	sic knowledge	of ma	chine	learnin	g Sei	mester]	End Ex	aminati	ons		60
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Course Ob	jectives		•	0							
• To	introduce the fun	damental c	concept	s of data	a scien	ce.					
• To	apply statistical n	nethods to	summa	arize, ex	plore a	and drav	v concl	usions	from data.		
• To	utilize probability	theory to	unders	tand dat	a unce	rtainty	and rela	ationshi	ps		
• To	emplov basic mad	chine learr	ing alg	orithms	for bo	th supe	rvised a	and uns	- upervised lear	ning	tasks.
Programn	ne Outcomes (PO	s)		,					- F	8	
PO1 A	n ability to inde	pendently	carry	out res	earch	/ invest	igation	and d	evelopment v	vork	to solve
p	ractical problems.	pendentij	ourry	040 105	ouron	111.05		una a	e veropinent v	, oin	0 50110
PO2 Â	n ability to write	and preser	nt a sub	stantial	technic	al repo	rt/docu	ment.			
PO3 S	tudents should b	e able to	demo	onstrate	a deg	gree of	maste	ery ove	er the area	of C	omputer
S	cience and Engine	eering.									
PO4 E	fficiently design	, build	and de	evelop	syster	n appl	ication	softw	are for dist	tribut	ed and
	entralized comput	ing enviro	nments	in vary	ing do	mains a	nd plat	torms.	1	:4 4-	
POS (nderstand the w	Vorking o	f curre	ent Ind	ustry	trends,	the i	new ha	ardware arch	itecti	ting and
5 P	ffectively workin	o with pr	ofessio	nals in	variou	ieai v	vonu p veering	fields	and pursue i	unica esear	ch
	rientation for a life	elong prof	essiona	l develo	opment	in com	puter a	nd auto	mation arenas	esear	CII
PO6 N	Iodel a comput	er based	auton	nation	svsten	n and	design	1 algo	rithms that	expl	ore the
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Course Ou	itcomes (COs)										
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001	various industries.		p 01 00010	• • • •			io ang is		e f ar an	105 11	npare on
CO2	Apply core probal	oility conc	epts an	d releva	nt stati	stical d	istribut	ions to	analyze and n	nodel	network
	mobilization patte	rns.	Î						-		
CO3	Evaluate the valid	lity of cla	ims and	d hypot	heses 1	using aj	ppropri	ate stat	istical tests a	nd co	nfidence
	intervals, consider	ring potent	ial limi	tations	and po	wer of t	he tests	<u>.</u>			<u> </u>
CO4	Examine relations	hips betwe	een var	ables u	sing co	rrelatio	n analy	sis and	linear algebra	tech	niques.
C05	Create basic mac	nine learni	ng mo	dels usi	ng sup	ervised	and ur	nsuperv	ised learning	algoi	ithms to
Articulatio	solve leal-wolld d		e proble								
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Unit I INTRODUCTION TO DATA SCIENCE AND STATISTICS

Data Science- Big Data and Data Science – Datafication – Current landscape of perspectives, Matrices – Matrices to represent relations between data, and necessary linear algebraic operations on matrices - Approximately representing matrices by decompositions (SVD and PCA); Statistics: Descriptive Statistics and Data Visualization – Statistical Inference: Populations and samples- Measures of Central Tendency - Measures of Variation-Measures of Shape-Data Visualization.

Unit II NETWORK MOBILIZATION AND SAMPLING STATISTICS

9 Hours

Probability Theory - Terminology - Axioms of Probability -Bayes' Theorem-Random Variables - PDF & CDF of Continuous-Random Variable-Binomial Distribution-Poisson Distribution-Geometric Distribution-Uniform Distribution-Exponential Distribution-Normal Distribution-Chi-Square Distribution - Student's t-Distribution - F: Distribution – Population Parameter & Sample Statistic - Probabilistic Sampling - Non-Probability Sampling - Sampling Distribution - Central Limit Theorem - Sample Size Estimation for Mean of the Population - Estimation of Population Parameters - Method of Moments - Estimation of Parameters Using Maximum Likelihood Estimation.

Unit III INFERENCE STATISTICS AND ADVANCED ANALYSIS TECHNIQUES

9 Hours

Confidence Intervals (CI) : CI for Population Mean - CI for Population Proportion - CI for Population Mean when Standard Deviation is unknown - CI for Population Variance - Hypothesis Testing : Setting up a Hypothesis Test - One-Tailed and Two-Tailed Test - Type I Error, Type II Error, and Power of the Hypothesis Test - Hypothesis testing for Population Mean with Known Variance: Z-Test - Hypothesis testing for Population Proportion: Z-Test - Hypothesis test for Population Mean under Unknown Population Variance: t-test – Paired Sample t-test - Two-Sample Z and t-test - Two-Sample Z-Test for Proportions - Effect Size: Cohen's D - Hypothesis Test for Equality of Population Variances - Nonparametric Tests: Chi-Square Tests - Analysis of Variance: Multiple t-Tests for Comparing Several Means - One-way ANOVA - Two-way ANOVA.

Unit IV CORRELATION ANALYSIS AND APPLIED LINEAR ALGEBRA

9 Hours

Correlation Analysis : Pearson Correlation Coefficient - Spearman Rank Correlation – Point Bi-Serial Correlation - The Phi-Coefficient - Applied Linear Algebra : Why do we need Linear Algebra? - Matrix Algebra and Operations - EigenValues and EigenVectors – Linear Algebra in Dimensionality Reduction - Linear Algebra in Natural Language Processing - Linear Algebra in Machine Learning.

UNIT V BASIC MACHINE LEARNING ALGORITHMS

9 Hours

Data Cleaning and handling - Supervised Learning : Linear regression - The bias-variance tradeoff - LASSO, Ridge and Elastic Net - An overview of classification - Decision trees and k-nearest neighbors -Ensemble methods (Bagging, Random Forests and Boosting) - Unsupervised learning : Clustering (kmeans, spectral clustering and overview of other methods) - Principal Component Analysis.

	Total	45 Hours
Refere	nces	
1.	Cathy O'Neil and Rachel Schutt, " Doing Data Science, Straight Talk From The Frontl O'Reilly, 2014.	ine",
2.	Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques", Edition. ISBN 0123814790, 2011.	Third
3.	Mohammed J. Zaki and Wagner Miera Jr, "Data Mining and Analysis: Fundamental C Algorithms", Cambridge University Press, 2014.	Concepts and

43

9 Hours

- 4. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.
- 5. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.
- 6. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 2012.

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CO5	Develop technique	es and tool	s for in	nprovin	ig team	collabo	oration a	and soft	ware quality.			
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	nit I AGILE SOFTWARE DEVELOPMENT
- Agile Software e Manifesto and ams -Agility in derstand as Capabilities and	undamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, - evelopment -Traditional Model vs. Agile Model - Classification of Agile Methods -Agile rinciples -Agile Project Management -Agile Team Interactions -Ethics in Agile Team esign, Testing - Testing plan links between testing, roles and key techniques, principles, unde means of assessing the initial status of a project -Agile Documentations - Agile Drivers, C alues.
9 Hours	nit II AGILE PROCESS
pment - Extreme	ean Production -SCRUM, Crystal, Feature Driven Development- Adaptive Software Developr ogramming: Method Overview -Lifecycle -Work Products, Roles and Practices.
9 Hours	nit III AGILITY AND KNOWLEDGE MANAGEMENT
vledge Evolution XM in Software ogies -Agile	gile Information Systems -Agile Decision Making -EarlS Schools of KM -Institutional Knowl ycle -Development, Acquisition, Refinement, Distribution, Deployment, Leveraging -KM ngineering -Managing Software Knowledge -Challenges of Migrating to Agile Methodolog nowledge Sharing -Role of Story-Cards -Story-Card Maturity Model (SMM)
9 Hours	nit IV AGILITY AND REOUIREMENTS ENGINEERING
9 Hours Using Agile -	nit IV AGILITY AND REQUIREMENTS ENGINEERING appact of Agile Processes in RE-Current Agile Practices -Variance -Overview of RE -
9 Hours • Using Agile - raction Model - le Requirements	nit IV AGILITY AND REQUIREMENTS ENGINEERING apact of Agile Processes in RE-Current Agile Practices -Variance -Overview of RE - lanaging - Unstable Requirements -Requirements Elicitation -Agile Requirements Abstra equirements Management in Agile Environment, Agile Requirements Prioritization -Agile lodeling and Generation -Concurrency in Agile Requirements Generation.
9 Hours Using Agile - raction Model - le Requirements 9 Hours	nit IV AGILITY AND REQUIREMENTS ENGINEERING apact of Agile Processes in RE-Current Agile Practices -Variance -Overview of RE - Lanaging - Unstable Requirements -Requirements Elicitation -Agile Requirements Abstratequirements Management in Agile Environment, Agile Requirements Prioritization -Agile Lodeling and Generation -Concurrency in Agile Requirements Generation. NIT V AGILITY AND QUALITY ASSURANCE
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9 Hours • Using Agile - raction Model - le Requirements 9 Hours -Financial and elopment -Agile Testing tal 45 Hours Al an Apt Series Product arson New	nit IV AGILITY AND REQUIREMENTS ENGINEERING anpact of Agile Processes in RE-Current Agile Practices -Variance -Overview of RE - lanaging - Unstable Requirements -Requirements Elicitation -Agile Requirements Abstraequirements Management in Agile Environment, Agile Requirements Prioritization -Agile lodeling and Generation -Concurrency in Agile Requirements Generation. NIT V AGILITY AND QUALITY ASSURANCE gile Product Development -Agile Metrics -Feature Driven Development (FDD) - oduction Metrics in FDD -Agile Approach to Quality Assurance -Test Driven Developproach in Global Software Development. Agile Risk Management: Agile Tools. Agile Techniques, User Acceptance Test. Tota Geferences 1. Robert C. Martin, Agile Software Development, Principles, Patterns, and Practices (Agile 1 Management), 1st Edition, 2016. 3. Robert Martin, Agile Software Development, Principles, Patterns, and Practices, Pears International Edition, 2013.
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9 Hours • Using Agile - raction Model - le Requirements 9 Hours -Financial and elopment -Agile Testing tal 45 Hours Al an Apt Series Product arson New Computer neering:	nit IV AGILITY AND REQUIREMENTS ENGINEERING apact of Agile Processes in RE-Current Agile Practices -Variance -Overview of RE - fanaging - Unstable Requirements -Requirements Elicitation -Agile Requirements Management in Agile Environment, Agile Requirements Prioritization -Agile lodeling and Generation -Concurrency in Agile Requirements Generation. NIT V AGILITY AND QUALITY ASSURANCE gile Product Development -Agile Metrics -Feature Driven Development (FDD) - oduction Metrics in FDD -Agile Approach to Quality Assurance -Test Driven Developproach in Global Software Development. Agile Risk Management: Agile Tools. Agile Techniques, User Acceptance Test. Tota Agile Software Development, Principles, Patterns, and Practices AI (2011). 2. Paul VII, Agile: The Complete Overview of Agile Principles and Practices (Agile I Management), 1st Edition, 2016. 3. Robert Martin, Agile Software Development, Principles, Patterns, and Practices, Pears International Edition, 2013. 4. Hazza and Dubinsky, - Agile Software Engineering, Series: Undergraduate Topics in C Science, Springer, 2009. 5. David J. Anderson and Eli Schragenheim, - Agile Management for Software Engine Applying the Theory of Constraints for Business Results, Prentice Hall, 2009.

24CS56		SOFT	WARI	E QUA	LITY	ASSUF	RANCE	2		L		P C
	Pre-rea	uisite						Assess	nent Pattern	5		0 3
• [Understanding of Ba	sic Softwa	are Eng	ineerin	g. M	ode of	Assessr	nent		Wei	ghtag	ge(%)
• F	Fundamentals of Sof	tware test	ing.		Co	ontinuo	us Inter	nal Ass	essment		40	
					Se	mester	End Ex	aminat	ions		60	
Course (Objectives											
• 1	o introduce the imp	ortance of	f Qualit	y of So	ftware	Produc	ts.					
• 1	o elicit, analyze, pri	oritize, ai	nd mana	age bot	h funct	ional ar	nd quali	ty requ	irements.			
• 1	To plan for Software	quality as	surance	e.			•	•				
• T	To learn the concepts	of Relia	oility.									
• T	o understand and a	nnly conf	iouratio	on and	anality	manao	rement	technia	ues in softwa	re de	velon	ment
p	rocesses.	ppiy com	iguiun	Jii and	quanty	manag	Sement	teening	lues in solewa	ie de	velop	mont
Program	me Outcomes (PO	s)										
PO1	An ability to indepractical problems.	pendently	carry	out re	search	/ inves	stigatior	n and o	development	work	to so	olve
PO2	An ability to write a	nd presen	t a subs	stantial	technic	al repo	rt/docu	ment.				
PO3	Students should l	be able the	to dem	onstrat	e a de	egree (of mas	tery ov	ver the area	of (Comp	uter
PO4 E	fficiently design,	build an	d deve	elop sy	ystem	applica	ation so	oftware	e for distr	ribute	d	and
PO5 1	Inderstand the wo	rking of	currer	t Indu	istrv ti	rends	$\frac{110}{100}$ the	$\frac{101115}{\text{new}}$	ardware arcl	hitect	ures	the
	software compone	nts and	design	solutio	ons for	real v	world 1	problen	ns by Comm	unica	ting	and
	effectively workin	g with	profess	ionals	in va	rious e	ngineer	ring fi	elds and pu	rsue	resea	arch
	orientation for a life	elong prof	fessiona	al devel	opmen	t in con	nputer a	and auto	omation arena	s.		
PO6 N	Aodel a compute	r based	auton	nation	systen	n and	desig	n algo	orithms that	exp	lore	the
	understanding of th	e tradeoff	s involv	ved in c	ligital t	ransfor	mation.					
<u> </u>												
The stude	ants will be able to											
<u>CO1</u>	Understand the sig	<u>inificance</u>	of soft	ware qu	uality a	ssuranc	e in sof	tware p	projects.			
CO2	Understand and ap	ply softw	are qua	ulity ass	surance	metric	s in soft	ware p	rojects.			
C03	Identify contempo	piy soltw	are star	luaruiz	ation in	a gualit	$\frac{1}{1}$	ects.	v techniques			
C04 C05	Develop and apply	$\frac{1}{1}$ the pract	$\frac{1}{1}$ ice soft	tware re	eliabilit	v techn	iques	maomi	y teeninques.			
Antioulor	tion Motin	the place		en are re	211401111		iques.					
Articula		CO No	DO1	DOJ	DO2	DO 4	DO5	DOC	1			
		CO. NO.	PUI	PU2	PUS	PU4	P05	PU0				
		1	3	3	3	3	2	3				
		2	2	2	2	3	2	3				
		3	3	1	1	2	1	3				
		4	2	2	2	3	2	1				
		5	1	1	1	3	1	2				

Unit I FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 9 Hours

The Role of SOA - Software Quality Assurance Plan - Software Quality Assurance considerations - Need of Software Quality Assurance - SQA People.

Unit II MANAGING SOFTWARE QUALITY

Quality Management-Software Configuration Management-Managing Software organizations- Managing Software quality –Defect Prevention.

Unit III SQA METRICS

Software Quality-Total Quality Management (TQM)-Quality Metrics-Software Quality metric Analysis.

SOFTWARE QUALITY PROGRAM AND SOA STANDARDIZATION 9 Hours Unit IV

Software quality program Concepts-Establishment of a software quality program-Software Quality Assurance planning-purpose and scope of Software Quality Program- Software standards-ISO 9000 Quality system standards-Capability Maturity model and the Role of SQA in software development maturity- Six Sigma Concepts.

UNIT V **RELIABILITY ENGINEERING PROCESS**

Reliability Definition-Quality and Reliability-Reliability Functions-Reliability Mathematics - Measures of Reliability - Defining the product-Testing the acquired software-Learning reliability concepts-s/w and h/w reliability.

	Total	45 Hours
References		

- Mordechai Ben-Menachem / Garry S Marliss, -Software Quality, Vikas Publishing House, Pvt, 1. Ltd., New Delhi, 2021.
- 2. Meir Liraz, Quality Assurance: How to set up and manage a Quality Control System, Kindle Edition.2013.
- 3. SolisTech, Quality Assurance: Software Quality Assurance made easy, KindleEdition, 2016.
- 4. Watts S Humphrey, Managing the Software Process, Pearson Education Inc, 2007.
- 5. John D Musa, —Software Reliability Engineering, 1998.
- 6. Gordon G Schulmeyer, -Handbook of Software Quality Assurance, Third Edition, Artech House Publishers, 2007.
- 7. Charles E. Ebeling, —An introduction to Reliability and Maintainability engineering, TMH, 2000.
- RoyBillington and Ronald N. Allan, -Reliability Evaluation of Engineering Systems, Springer, 8. 2007

48

9 Hours

9 Hours

9 Hours

24CS57		DI	GITAI	L IMA(GE PR	OCESS	SING				L	T P) <u>C</u>
	Pre-rea	lisite					,	Assess	nent Pat	tern	5	0 0	
• Ba	sic of Computer	Vision i	ncludir	o featu	ire M	ode of	Assessi	nent			Weig	zhtag	e(%)
ex	traction. pattern	extra	ction.	patte	ern Co	ontinuo	us Inter	nal Ass	essment			40	
re	cognition.		,	1	Se	mester	End Ex	aminat	ions			60	
• Ba	asic knowledge	of ti	ansform	ms a	nd								
со	mpression techniqu	les.											
Course O	bjectives												
• To an	o impart fundament d transform functio	al steps n.	of digi	tal imag	ge proc	essing	based o	on imag	ge repres	entatio	ons, o	operat	ions
• To ob	o inculcate the know tain the desired image	vledge ab age quali	oout en ty.	hancem	ient, res	storation	n, comp	pression	i by appr	opriate	e tech	ınique	s to
• To	apply the related t	o image s	segmen	tation a	and reco	ognition	technio	ques to	real worl	ld prol	blems	5.	
Program	ne Outcomes (POs	;)											
PO1	An ability to indeport of the second se	pendently	carry	out re	search	/ inves	tigatior	n and c	levelopm	nent w	vork	to so	lve
PO2	An ability to write a	nd prese	nt a sub	ostantial	l techni	cal repo	ort/docu	iment.					
PO3	Students should be Science and Engine	e able to ering.	o dem	onstrate	e a de	gree o	f mast	ery ov	er the a	area o	of Co	omput	er
PO4	Efficiently design, centralized computi	build ng enviro	and d	levelop s in var	syster ying do	m app mains a	lication and plat	n softv tforms.	vare for	dist	ribute	ed a	nd
PO5	Understand the w	orking c	of curr	ent In	dustry	trends	, the	new h	ardware	archi	itectu	res,	the
5	software component	nts and	design	solutio	ons for	real	world j	problen	ns by C	lommu	inica	ting a	ind
6	effectively working	g with p	ofessio	onals in	n vario	us engi	neering	g fields	and pur	rsue re	esear	ch	
	brientation for a life	long pro	tession	al devel	lopmen	$\frac{t \ln con}{1}$	nputer a	and auto	mation a	arenas.	. 1		1
PO6	Model a compute	r based	autoi	mation	syster	n and	desig:	n algo	orithms	that	explo	ore t	ne
Course O	utcomes (COs)		S IIIVOI	veu m u	ligitai t	14115101	mation.						
The studer	ts will be able to												
	Understand the ir	nage typ	as and	ranras	ontation	ne invo	lund in	digita	1 imaga	nroce	ccino	eveto	m
CO1	Implement the arit	hmetic 1	orical	reomet	trical or	neration	$\frac{1}{1}$ s and t	ransfor	ns techn	iques	to pr	ocess	<u>an</u>
002	image.	innetic, i	ogical,	geome		peration	is and t	14115101		iques	to pr	00035	an
CO3	Analyze the techn frequency domain	iques su	itable 1	for ima	ige enh	anceme	ent and	l image	restora	tion ii	n spa	itial a	nd
CO4	Apply image com	ression a	nd seg	mentati	on tech	niques	to perfo	orm ima	ge proce	ssing.			
CO5	Apply an image re	presentat	ion and	l recogn	nition te	chniqu	es to so	lve real	world p	roblen	18.		
Articulati	on Matrix	•				-			<u> </u>				
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	2	2		3							
		2	2		3	3	2	3					
		3	3	3		2							
		4	3			2	3	3					
		5	2	2	2	2	2	3					
				<u> </u>	<u>I</u>	I		<u> </u>	I				

Unit I Digital Image Fundamentals	9 Hours
Nature of digital image processing - digital image representation - types of images	- digital image
processing operations - fundamental steps in image processing - image processing appli	ications - digital
imaging system - physical aspects of image acquisition - sampling and quantization - re	lationship
between pixels - image storage and file formats.	
Unit II Image Processing Operations and Transforms	9 Hours
omeni mugerrocessing operations and transforms	> 110u15
Arithmetic operations - logical operations - geometrical operations - image interpolat	ion techniques -
convolution and correlation operations - data structures and image processing applications det	evelopment
– transforms: need for image transforms - properties of fourier transform - discrete co	osine transform -
discrete sine transform - walsh transform - hadamard transform - haar transform - slant tran	sform - SVD and
KL transforms.	
Unit III Image Enhancement and restoration	9 Hours
Need for image enhancement - Point operations - Spatial filtering concepts - Frequency	domain
filtering - Image restoration model: Categories of image degradations - Image restoration in	1 noise -
Image restoration techniques.	
Unit IV Image Compression and Segmentation	9 Hours
Chief () Indee Compression and Segmentation	
Compression: Model – Types of redundancy – Lossless compression and lossy compre	ession algorithms
- Segmentation: Classification – Detection of Discontinuities – Edge detection - Co	rner detection –
Principles of Thresholding – Region based segmentation – Dynamic segmentation. Morpholog	ev-Dilation.
Erosion, Opening and Closing. Hit and Miss Algorithms Feature Analysis.	50
UNIT V Image Representation and Recognition	9 Hours
Boundary representation – Boundary Descriptions – Regional Descriptors – Fe	eature Selection
Techniques – Recognition: Pattern and Pattern classes – Template matching – classifier algo	orithms –
Evaluation of classifier algorithms – Case study: Biometrics- clustering techniques and its eva	luation.
Та	tal 45 Houng
Pafarancas	tal 45 Hours
1. Ratael C. Gonzalez and Richard E. Woods, Digital Image Processing. 4ed, PHI/Pe 2018.	arson Education,
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, Digital Image Processing, Education 2nd edition 2020	McGraw Hill

3. S. Sridhar, Digital Image Processing, Oxford University Press; Second edition, 2016.

24CS58	I	NFORM	ATIO	N RET	RIEVA	L TEC	CHNIQ	UES			T P	C
	 Dro_rogi	usita						Accore	nant Potta	J rn	UU	3
• 1	Inderstanding of	database	conce	ente a	nd M	ode of	Assess	nent		We	ightage	(%)
r	etrieval techniques	uatabase	conce	pis a		ontinuo	us Inter	nal Ass	essment		40	(,,,,)
• E	Basic knowledge	of info	rmatior	n theo	rv Se	mester	End Ex	aminat	ions		60	
с	oncepts.				5							
Course (Objectives											
• T ii • T	To gain the knowled ndexing and web sea To learn the retrieval	ge in info urching. modellin	ormatio g and r	n retrie etrieval	val wit evalua	h releva	ance to d under	modell stand th	ing, query ne various a	operation applications fu	ons, ions of I	R.
Drogrom	ma Outaamaa (PO)				in, uigi							•
Program	ime Outcomes (POs	5)										
PO1	An ability to ind practical problems.	ependent	ly carr	y out r	esearch	ı / inve	stigatio	on and	developme	ent work	to solv	ve 🛛
PO2	An ability to write a	nd presen	t a sub	stantial	technic	al repo	rt/docu	ment.				
PO3	Students should b	be able	to den	nonstrat	e a d	egree o	of mas	tery o	ver the ar	ea of	Comput	er
	Science and Engine	ering.										_
PO4 E	fficiently design,	build an	d dev	elop s	ystem	applica	ation s	oftware	for d	istribute	ed ar	ıd
DO5 I	Inderstand the wor	ng enviro	onment	s in var	ying ac	mains a	$\frac{1}{tho}$	norms.	orduura	rahitaa	turos ti	<u> </u>
105 0	software component	nts and	design	solutio	usury u ons for	real y	world i	nrohlen	aluwale a	nmunic	ating ar	nd
	effectively workin	g with	profess	ionals	in va	rious e	engineer	ring fi	elds and	pursue	researd	ch
	orientation for a life	elong prot	fession	al devel	opmen	t in con	nputer a	and auto	omation are	enas.	100000	
PO6 N	Aodel a computer	r based	autor	nation	system	n and	desig	n algo	orithms th	nat exp	olore th	ne
	understanding of the	e tradeoff	s invol	ved in c	ligital t	ransfor	mation.					
Course (Dutcomes (COs)											
The stude	ents will be able to											
CO1	Classify the inform	nation ret	rieval s	ystem a	and web	search	1.					\neg
CO2	Outline the class	sic infor	mation	retrie	val m	odels a	and ev	aluate	the perfe	ormance	e of a	n
	information retriev	al system	ì.									
CO3	Implement the con	ncepts of	index	constr	uction	and co	ompress	sion for	r informati	ion retr	ieval and	t
<u> </u>	query processing in	n informa	tion re	rieval.					in make an	1 <i></i> -		
<u>CO4</u>	Understand the	t search e	$\frac{1}{1}$	no ana	se the	e web co	ion D	tructure	(IP) me	awier.	nd that	
	applications in var	ious lingu	istic co	ontexts.	01 11	normat		euleval	(IK) IIIC	Juers a	na thei	1
Articulat	tion Matrix	U										
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	2	2	1	2	2	2				
		1	Ζ	Z	1	3	3					
		2	1	1	1	3	2	1				
		3	2	1	2	3	3	3				
		4	1	2	2	1	2	3				
		5	2	2	3	3	1	3				

Unit I	INTRODUCTION	9 Hours
Motiva Inform Perforn Engine	ation-Information versus Data Retrieval-Basic Concepts -Past, Present, Future-Retrievation Retrieval Systems-Architecture-Characterization of IR Model -Documents a mance Evaluation-Indexing-Web Searching-IR Versus Web Search-Components of a Se	eval Process and Update- arch
Unit I	I RETRIEVAL MODELING AND RETRIEVAL EVALUATION	9 Hours
Taxone Theore Retriev	omy and Characterization of IR Models-Classic Information Retrieval Model- Alter etic, Algebraic, Probabilistic Model-Structured Text Retrieval Model-Models for val Evaluation-Retrieval Metrics-Retrieval Performance Evaluation-Reference Collection.	native Set Browsing-
Unit I	II SQA INDEXING AND QUERY PROCESSING	9 Hours
Static a Search Query	and Dynamic Inverted Indices-Index Construction and Index Compression. Searching- Sec ing and Pattern Matching. Query Operations-Query Languages-Structural Query- Query Pr Processing-Automatic Local and Global Analysis.	uential otocols-
Unit I	V WEB RETRIEVAL AND WEB CRAWLING	9 Hours
The W Link A Crawle	Yeb-Search Engine Architectures-Crawling the web-Crawling Documents and Email-Docum Analysis -Ranking-Simple Ranking Functions-Learning to Rank-Browsing - Applications of er-Evaluating Search Engines-Social Search.	f a Web
UNIT	V CROSS LINGUAL AND MULTIMEDIA INFORMATION RETRIEVAL	9 Hours
Cross Approa – Othe Query series	Lingual Information Retrieval: IR models – Language Problems in IR - Problems of CLI aches to Translation in CLIR - Using manually constructed Translation systems and resource er methods to improve CLIR - Multimedia Information retrieval (MIR): Introduction - data languages - Spatial access methods - A general multimedia indexing approach - One-dime - Two-dimensional colour images - Automatic picture extraction.	R - ces for CLIR modelling - nsional time
		45 11
Refere	ences	45 Hours
1.	Ricardo Baeza Yates, Berthier Ribeiro Neto, Modern Information Retrieval: The C Technology behind Search, (ACM Press Books), Second Edition, Reprint 2016.	concepts and
2.	Chrstopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Introduction to Retrieval Cambridge University Press, First South Asian Edition, 2011.	Information
3.	Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval I and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts Londo 2016.	mplementing on, England,
4.	Bruce Croft, Donald Metzler, Trevor Strohman, Search Engines: Information Practice, Pearson Education, 2015.	Retrieval in
5.	Jian-Yun Nie, Cross-Language Information Retrieval by Morgan & Claypool Publisher ser	ries, 2010.

24CS59		Ň	ATUR	AL LA	NGUA	GE PO	ORCES	SING			L		P C
	P	re-requisit	e					As	sessment P	attern	3	UU	<u> </u>
• [Inderstanding	g of basic li	nguisti	c conce	pts.	Mod	e of As	sessme	ent		Wei	ghtag	ge(%)
1	anguage mod	lels and gra	mmars.		P*8,	Cont	inuous	Interna	l Assessmer	nt	· ·	40	<u>, , ,</u>
• F	Basic experies	nce with tex	kt proce	essing		Sem	ester Ei	nd Exar	ninations			60	
t	echniques.												
Course (Objectives												
•]	o understand	l the basics	of ling	uistics,	probabi	ility and	l statist	ics.					
•]	o understanc	l statistical	approad	ches to	NLP ar	nd seque	ence lat	beling.					
•]	o outline dif	ferent parsi	ng tech	niques	associa	ted with	n NLP.						
• 7	To explore the	e semantics	of wor	ds and a	semanti	ic role l	abeling	of sent	ences.				
• 7	o apply the r	nethods for	discou	rse ana	lvsis a	uestion	answer	ing and	d chatbots				
	o uppij ulo i	nethous for	uiseou	ise unu	.j.515, ¶			<u>6</u> , u	a charooto.				
Program	me Outcom	es (POs)											
PO1	An ability t	to independ	lently a	carry o	ut rese	arch /	investi	vation	and develor	ment v	vork	to sc	lve
101	practical pro	blems.	activity v	ourry o	ut 1050	uren /	in vestig	Sation	und develop		, olk	10 50	///0
PO2	An ability to	write and	present	a subst	antial te	echnica	l report	/docum	ent.				
PO3	Students she	ould be al	ble to	demon	strate	a degr	ee of	master	y over the	area o	of C	ompu	iter
DO 4	Science and	Engineerin	<u>g.</u>	1 1	1		1'		<u> </u>	· 1' /		1	1
PO4	centralized of	design, bu	anviron	ld dev ments i	elop s	system	applic	ation d platfo	software I	or dist	ribut	ed a	ind
PO5	Understand	the worki	ng of	currer	t Indu	istrv ti	ends.	the ne	w hardwar	e arch	itectu	ires.	the
	software co	omponents	and de	esign s	olution	s for 1	eal wo	orld pr	oblems by	Comm	inica	ting	and
	effectively v	working wi	ith prot	fession	als in v	various	engine	ering f	ields and p	ursue r	esear	ch	
7.0 (orientation f	for a lifelon	g profes	ssional	develop	oment i	n comp	uter and	d automation	n arenas			
PO6	Model a c	computer I	based	automa	ttion s	system	and (design	algorithms	that	expl	ore	the
Course (Dutcomes (C	(\mathbf{Os})	lucons		u ili ulį		15101116	ation.					
The stude	ents will be a	ble to											
CO1	Understand	the basics	of ling	istics.	probabi	lity, an	d statis	tics asso	ociated with	NLP.			
CO2	Understand	l various te	chnique	es in N	LP, inc	luding	n-gram	s, lang	uage models	s, name	d ent	ity	
	tagging, an	d evaluating	g vecto	r model	s for la	nguage	tasks.	, 0	U	,		5	
CO3	Understand	and apply	y techi	niques	for an	alyzing	and	represe	nting the	structure	e of	natu	ıral
	language se	entences.	1:66	- 4	1		4 :	- 1	. 1	1.1	4		
C04	and concern	d analyze	differei	nt word	1 sense	es, sem	antic r	oles, ai	nd relations	nips be	twee	n wo	rds
CO5	Develop a s	simple chat	bot usir	ng dialo	gue sys	stem co	ncepts.						
Articula	tion Matrix	1		0	<u> </u>		1						I
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1		2	3	1	1						
		-					-						
		2	2	2	2	3		3					
		3	3		3	3		3					
		4	1		2	3		3					
		5	1		2	3		3					
]				

Unit I	INTRODUCTION TO NLP	9 Hours
Natural Languag Tokenization-Mc Categories.	e Processing – Components - Basics of Linguistics, Probability and Statistic rphology-Finite State Automata- Finite State Automata for more G	s – Words- Frammatical
Unit II	STATISTICAL NLP AND SEQUENCE LABELING	9 Hours
N-grams and Lar Semantics – TF- Speech Tagging	guage models –Smoothing -Text classification- Naïve Bayes classifier – Evaluat IDF - Word2Vec- Evaluating Vector Models –Sequence Labeling – Part of Spee Named Entities –Named Entity Tagging.	ion - Vector ch – Part of
Unit III	CONTEXTUAL EMBEDDING	9 Hours
Evaluating Parse Based.	cs -Partial Parsing – Dependency Relations- Dependency Parsing Transition Base	ed - Graph-
	COMPUTATIONAL SEMANTICS	9 Hours
Word Senses ar Semantic Role Extraction - Ten	d WordNet – Word Sense Disambiguation - types of word sense disam Labeling – Proposition Bank- FrameNet- Selectional Restrictions -	biguation – Information
	plate Filling.	
UNIT V	DISCOURSE ANALYSIS AND SPEECH PROCESSING	9 Hours
UNIT V Discourse Coher Question Answer – Frame-based D	DISCOURSE ANALYSIS AND SPEECH PROCESSING ence – Discourse Structure Parsing – Centering and Entity Based Coherence ing –Factoid Question Answering – Classical QA Models – Chatbots and Dialog ialogue Systems – Dialogue–State Architecture.	9 Hours ce – ue systems
UNIT V Discourse Coher Question Answer – Frame-based D	DISCOURSE ANALYSIS AND SPEECH PROCESSING DISCOURSE Structure Parsing – Centering and Entity Based Coherence ing –Factoid Question Answering – Classical QA Models – Chatbots and Dialog ialogue Systems – Dialogue–State Architecture. Total	9 Hours ce – ue systems 45 Hours

- 3. Christopher Manning, "Foundations of Statistical Natural Language Processing", MIT Press, 2009.
- 4. Nitin Indurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover, 2010.
- 5. Deepti Chopra, Nisheeth Joshi, "Mastering Natural Language Processing with Python", Packt Publishing Limited, 2016.
- 6. Mohamed Zakaria Kurdi "Natural Language Processing and Computational Linguistics: Speech, Morphology and Syntax (Cognitive Science)", ISTE Ltd., 2016.
- 7. Atefeh Farzindar, Diana Inkpen, "Natural Language Processing for Social Media (Synthesis Lectures on Human Language Technologies)", Morgan and Claypool Life Sciences, 2015.

24CS60		DEEP LEARNING TECHNIQUES					T	P	C				
	Pre-regi	uisite						Δεερεετ	nent Patte		U	U	3
• 1	Inderstanding of lir	near algel	na Ca	alculus	M	ode of	Assessi	nent		We	ight	age	(%)
F	Probability and Statis	stics	Ju, Ci	iicuius,	Co	ontinuo	us Inter	nal Ass	essment		4	40	(, , ,
• E	Basic knowledge of r	nachine l	earning	Ţ	Se	mester	End Ex	aminat	ions		6	50	
с	oncepts and Optimiz	zation tecl	hnique	s.									
Course (Objectives									ľ			
• 7	o introduce the fund	lamental o	concep	ts of de	ep leari	ning.							
• 1	To explore the different	ent types of	of neur	al netw	orks.	U							
• 1	o gain proficiency in	n implem	enting	and trai	ining re	inforce	ment le	arning	algorithms.				
• 1	To learn techniques f	or interpr	eting a	nd impi	roving 1	nodel p	erform	ance.	C				
Program	me Outcomes (POs	s)		•	Ũ								
PO1	PO1 An ability to independently carry out research / investigation and development work to solve practical problems.												
PO2	An ability to write a	and presei	nt a sub	ostantial	l techni	cal repo	ort/docu	iment.					
PO3	Students should be	able to	demon	strate a	degree	e of ma	astery c	over the	area of	Comput	er		
DO 4	Science and Engine	ering.	1 1					0	6	11 . 11	. 1		_
PO4	Efficiently design,	build	and d	levelop s in var	systei ving do	m app	lication	1 SOftv	vare for	distribu	ted	and	1
PO5	Understand the w	orking o	of curr	ent In	dustry	trends	the	new h	ardware a	rchitect	ures	tł	ne
105	software compone	nts and	design	solutio	ons for	real	world	problen	as by Cor	nmunic	atin	y, u gar	nd
	effectively working	g with pr	ofessio	onals in	vario	us engi	neering	fields	and pursu	ie resea	rch	5 ***	
	orientation for a life	elong prof	fession	al devel	lopmen	t in con	nputer a	and auto	omation are	enas.			
PO6	Model a compute	er based	autor	mation	syster	n and	desig	n algo	orithms th	at exp	lore	th	e
	understanding of th	e tradeoff	s invol	ved in o	digital t	ransfor	mation.						
Course (Dutcomes (COs)												
The stude	ents will be able to												
CO1	Apply the deep lea	rning tecl	hniques	s to trai	n neura	l netwo	orks effe	ectively	•				
CO2	Analyze the perfo	ormance o	of diff	erent n	eural n	etwork	archite	ectures	suitable fo	or diffei	ent		
CO3	Implement reinfor	cement le	earning	algorit	thms to	train o	leep rei	inforcer	nent learni	ng agen	ts f	or	
	various environme	ents.		. 0			1			00			
CO4	Analyze case stu	dies and	real-w	orld ap	plication	ons of	model	interp	retability a	nd exp	olain		
COF	ability techniques.	maintain				a offered			برا مربع المراسم	ti a m			
05	environment	maintain	deep I	earning	; model	s effect	ivery i	n real-v	voria produ	iction			
Articula	tion Matrix												
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	2	2		3	3	3					
		2	2	2	2	3	3	2					
		3	2	2	2	3	2	3					
		4	2	2	1	3	3	3					
		5	2	2	-	3	2	2					
		5	2	2		3	2	2					

Unit I INTRODUCTION TO DEEP LEARNING

Overview of Deep Learning: Definition and brief history - Key concepts: neurons, layers, activation functions-Neural Networks Fundamentals: Perceptron's and the basics of artificial neural networks- Forward and backward propagation-Gradient descent and optimization algorithms-Deep Learning Frameworks: Introduction to popular frameworks: TensorFlow, PyTorch, Keras.

Unit II NEURAL NETWORKS

Convolutional Neural Networks (CNNs): Structure and working principle of CNNs- Applications in image recognition and computer vision- Implementation and training of CNNs- Recurrent Neural Networks (RNNs): Understanding sequential data processing-Structure and functioning of RNNs- Generative Adversarial Networks (GANs): Introduction to GAN architecture-Training GANs-Graph Neural Networks: Basics of graph representation learning.

Unit III DEEP REINFORCEMENT LEARNING

Introduction to Reinforcement Learning (RL): Basics of reinforcement learning: agents, environments, rewards-Markov decision processes (MDPs)-Q-Learning and Deep Q-Networks (DQNs): Understanding Q-learning algorithm-Introduction to Deep Q-Networks (DQNs) and experience replay-Policy Gradient Methods: Policy gradients and REINFORCE algorithm.

Unit IV MODEL INTERPRETABILITY AND EXPLAINABILITY

Importance of Model Interpretability: Motivation for model interpretability and explainability-Ethical considerations in AI-Interpretability Techniques: Feature importance methods-Local and global explanation methods-Interpretable Models: Decision trees and rule-based models-Linear models and logistic regression-Case Studies and Applications.

UNIT V DEPLOYMENT AND SCALABILITY

Model Deployment Strategies: Introduction to model deployment-Considerations for deploying deep learning models-Scalability and Performance Optimization: Techniques for improving model performance-Distributed training and model parallelism.

References

- 1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
- 2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer International Publishing AG, 2018.
- 3. Rajalingappaa Shanmugamani, Deep Learning for Computer Vision, Packt Publishing, 2018.
- 4. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, MIT Press, 2018.
- 5. Christoph Molnar, Interpretable Machine Learning, Lulu.com, 2020.
- 6. Emmanuel Ameisen, Building Machine Learning Powered Applications: Going from Idea to Product, O'Reilly Media, Inc., 2020.

9 Hours

9 Hours

9 Hours

9 Hours

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9 Hours

45 Hours

Total

24CS61		B	IG DA	TA M	INING	AND A	ANALY	TICS			TI	\mathbf{C}
	Dr		0					٨	seesement Pottern	3	UU	5
• •	II Decie underste	e-requisit	e oto Mi	nina		Mor	le of A	A	ont	Wei	ahtaa	e(%)
• <u> </u>	asic unuersia	nunig of D		mng		Con	tinuous	Interns	al Assessment		<u>gntag</u> 40	C(/0)
• F	Samiliarity v	with hig	data	storag	e and	Sem	ester F	nd Eva	minations	_	60	
n	rocessing tech	nologies	uutu	storag	,e une				liniacions		00	
Course (D biectives	morogresi										
	To understand	the concer	nto and	ahallan	gos of l	ia data	minin	a and a	alution			
• 1		the concep		chanen	ges of t		ı 111111111	g and an	larytics.			
• 1	o explore diff	terent data	mining	g algorit	hms an	d their	applica	tions.				
•]	o understand	the variou	s searcl	h algori	thms ap	oplicabl	le to Bi	g Data.				
• 1	To apply data visualization techniques to communicate insights effectively.											
• 1	o analyse real	l-world cas	se studi	es and	practica	al appli	cations	of big c	lata analytics.			
Program	me Outcome	s (POs)				<u> </u>		0	j			
	A		1			1 - /	•			1-	4	1
POI	n additional prob) independ	lentry	carry o	ut rese	arcn /	investi	gation	and development	WOLK	to so	Ive
PO2	An ability to	write and i	nresent	a subst	antial to	chnics	l renor	docum	pent			
PO3	Students sho	uld be al	ple to	demon	strate	a degi	ree of	master	v over the area	of C	ompu	ter
105	Science and I	Engineerin	g.	demon	struce	u ucgi	00 01	muster	y over the area	01 0	ompu	.01
PO4	Efficiently d	lesign, bu	uild au	nd dev	velop	system	applic	cation	software for di	stribut	ed a	nd
_	centralized computing environments in varying domains and platforms.											
PO5	Understand the working of current Industry trends, the new hardware architectures. the											
	software con	nponents	and de	esign s	olution	s for	real wo	orld pr	oblems by Comn	nunica	ting	and
	effectively w	vorking wi	ith pro	fession	als in v	various	engine	eering f	fields and pursue	resear	ch	
	orientation fo	or a lifelon	g profe	ssional	develop	oment i	n comp	uter an	d automation arena	lS.		
PO6	Model a co	omputer l	based	automa	ation s	ystem	and	design	algorithms that	expl	ore t	he
C	understandin	g of the tra	aeoms	involve	a in aig	gital tra	nstorm	ation.				
The stude	Dutcomes (CC	$\frac{JS}{10}$										
<u>CO1</u>	Apply the co	omputation	hal appi	roaches	to mod	elling,	analyse	and in	terpret the data.			
CO2	Apply the se	earch techr	nques 1	or effic	ient ret	rieval c	of simila	ar data i	trom large database	e.		
C03	Design a mo	l ontimizo	act val	uable II	isignis i	atoot li	nunuo	us data	streams enficiently	n coto		
C04	Analyze str	eaming de	ata and	t naral	lelize	cleet II.	ng alg	orithms	culminating in	the i	oractio	•a1
0.05	application of	of clusterir	ng meth	nods to a	solve re	al-wor	ld probl	lems.	, cummating m	the	Jacin	Jai
Articula	tion Matrix						P					
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		00110	101	10-	100	101	100	100				
		1	1	2	1	3	1	1				
			n	2		2	1	2				
		2	Z	5		Z	1	2				
		3	1	1	2	1		2				
		5	_			_						
		4	2					3				
		5	1		2	1		1				
								I	l			

DATA MINING AND LARGE SCALE FILES Unit I 9 Hours Modelling - Summarization - Feature Extraction - Statistical Limits on Data Mining - Distributed File Systems - Map-reduce - Algorithms using Map Reduce - Efficiency of Cluster Computing Techniques. SIMILARITY DETECTION Unit II 9 Hours Nearest Neighbor search – Shingling of Documents – Similarity preserving summaries – Locality sensitive hashing for documents - Distance Measures - Theory of Locality Sensitive Functions - LSH Families – Methods for High Degree of Similarities. Unit III MINING DATA STREAMS 9 Hours Stream Data Model - Sampling Data in the Stream - Filtering Streams - Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows. Unit IV LINK ANALYSIS AND FREQUENT ITEMSETS 9 Hours Page Rank -- Efficient Computation - Topic Sensitive Page Rank -- Link Spam -- Market Basket Model -- Apriori algorithm – Handling Larger Datasets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets. UNIT V CLUSTERING 9 Hours

Introduction to Clustering Techniques – Hierarchical Clustering –Algorithms – K-Means – CURE – Clustering in Non - Euclidean Spaces - Streams and Parallelism - Case Study: Advertising on the Web -Recommendation Systems.

	1
Total	45 Hours
References	

- 1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.
- 2. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2011.
- 3. Ian H.Witten, Eibe Frank "Data Mining Practical Machine Learning Tools and Techniques", Morgan Kaufman Publications, Third Edition, 2011.
- 4. David Hand, HeikkiMannila and Padhraic Smyth, "Principles of Data Mining", MIT PRESS, 2001.
- Saumyadipta Pyne, B.L.S. Prakasa Rao, S.B. Rao, "Big Data Analytics: Methods and 5. Applications", Springer, 2018.

24CS62		DATA VISUALIZATION TECHNIQUES				L	T P C				
	Pre-real	isite						A scess	nent Pattern	3	005
• U	inderstanding of var	ious type	s of da	ta	Μ	ode of	Assessi	ment		Wei	ghtage(%)
vi	sualizations.	ious type	5 01 00	lu	Co	ontinuo	us Inter	nal Ass	essment		40
• F	amiliarity with prin	ciples of	good d	lata	Se	mester	End Ex	aminat	ions		60
vi	isualization.	•	0								
Course O	bjectives										
• T	o understand the co	ncepts an	d chall	enges o	f big da	ata mini	ing and	analyti	cs.		
• T	o explore different of	lata mini:	ng algo	rithms	and the	ir appli	cations.				
• T	o understand the va	rious sear	ch algo	orithms	applica	ble to I	Big Dat	a.			
• T	To apply data visualization techniques to communicate insights effectively.										
• T	o analyse real-world	l case stu	dies an	d practi	ical ann	lication	ns of hi	n data a	nalytics		
• 1	o anaryse real-work	i case stu	uics an	u pracu	icai app	incation	15 01 012	g uata a	narytics.		
Program	me Outcomes (POs	5)									
PO1	An ability to inde	pendently	carry	out re	search	/ inves	stigation	n and c	levelopment v	work	to solve
	practical problems.										
PO2	An ability to write a	and prese	nt a sut	ostantia	l techni	cal repo	$\frac{\operatorname{ort}/\operatorname{doct}}{c}$	iment.	.1	6.0	
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer										
PO4	Efficiently design, build and develop system application software for distributed and										
	centralized computing environments in varying domains and platforms.										
PO5	Understand the w	orking c	of curr	ent In	dustry	trends	, the	new h	ardware arch	itectu	ires, the
	software compone	nts and	design	solutio	ons for	real y	world	problen	ns by Comm	unica	ting and
	effectively working	g with pi	rotessic	onals in	i varioi	is engi	neering	g fields	and pursue re	eseard	:h
P O6	Model a compute	elong pro	ression	al devel	lopmen	t in con	nputer a	and auto	mation arenas	ovnl	ora tha
POO	understanding of th	e tradeoff	fs invol	ved in a	syster digital t	n and ransfor	mation	n algo	orithms that	expi	sie the
Course O	utcomes (COs)	e tradeon		i eu in e	aigitai t	runsion	mation				I
The stude	nts will be able to										
CO1	Understand the key	y techniq	ues and	l theory	behind	data vi	isualiza	tion.			
CO2	Analyze and use	effective	ely the	vario	us vist	alizatio	on stru	ctures	(like tables,	spati	al data,
	tree and network e	tc.).									
CO3	Evaluate informati	ion visua	lizatio	n syste	ms and	d other	forms	of vis	sual presentat	ion f	or their
<u>CO4</u>	effectiveness.	1.4.0	1:		• •						
C04 C05	Analyse streaming	$\frac{1}{1}$ $\frac{1}$	nd par	1 systen	us.	ring of	laorithr		minating in	tha 1	aractical
005	application of clus	tering me	thods t	o solve	real-we	orld pro	blems.	ns, cui	ininating in	uie j	Jactical
Articulat	ion Matrix										I
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6			
		1	2		2	2	- 1	2			
		1	3	1	2	2	1	2			
		2	2	1	2	3	2	2			
		3	1		2	2	1	1			
			-								
		4	3	1	3	3	2	2			
		5	2	1	3	2	1	1			

Unit I	FUNDAMENTALS OF VISUALIZATION	9 Hours				
Introduction to V	isualization: Purpose of Visualization, External Representation and Significance	, Validation				
Challenges. Data	Abstraction in Visualization: Datasets Types & Characteristics, Attribute Types	and				
Semantic Represe	entations.					
Unit II	PRINCIPLES OF REPRESENTATION	9 Hours				
Marks and Ch	annels: Exploring Different Marks and Uses, Understanding Channel	ls in Data				
Visualization, T	able and Spatial Data Organization: Rules for Arranging Tables, S	patial Data				
Representation: C	eometry, Scalar Fields, Vector Fields, Tensor Fields.					
Unit III	ADVANCED DATA VISUALIZATION TECHNIQUES	9 Hours				
Networks and T	rees Visualization: Strategies for Arranging Networks and Trees, Matrix	Views for				
Representing Cor	nections. Mapping Color in Visualization: Color Theory and Its Application,	Effective				
Use of Color Map	os and Other Channels.					
Unit IV	INTERACTIVE VISUALIZATION AND MANIPULATION	9 Hours				
Manipulating Vi	ews: Dynamic View Changes over Time, Selective Element Display &	Interaction,				
Changing Viewp	oints & Reducing Attributes. Faceting & Focus/Context: Juxtaposing &	Coordinating				
Multiple Views, S	Static & Dynamic Layers in Visualization, Filtering and Aggregation.					
UNIT V	VALIDATION AND CASE STUDIES	9 Hours				
Validation in Visualization: Levels of Validation, Validation Approaches. Focus & context						
Superimpose – Distort – Case studies: Real World Applications.						
	Total	45 Hours				
References						

- 1. Tamara Munzner, Visualization Analysis and Design, A K Peters Visualization Series, CRC Press, 2014.
- 2. Scott Murray, Interactive Data Visualization for the Web, O'Reilly, 2013.
- 3. Alberto Cairo, The Functional Art: An Introduction to Information Graphics and Visualization, New Riders, 2012.
- 4. Nathan Yau, Visualize This: The Flowing Data Guide to Design, Visualization and Statistics, John Wiley & Sons, 2011.

24CS63		BLO	СКСН	AIN TI	ECHN	DLOG	IES			L	T P	C
										3	0 0	3
	Pre-req	uisite					As	sessment	Pattern	-		(0/)
• E	asic understanding	of cryptogr	aphic		Mod	le of As	sessme	ent	1	Wei	ghtage	(%)
p	rinciples.	4	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	and	Con	inuous	Interna	I Assessm	ent	_	40	
• F s	undamentals of ne	tworking co	oncepts	and	Sem	ester Ei	na Exar	ninations			60	
Course (Objectives											
• 1	o understand the fu	ndamentals	of Bloc	ckchain	techno	logy.						
• 1	o study the archited	ture of Bloc	ckchain	and bit	coins.							
• 1	o understand and d	evelop an E	thereun	n ecosy	stem.							
• 1	o understand the hy	perledger fa	abric te	chnolog	gy.							
• 1	o design different E	slockchain b	based a	oplicati	ons.							
Program	me Outcomes (PO	s)										
DO1	A 1'1' / ' 1	1 (1			1 /	. ,.		1 1 1		1	. 1	
POI	An ability to inde	pendently d	carry o	ut rese	arch /	investig	gation a	and develo	opment	WOrk	to sol	ve
PO2	An ability to write and present a substantial technical report/document.											
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer											
	Science and Engineering.											
PO4	Efficiently design,	build and o	develop	systen	n applie	cation s	software	e for dist	ributed	and		
DO 5	centralized comput	ing environ	ments i	n varyi	ng dom	ains and	d platfo	rms.		1.4		1
P05	understand the w	Orking OI	curren	olution	stry ti	enas,	the ne	w nardw	are arc	nitecti	ures, t	ne nd
	effectively workin	σ with nrot	fession	als in y	arious	engine	ering f	ields and	nursue	reseat	ung a ch	liu
	orientation for a life	elong profes	ssional	develor	oment i	n comp	uter and	automati	on arena	IS.	UII	
PO6	Model a compute	er based	automa	ation s	ystem	and	design	algorithm	ns that	expl	ore th	e
	understanding of th	e tradeoffs	involve	d in dig	gital tra	nsforma	ation.	C		•		
Course (Outcomes (COs)											
The stude	ents will be able to											
CO1	Understand the cr	vntographic	basics	of bloc	k chain	techno	10gv					
CO2	Understand basics	of architec	tural de	sign of	block c	hain ar	nd bitco	ins trading	.			
CO3	Develop private b	lock chain e	environ	ment an	d deve	lop a sn	nart cor	tract on E	thereum			
CO4	Design the hyperle	edger archit	ecture a	and the	consen	sus mec	chanisn	applied o	n it.			
CO5	Design of differen	t block chai	in based	applic 1	ations f	or incre	eased se	ecurity.				
Articula	ion Matrix											
ni ucula	CO.	No. PO1	PO2	PO3	PO4	PO5	PO6					
	1	2	1	3	2	2	3					
	2	2	1	2.	3	2	2					
						_						
	2		1 1	2	1 1	1	1					

2	2	1	2	3	2	2
3	2	1	3	1	2	1
4	2	1	2	3	2	2
5				1	1	1

Digital Money	to Distributed Ledgers, Block chain Basics, Growth of block chain	technology,
Distributed syst	ems, History of block chain and Bitcoin, Types of block chain,	Methods of
decentralization,	Routes of decentralization, Block chain and full ecosystem decentralization,	Smart
contracts, Decent	ralized organizations, Platforms for decentralization.	
Unit II	BLOCK CHAIN AND BITCOINS	9 Hours
Block chain Arc	hitecture, Versions, Variants, Use cases of block chain, Block chain vs share	ed Database,
Introduction to	cryptocurrencies, Types, Applications. Bitcoins: Introduction, Bitcoin digit	al keys and
addresses, Transa	ctions, Block chain mining, Alternative Coins, Limitations of Bitcoin, Application	ons of
Bitcoin Scripts, E	itcoin Blocks.	
I nit III	FTHEREIM	9 Hours
		<i>></i> 110013
Introduction: Et	pereum The Ethereum ecosystem IOTA EOS Multichain Bigchain Adv	vantages and
Disadvantages F	thereum vs Ritcoin Design of new blockchain Potential for disruption Design of	of distributed
application View	ving Information about blocks in Blockchain Blockchain applications Devel	loping smart
contract on privat	te Block chain.	oping sinut
1		
Unit IV	HYPERLEDGER	9 Hours
Introduction to H	lyper ledger fabric, components of Hyper Ledger Fabric Technology, Develop F	Iyper Ledger
Block Chain App	lications using Composer Framework, Model the Block Chain Applications usin	ng Composer
modelling langua	age, Alternative Decentralized Solutions, Hyper ledger Fabric II: Beyond Chai	in code,
fabric SDK and F	ront End-Hyper ledger composer tool.	
UNIT V	APPLICATIONS	9 Hours
Block chain in F	inancial Software and Systems (FSS): Settlements, KYC, Capital markets-Insu	rance Block
chain in trade/sup	pply chain, Block chain for Government: Digital identity, land records and other	kinds
ot record keeping	between government entities, public distribution system / social welfare system.	

HISTORY OF BLOCK CHAIN

Defense
Kelerences

Unit I

- 1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018.
- 2. Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016.
- 3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
- 4. Bahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2016.

62

9 Hours

45 Hours

Total

240864		Α ΤΙΩΝΙ ΝΕΥΓΙ ΩΒΜΕΝΤ							
240.504	FULL STACK WEB APPLIC.	ATION DEVELOPMENT	$\begin{array}{c c c c c c c c c c c c c c c c c c c $						
	Pre-requisite	Assessment Pattern							
• 1	Inderstanding of web protocols and web	Mode of Assessment	Weightage(%)						
s	andards	Continuous Internal Assessment	40						
• B	asics of Database connectivity	Semester End Examinations	60						
Course (Dbjectives								
• T	o understand the basics and components of fro	ntend web development.							
• T	o understand back end web development basic	s and tools.							
• T	o understand the PHP components and framew	ork for web development.							
• T	• To explore the features of SQL and MySQL for databases.								
• T	o explore integration of PHP and advanced we	b development features.							
Program	me Outcomes (POs)								
PO1	An ability to independently carry out resea	rch / investigation and development y	work to solve						
	practical problems.								
PO2	An ability to write and present a substantial tec	chnical report/document.							
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer								
	Science and Engineering.								
PO4	Efficiently design, build and develop sy	stem application software for dist	tributed and						
DO5	centralized computing environments in varying	g domains and platforms.							
POS	Understand the working of current industry	r real world problems by Communication	es, the						
	offectively working with professionals in w	r lear world problems by Communication	ng and						
	orientation for a lifelong professional develop	ment in computer and automation arenas	esearen						
PO6	Model a computer based automation sy	stem and design algorithms that	explore the						
100	understanding of the tradeoffs involved in digi	tal transformation.	empione une						
Course C	Outcomes (COs)		L						
The stude	nts will be able to								
CO1	Understand the basics of JavaScript, CSS and	other web development features.							
CO2	Understand various back end web developme	nt tools and frameworks.							
CO3	Understand and apply techniques for analyzed	zing and representing the structure of	natural						
	language sentences.								
CO4	Explore the necessity of SQL and MySQL fe	atures for databases.							
CO5	To develop a simple Web Application	on by integrating simple and ad	ivanced web						
	development features.								
Articulat	ion Matrix								

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1			2	3	3	3
2			2	3	3	3
3	2		1		3	3
4	2		2		3	3
5	3	3			3	3

Unit IINTRODUCTION TO WEB DEVELOPMENT9 Hours

Introducing Flexbox– JavaScript for Front-end- Syntax & Creating Concepts with JavaScriptDesign Patterns & Object Modelling- HTTP Requests & Routes- Introducing CSS- CSS Grid & Creating Responsive Layouts– jQuery & jQuery-mobile- Bootstrap & Angular JS-Node & Express Backend integration- Basics of Web pack & Sass and Web pack.

Unit II BACK END WEB DEVELOPMENT

OOPS-JSON-AJAX- Node.js-Development Environment & Tools- Express Framework, Building scalable web applications, Design Patterns & Object Modelling– Database & MongoDB- HTTP & Web sockets for Node.js

Unit IIIHYPERTEXT PREPROCESSOR9 Hours

Introduction, PHP Document, Language Fundamentals, Decision Making Statement, Loops, Statements, Operators, PHP functions, Arrays & Functions, String Functions, Server-Side Processing, Processing Forms via GET/POST, State and Persistence, Web Application Development, Introduction to PHP Frameworks & Basic OOP

Unit IV NO SQL

ntroduction to NoSQL, History of NoSQL Exploring NoSQL, Interfacing and Interacting with NoSQL, NoSQL Storage Architecture, , Querying, Modifying and Managing. Data Storage in NoSQL, Working with NoSQL, Surveying Database Internals, Migrating from RDBMS to NoSQL, Web Frameworks and NoSQL, using MySQL as a NoSQL, case study: implement Advanced columnar data model functions for the real time applications.

UNIT V DATABASE FOR THE MODERN WEB

Introduction to Node.js- Installing Node.js - Using Events, Listeners, Timers, and Callbacks in Node.js – Introduction to MongoDB- Accessing MongoDB from Node.js. Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document- Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language. Developing Web Application with NOSQL and NOSQL Administration Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP.

	Total	45 Hours
References		

- 1. Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", First Edition 2018.
- 2. Frank Zammetti, Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Second Edition 2022.
- 3. Riyaz Ahmed, "Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5", CSS3, Bootstrap, JavaScript, MySQL, and PHP", Amazon Digital Services LLC Kdp, 16 Apr 2021.
- 4. Jack Chan, Ray Chung, Jack Huang, "Python API Development Fundamentals: Develop a fullstack web application with Python and Flask", 2019.
- 5. Edwin Ross, "Torres Full Stack Web Development: Round One Begin!" 2021. 6. Brad Dayley, Brendan Dayley, and Caleb Dayley, Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications, 2nd Edition, Pearson Education, 2021.

64

9 Hours

9 Hours

9 Hours

24CS65	65 CYBER PHYSICAL SYSTEMS		L	ΤI) [C					
210500				0 0) 3					
	Pre-requisite	Assessment Patter	ttern							
•	Understanding basics of physical systems and	Mode of Assessment	Wei	ghtag	e(%)					
1	networking concepts.	Continuous Internal Assessment		40						
•]	Familiarity with sensor technologies.	Semester End Examinations	60							
Course	Objectives									
• ′	To learn about the principles of cyber-physical s	systems, basic requirements of CPS.								
• ′	Γo know about CPS models, CPS foundations.									
• ′	To make the students explore the applications and platforms.									
• ′	To provide introduction to practical aspects of c	yber physical systems.								
• ′	To equip students with essential tools to implem	ent CPS.								
Program	nme Outcomes (POs)									
·										
PO1	An ability to independently carry out research / investigation and development work to solve practical problems.									
PO2	An ability to write and present a substantial technical report/document.									
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.									
PO4	Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.									
PO5	Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.									
PO6	Model a computer based automation sy	stem and design algorithms that	t expl	ore t	he					
	understanding of the tradeoffs involved in digi	tal transformation.								
Course	Outcomes (COs)									
The stud	ents will be able to									
CO1	Explain the core principles behind CPS									
CO2	Discuss the requirements of CPS									
CO3	Explain the various models of CPS	Explain the various models of CPS								
CO4	Describe the foundations of CPS.	Describe the foundations of CPS.								
COE	Use the various platforms to implement the CPS									

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	3	3	3		1	
2	2	2	2		1	
3			3	1		1
4			3	1		1
5	2		2	3	3	3
	Regulations.	2024				
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Unit I	INTRODUCTION TO CYBER-PHYSICAL SYSTEMS	9 Hours				
Cyber- Drivers Design	Physical Systems (CPS)-Emergence of CPS, Key Features of Cyber-Physical Systems-Synchronous Model: Reactive Components, Properties of Components, Composing Comus-Asynchronous Model of CPS: Processes, Design Primitives, Coordination Protocols.	stems, CPS ponents,				
Unit I	I CPS - REQUIREMENTS	9 Hours				
Safety Livene	Specifications: Specifications, Verifying Invariants, Enumerative Search, Symbess Requirements: Temporal Logic, Model Checking, Proving Liveness	olic Search				
Unit I	II CPS MODELS	9 Hours				
Dynam Analys	nical Systems: Continuous, Linear Systems-Time Models, Linear Systems, Designing sis Techniques-Timed Model: Processes, Protocols, Automata-Hybrid Dynamical Models.	Controllers,				
Unit I	V CPS FOUNDATIONS	9 Hours				
Symbo	lic Synthesis for CPS- Security in CPS-Synchronization of CPS-Real-Time Schedulin	g for CPS				
UNIT	V APPLICATIONS AND PLATFORMS	9 Hours				
Medica iRobot	al CPS- CPS Built on Wireless Sensor Networks- CyberSim User Interface- iClebo Create- myRIO- Cybersim- Matlab toolboxes - Simulink.) Kobuki -				
	Total	45 Hours				
Refere	ences					
1.	Raj Rajkumar, Dionisio De Niz , and Mark Klein, Cyber-Physical Systems, Addison-W Professional, 2016	/esley				
2.	Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.					
3.	Lee, Edward Ashford, and Sanjit Arunkumar Seshia. Introduction to embedded system physical systems approach. 2nd Edition, 2017.	s: A cyber				
4.	André Platzer, Logical Analysis of Hybrid Systems: Proving Theorems for Complex Dyn Springer, 2010. ISBN 978-3-642-14508-7.	namics,				
5.	Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use M The publisher, Paul Temme, 2011.	odules in C,				

6. Jensen, Jeff, Lee, Edward, A Seshia, Sanjit, An Introductory Lab in Embedded and Cyber Physical Systems, http://leeseshia.org/lab, 2014.

24CS66				N	IIXED	REAL	ITY			L 3	T 0	MIXED REALITY									
		Pre-requi	site						Assessment Pattern		v	0 0									
• Fai	miliarity	with	comp	uter	graphi	cs M	lode of	Assess	ment	Wei	ghta	ge(%)									
fur	ndamenta	ls.	· · · ·		8 °T	С	ontinuo	us Inter	rnal Assessment		40)									
• Un	nderstandi	ing of 3D i	nodelli	ng and	renderi	ng Se	emester	End Ex	xaminations		60)									
tec	hniques.																				
Course Ob	ojectives																				
• To	study ab	out Fundar	nental (Concep	t and Co	mpon	ents of	Virtual	Reality.												
• To	study ab	out Interac	tive Te	- chniaue	es in Vir	- tual Re	eality.														
• To study about Visual Computation in Virtual Reality.																					
 To study about Augmented and Mixed Deality and Its Applications 																					
• 10						ly and	ns App	incation	IS.												
• To	know ab	out I/O Int	erfaces	and its	function	ns.															
Programn	ne Outco	mes (POs)																			
PO1 A	Annly ma	thematical	found	ations	algorith	mic r	rinciple	es and	computer science t	heory	in	the									
n	nodelling	and design	n of con	nputer-	based sy	vstems	of vary	ing con	nplexity.	neory		the									
PO2 I	dentify, f	ormulate,	critical	ly anal	yse, an	d solv	e prob	lems in	n the field of Comp	uter	Scie	ence									
a	nd Engin	eering, cor	siderin	g recen	t and fu	ture tre	ends.														
PO3 [Design a	system, c	ompone	ent, or	proces	s to r	neet de	esired	needs within realisti	c con	istra	ints									
S	uch as ec	conomic, se	ocial an	d ethic	al in the	field o	of Comp	outer Sc	cience and Engineering	g.											
PO4 U	Jse curre	nt techniq	ues, sk	ills, ai	nd tools	nece	ssary f	or con	puting practice and	dem	onst	rate									
		knowledge	of a se		lifelon	$\frac{1}{100}$	Compt	ner Sci	ence and Engineering	$\frac{\text{discip}}{1 \text{func}}$											
PU5 L	Jemonstra offectively	ale an adm	to accor	gage m mnlish	a comm	on gos	ing for j d	protessi	ional development and	1 Tunc	tion										
PO6 (Tritically	analyse ex	cisting	literatu	re in a	n area	of sp	ecializa	tion and develop in	novat	ive	and									
r	esearch- o	oriented me	ethodol	ogies to	tackle	gaps ic	lentified	1.	and develop in	novu	110	una									
Course Ou	utcomes ((COs)		0																	
The studen	ts will be	able to																			
CO1	Apply p	orinciples	of inte	raction	design	to c	reate in	ntuitive	and immersive use	er int	erac	tions									
~~~	within m	ixed reality	applic	ations.																	
CO2 An	alyze rea	al-world s	cenario	s and	identify	y suit	able ap	oplicatio	ons for mixed reali	ty te	chnc	ology									
	entertain	various u ment	omains	, men	lang	gammg	g, eau	cation,	nearmeare, manufa	acturi	ng,	and									
CO3 De	velon pr	oficiency	in des	ionino	user i	nterfac	es and	exner	iences tailored for	mixe	d re	ality									
	environm	ents	in uco	-5-mg		inci i ac	es anu	слры		mad	. 10	unty									
CO4	Acquire s	kills in 3D	modeli	ng, ani	mation,	and as	set crea	tion for	mixed reality content												
CO5 De	monstrate	e an unde	erstandi	ng of	the fu	ndame	ntal co	ncepts	and principles of	mixed	1 re	ality									
	technolog	gy, includii	ng virtu	al reali	ty (VR)	augm	ented re	eality (A	AR), and their integrat	ion.											
Articulatio	on Matri	X			г г		1		1												
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6													
		1	3	1	3	1															
		-																			
		2	3		3		1														
		3	3	1			1														
		4					1														
		5	L	1	3			2													
	l																				

# Unit IINTRODUCTION TO VIRTUAL REALITY9 Hours

Introduction, Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism Stereographic image.

# Unit II INTERACTIVE TECHNIQUES IN VIRTUAL REALITY

Safety Specifications: Specifications, Verifying Invariants, Enumerative Search, Symbolic Search Liveness Requirements: Temporal Logic, Model Checking, Proving Liveness.

### Unit III VISUAL COMPUTATION IN VIRTUAL REALITY

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

### Unit IV AUGMENTED AND MIXED REALITY

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems

## UNIT V I/O INTERFACE IN VR & APPLICATION OF VR

Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML, Input -- Tracker, Sensor, Digital globe, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices. VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

### References

- 1. Burden, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.
- 2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, First Edition 2013.
- 3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
- 4. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.
- 5. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
- 6. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.
- 7. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008.

9 Hours

9 Hours

9 Hours

9 Hours

45 Hours

Total

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24CS6	7			D	EVOP	S AND	MICI	ROSER	VICES		$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
			Dro rogi	vigito						A gaagemont Dottonn	3 0 0 3			
	E.		rre-requ				1	Modoo	f Accor	Assessment	Waightaga(9/			
•	Fai	innarity	with ng of clou	cioud id sorvi		orms	and	Continu	ous Int	ernal Assessment	40			
•	Ra	sic under	standing	of cloue	tes. L'denlo	ument		Semeste	r End I	Examinations	60			
Course			standing		u ucpio	yment.		bennest		Examinations	00			
Course	• To learn the basic concepts and terminology of DevOps.													
•	10	learn the	basic coi	icepts a	ind terr	ninolog	y or D	evOps.						
•	I o gain knowledge on Devops platform													
•	То	understa	nd buildii	ng and	deployı	nent of	code.							
•	То	be famili	iar with D	DevOps	automa	ation too	ols.							
•	То	learn bas	sics of MI	LOps.										
Progra	mm	e Outco	mes (POs	s)										
PO1	p	An abili ractical p	ty to ind roblems.	epende	ntly ca	rry out	resear	rch / inv	vestigat	tion and development	work to solve			
PO2	Â	n ability	to write a	nd pres	ent a su	bstantia	al tech	nical rep	ort/doc	cument.				
PO3	S	tudents	should b	e able	to de	emonstr	ate a	degree	of m	astery over the area	of Computer			
	S	cience ar	nd Engine	ering.										
PO4	Eff	iciently	design,	build	and de	evelop	system	n appli	cation	software for distr	ibuted and			
	C	entralized	d computi	ng env	ironme	nts in va	arying	domain	s and p	latforms.	<u> </u>			
PO5	Un	derstand	the wor	rking o	ot curi	ent In	dustry	trends,	, the	new hardware arch	intectures, the			
	S	ontware ffootivoly	componei	nts and	1 desig	n solu	ions i	for real	world	problems by Comm	unicating and			
		rientation	for a life	g with	rofessio	nal dev	elonm	ent in co	ompute	r and automation arenas				
PO6	Mc	del a	computer	r base	d aut	omatior	svst	tem an	$\frac{d}{d} \frac{d}{d}$	ign algorithms that	explore the			
200	u	nderstand	ling of the	e tradeo	offs inv	olved ir	n digita	al transfo	ormatio	n.	empione due			
	_		0				0							
Course	e Ou	tcomes (	(COs)											
The stu	Iden	ts will be	able to											
C01		Underste	nd the co	ncont o	fmodo	m coftu	ioro Er	nginoori	na proc	000				
$\frac{CO1}{CO2}$		$\frac{1}{4}$ nalyze i	the Dev $\Omega$	ne serv	ices an	d work	nlatfor	m under	r virtua	lization				
C02		Build tes	and den	ps serv	le on m	icro-ser	vices	architect	lire	IIZation				
CO4		Explore I	DevOns a	utomati	ion tool	s for in	frastru	cture m	anagem	ent				
CO5		Correlate	MLOps	concept	ts with	real tim	e exan	nples	inagen					
Antion	lo4:-	n Matri	<b>E7</b>											
Агиси	1411(	m watri		DO1	DO1	DO1	DO4	DO5	DOC	1				
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CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	3	2	1	2	3	
2	3	2			3	
3	3	2	2	3	2	3
4	3	2	1	2	3	
5	3	2	2	1	2	3

	Regulations	2024
Unit I	INTRODUCTION	9 Hours
Software En DevOps life c	gineering - traditional and Agile process models - DevOps -Definition - ycle process - need for DevOps –Barriers.	Practices -
Unit II	DEVOPS PLATFORM AND SERVICES	9 Hours
Cloud as a p Centers - Ope capacity plan	blatform - IaaS, PaaS, SaaS - Virtualization - Containers –Supporting Multiple eration Services - Hardware provisioning- software Provisioning - IT services - Sl ning - security - Service Transition - Service Operation Concepts.	Data LA -
Unit III	BUILDING, TESTING AND DEPLOYMENT	9 Hours
Development monitoring - s	and Pre-commit Testing -Build and Integration Testing - Continuous integration - security - Resources to Be Protected - Identity Management.	
Unit IV	DEVOPS AUTOMATION TOOLS	9 Hours
Infrastructure Management	Automation- Configuration Management - Deployment Automation - - Log Management - Monitoring.	Performance
UNIT V	MLOPS	9 Hours
MLOps - De Real world ex	finition - Challenges -Developing Models - Deploying to production - Model amples.	Governance -
	Total	45 Hours
References		
1. Len H Educa	Bass, Ingo Weber and Liming Zhu, —"DevOps: A Software Architect's Perspect ation, 2016.	ive", Pearson
2. Joaki	m Verona - "Practical DevOps" - Packet Publishing , 2016.	
3. Vikto	r Farcic -"The DevOps 2.1 Toolkit: Docker Swarm" - Packet Publishing, 2017.	
4. Mark	Treveil, and the Dataiku Team-"Introducing MLOps" - O'Reilly Media- 2020.	

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										3	0	0 3	
	I	Pre-requis	site				ŀ	Assessment	Pattern				
•	Basic knowle	edge of m	obile da	atabase syste	ms M	ode of A	Assessn	nent		Wei	ghtaş	ge(%	
	and data sync	hronizatio	on techni	iques.	Co	ontinuou	us Inter	nal Assessme	ent		40		
•	Understandin	g of mobi	le OS in	iternals and	Se	emester	End Ex	aminations			60		
	capabilities.												
Course	Objectives												
•	To introduce	the concep	pts of me	obile commu	nicatior	n system	n and pe	rvasive com	puting.				
•	To understan	d the conc	epts of e	emerging mo	bile tecl	nnology							
•	• To understand wireless networks												
	To be encorre	of porvoci		uting prostic	06								
•	To be aware o		ve comp		es.								
•	To learn conc	cepts of pe	ervasive	computing a	nd proto	cols.							
Program	mme Outcom	es (POs)											
PO1	An ability	v to indep	endently	v carry out	research	) / inve	stigatio	n and devel	opment	work	to se	olve	
101	practical pr	oblems.		<i>y</i> • • • • • • • • • • • • • • • • • • •		.,	Subano		opinoite				
PO2	An ability to	write and	l present	t a substantia	l technic	cal report	rt/docui	ment.					
PO3	Students s	hould be	able to	o demonstra	ite a d	egree d	of mas	tery over th	he area	of C	Comp	uter	
	Science and	l Fnoineer	Science and Engineering										
	belefice and	<b>PO4</b> Efficiently design, build and develop system application software for distributed and											
<b>PO4</b>	Efficiently d	esign, bu	ild and	d develop	system	applica	tion so	oftware for	distr	ributed	d	and	
<b>PO4</b>	Efficiently d centralized	esign, bu	ild and g enviror	d develop nments in va	system rying do	applica	tion so and plat	oftware for forms.	distr	ributed	d	and	
<b>PO4</b>	Efficiently d centralized Understand	esign, bu computing the worki	ild and g environing of	d develop nments in va current Ind	system rying do ustry t	applica omains a rends,	tion so and plat the	oftware for forms. new hardw	distr are arcl	ributeo hitectu	d ures,	and the	
PO4 3	Efficiently d centralized Understand t software co effectively	esign, bu computing the worki omponents working	ild and genviron ing of s and c with r	d develop nments in va current Ind lesign solution professionals	system rying do ustry t ons for in yay	applica omains a rends, real y	tion so and plat the world province	oftware for forms. new hardw problems by	distr are arcl Comm	ributed hitectu nunica	d ures, ting	and the and	
PO4 ]	Efficiently d centralized Understand software co effectively orientation	esign, bu computing the worki omponents working for a lifelo	ild and g environ ing of s and c with p	d develop nments in va current Ind design soluti professionals essional deve	system rying do ustry t ons for in va lopmen	applica omains a rends, real v rious e t in com	tion so and plat the world p ngineer	oftware for forms. new hardw problems by ing fields nd automatic	distr are arcl Comm and pu	ributed hitectu nunica Irsue	d ures, ting resea	and the and arch	
PO4 1 PO5 1 PO6 1	Efficiently d centralized Understand t software co effectively orientation	esign, bu computing the worki pomponents working for a lifelo omputer	ild and g environ ing of s and c with p ong profe based	d develop nments in va current Ind lesign soluti professionals essional deve automation	system rying do ustry t ons for in va elopmen syster	applica omains a rends, real v rious e t in com n and	tion so and plat the world p ngineer puter a design	oftware for forms. new hardw problems by ing fields nd automation n algorithm	distr are arcl Comm and pu on arena as that	ributed hitectu nunica irsue s. expl	d ures, ting resea	and the and arch the	
PO4 2 PO5 2 PO6 2	Efficiently d centralized Understand t software co effectively orientation Model a c understandi	esign, bu computing the working mponents working for a lifelo omputer ng of the t	nig. nild and g environ ing of s and c with p ong profe based tradeoffs	d develop nments in va current Ind design solution professionals essional deve automation s involved in	system rying do ustry t ons for in vas clopmen syster digital t	applica omains a rends, real v rious e t in com n and rransform	tion so and plat the world p ngineer nputer a design mation.	oftware for forms. new hardw problems by ing fields nd automation n algorithm	distr are arcl Comm and pu on arena as that	ributed hitectu nunica nrsue s. expl	d ures, ting resea	and the and arch the	
PO4 2 PO5 2 PO6 2	Efficiently d centralized Understand t software co effectively orientation Model a c understandi	esign, bu computing the working mponents working for a lifelo omputer ng of the t	nig. nild and g environ ing of s and c with p ong profe based tradeoffs	d develop nments in va current Ind design solution orofessionals essional deve automation s involved in	system rying do ustry t ons for in va elopmen syster digital t	applica omains a rends, real v rious e t in con n and rransform	tion so and plat the world p ngineer puter a design mation.	oftware for forms. new hardw problems by ing fields nd automation n algorithm	distr are arcl c Comm and pu on arena ns that	ributed hitectu uunica ursue s. expl	d ures, ting resea	and the and arch the	
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Unit I	INTRODUCTION	9 Hours
Mobile	e Computing – Networks – Middleware and Gateways – Developing Mobile	Computing
Applic	cations – Mobile Computing Architecture: Architecture for Mobile Computing – Three-Tie	r
Archite	ecture – Design Considerations for Mobile Computing.	
Un:4 I	TELECOMMUNICATION SYSTEMS	0 Houng
Unit	I IELECOMMUNICATION STSTEMS	9 Hours
Global GSM Auther Teleph	l System for Mobile Communications – GSM Architecture – GSM Entities - Call – GSM Addresses and Identifiers – Network Aspects in GSM – GSM Frequency – ntication and Security -Mobile Computing through Internet –Mobile Computing throug none – Emerging Technologies: - Bluetooth – RFID -Wireless Broadband (WiMax) - Mobile	Routing in Allocation – th IP.
Unit I	II WIRELESS NETWORKS	9 Hours
Wirele Netwo	ess Standards Wireless LAN – IEEE 802.11 – Infrared vs Radio Transmission, Infrastru orks, Ad-hoc Networks, HIPERLAN, Wi-Fi, Emerging Technologies: - Bluetooth – RFID - ess Broadband (WiMax) - Mobile IP.	icture
where		
Unit I Short M – GPF GPRS	V         MOBILE DATA TECHNOLOGIES           Message Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet D           RS Network Architecture – GPRS Network Operations –Data Services in GPRS- App           – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus G	9 Hours Data Network lications for GSM –
Unit I Short M – GPF GPRS Wirele	V       MOBILE DATA TECHNOLOGIES         Message Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet D         RS Network Architecture – GPRS Network Operations –Data Services in GPRS- App         – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus G         ess Data – Third Generation Networks – Applications on 3G.         V       PERVASIVE COMPUTING	9 Hours Data Network lications for GSM – 9 Hours
Unit I Short M – GPR GPRS Wirele	VMOBILE DATA TECHNOLOGIESMessage Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet D RS Network Architecture – GPRS Network Operations –Data Services in GPRS- App – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus C ess Data – Third Generation Networks – Applications on 3G.VPERVASIVE COMPUTING	9 Hours Data Network lications for GSM – 9 Hours
Unit I Short N – GPF GPRS Wirele UNIT Pervas Busine – Trac Machin	V       MOBILE DATA TECHNOLOGIES         Message Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet D         RS Network Architecture – GPRS Network Operations –Data Services in GPRS- App         – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus G         ess Data – Third Generation Networks – Applications on 3G.         V       PERVASIVE COMPUTING         ess – Application Examples: Retail, Airline check-in and booking – Sales force automation – cking – Car information system – E-mail access via WAP – Device Technology: Hardward ne Interfaces – Biometrics – Mobile OS – Programming for Pervasive devices	9 Hours Data Network lications for GSM – 9 Hours 9 Hours Market – m Health care e – Human
Unit I Short N – GPF GPRS Wirele UNIT Pervas Busine – Trac Machin	V       MOBILE DATA TECHNOLOGIES         Message Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet D         RS Network Architecture – GPRS Network Operations –Data Services in GPRS- App         – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus C         ess Data – Third Generation Networks – Applications on 3G.         V       PERVASIVE COMPUTING         sive Computing: Past, Present and Future Pervasive Computing - Pervasive Computing Ness – Application Examples: Retail, Airline check-in and booking – Sales force automation – eking – Car information system – E-mail access via WAP – Device Technology: Hardward ne Interfaces – Biometrics – Mobile OS – Programming for Pervasive devices         Total	9 Hours Data Network lications for BSM – 9 Hours 9 Hours Market – m- Health care e – Human 45 Hours
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Unit I Short N – GPF GPRS Wirele UNIT Pervas Busine – Trac Machin Refere 1. 2. 3.	V         MOBILE DATA TECHNOLOGIES           Message Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet D RS Network Architecture – GPRS Network Operations –Data Services in GPRS- App – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus C ess Data – Third Generation Networks – Applications on 3G.           V         PERVASIVE COMPUTING           ess – Application Examples: Retail, Airline check-in and booking – Sales force automation – eking – Car information system – E-mail access via WAP – Device Technology: Hardward ne Interfaces – Biometrics – Mobile OS – Programming for Pervasive devices           Total           ences           Ashok K.Talukder and Roopa R.Yuvagal, "Mobile Computing", 2nd Edition, Tata McC 2010.           Jochen Burkhardt, Horst Henn, Stefan Heper, Klaus Rindtorff and Thomas Schack, "Perv Computing Technology and Architecture of Mobile Internet Applications" Addison Wesle Uwe Hansmann, L. Merk, M. Nicllous, T. Stober and U.Hansmann, "Pervasive Compu Springer Verlag, 2003.	9 Hours Data Network lications for BSM – 9 Hours 9 Hours Market – m- Health care e – Human 45 Hours Graw Hill, vasive sy, 2002. tting",
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	Pre-requis	ite					Ass	essment	Pattern		• .		
					Mode	of Ass	essmen	t		Wei	ghta	ge(	%)
					Conti	nuous I	nternal	Assessme	ent		40	)	
~					Semes	ster Enc	I Exam	nations			60	)	
Course	Objectives												
•	To understand the types	of optimiz	zation 1	nethod	s.	-							
•	To impart adequate kno	wledge on	optimi	zation	algorith	ms and	unders	tand the	establish	led			
	andproposed variants of	particle sv	warm o	ptimiza	tion								
•	To analyze the performa	ance of par	ticle sv	warm oj	ptimiza	tion in a	applicat	ions					
Program	mme Outcomes (POs)												
<b>PO1</b>	An ability to indepen	ndently ca	rry ou	t resear	ch / ir	nvestiga	tion a	nd develo	opment	work	to s	olv	e
	practical problems.	·	•			C			•				
PO2	An ability to write and	l present a	substa	ntial tec	chnical	report/c	locume	nt.					
PO3	Students should be	e able t	o der	nonstra	te a	degree	of	mastery	over	the	area	0	of
	ComputerScience and	Engineeri	ng.			C		•					
PO4	Efficiently design,	build a	nd d	evelop	syste	m ap	plicatio	n softw	are fo	or d	istrit	ute	d
	andcentralized comput	ting enviro	nment	s in var	ying do	mains a	and plat	forms.					
PO5	Understand the wo	rking of	curre	nt Ind	lustry	trends,	the	new ha	rdware	arch	itect	ures	s,
	thesoftware component	nts and de	esign s	olution	s for r	eal wo	rld pro	blems by	y Comn	nunica	ating	an	d
	effectively working	with pro	fession	als in	variou	is engi	neering	fields	and pu	irsue	rese	arc	h
	orientation for a lifelor	ng profess	ional d	evelopr	nent in	comput	ter and	automati	on arena	s.			
PO6	Model a computer	based a	utomat	tion sy	/stem	and d	esign	algorithr	ns that	exp	lore	th	e
	understanding of the tr	radeoffs in	volved	in digi	tal trans	sformat	ion.	-		-			
Course	Outcomes (COs)												
The stud	lents will be able to												
<b>CO1</b>	Analyze the engineer	ing applica	ation of	f optimi	zation	techniq	ues.						
CO2	Implement the bas	ic optimi	zation	algorit	thms f	or sol	ving c	onstraine	d and	unco	nstra	ine	d
	optimization problem	ıs.		÷			2						
CO3	Apply the modern me	ethods of c	ptimiz	ation te	chniqu	es to so	lve eng	ineering	problem	s usin	g Ma	atlal	b
CO4	Analyze the establish	ed and pro	posed	variants	s of par	ticle sw	arm op	timizatio	n techni	ques.	-		
CO5	Examine the performance of particle swarm optimization techniques.												
	1												
Articula	Articulation Matrix												
		CO. No.	<b>PO1</b>	PO2	PO3	PO4	PO5						

CO. No.	PO1	PO2	PO3	PO4	PO5
1	3	2	2	3	2
2	3	2	1		1
3	3	1	2	1	1
4	3	2	2		1
5	3			1	1

# Unit IINTRODUCTION TO OPTIMIZATION9 Hours

Engineering application of optimization - Statement of an optimization problem - Optimal problem formulation - Classification of optimization problem. Optimum design concepts: Definition of global and local optima - Optimality criteria - Review of basic calculus concepts - Global optimality

## Unit II OPTIMIZATION ALGORITHMS

Optimization algorithms for solving unconstrained optimization problems - Gradient based method: Cauchy's steepest descent method, Newtons method, Conjugate gradient method. Optimization algorithms for solving constrained optimization problems : Direct methods - Penalty function methods – Steepest descent method.

### Unit IIIMODERN METHODS OF OPTIMIZATION9 Hours

Modern methods of Optimization: Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search - Neural-Network based Optimization -Fuzzy optimization techniques -Particle Swarm Optimization- Applications. Use of Matlab to solve optimization problems.

Unit IV ESTABLISHED AND PROPOSED VARIANTS OF PSO

9 Hours

9 Hours

Unified Particle Swarm Optimization - Memetic Particle Swarm Optimization - Vector Evaluated Particle Swarm Optimization - Composite Particle Swarm Optimization A Meta-Strategy Approach – Guaranteed Convergence Particle Swarm Optimization - Cooperative Particle Swarm Optimization - Niching Particle Swarm Optimization - Tribes - Quantum Particle Swarm Optimization.

### UNIT V PERFORMANCE ENHANCING TECHNIQUES 9 H

9 Hours

Introduction-The stretching technique for Alleviating Local Minimisers-The Deflection Technique for Detecting Several Minimisers-The Repulsion Technique-Rounding technique for Integer Optimization Applications of Particle Swarm Optimization.

Total	45 Hours
References	

References

1.DEB. K, Optimization for Engineering Design: Algorithms and Examples, India: PHI Learning, 2012 2.Yang. X, Optimization Techniques and Applications with Examples, United States: Wiley, 2018

3.Nayak. S, Fundamentals of Optimization Techniques with Algorithms, United Kingdom: ElsevierScience, 2020

4.Konstantinos. E, Parsopoulos and Michael N. Vrahatis, Particle Swarm Optimization and Intelligence Advances and Applications, Information Science Reference, IGI Global, New York, 2010.

24XE01		ENG	GLISH	FOR	RESEA	ARCH	PAPEI	R WRI	TING	L	T P	• C
										2	0 0	0
	P	re-requis	site						Assessment Pattern			
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						Co	ontinuo	us Inter	nal Assessment		100	
						Se	mester	End Ex	aminations			
Course Ob	ojectives											
• Illu	strate that	how to in	nprove	your w	riting sl	kills and	d level	of reada	ability.			
• Lea	arn about w	what to wr	ite in e	ach sec	tion.							
• Re	cognize the	e skills ne	eded w	hen wr	iting a 🛛	Fitle.						
• En	sure the go	od quality	of pap	oer at vo	ery first	-time s	ıbmissi	on.				
	C C				•							
Programm	e Outcom	es (POs)										
PO2 A	n ability to	o write and	d prese	nt a sut	ostantia	l techni	cal repo	ort/docu	iment.			
Course Ou	itcomes (C	Os)										
The studen	ts will be a	ble to										
<b>CO1</b>	Illustrate th	e researcl	h ideas	and wr	iting jo	urnal pa	apers.					
CO2	Creating re	search pa	per wri	ting.	03	1	1					
Articulatio	n Matrix											
Alticulation	)   IVIALI IX	CO N	<b>D</b> O1	<b>D</b> O <b>A</b>	DOA	DOA		DOC	]			
		CO. No.	POI	PO2	PO3	PO4	PO5	PO6				
		1		2								
		2		3								
									1			
Unit I											6 H	ours
DI '	1.D		101	D	1'	1		0.		1.4	<u> </u>	
Planning and Being Cond	nd Prepara	tion, Woi moving R	ra Orac	er, Brea	aking u	p long	senten	ces, Str nd Vam	ucturing Paragraphs	and S	senten	ices,
Dellig Colk		moving i	Cuunu	ancy, r	worum	g Allioi	guity ai	iu vagi	uciiess.			
Unit II										<u> </u>	6 H	ours
Clarifying '	Who Did V	Vhat, Higl	hlightir	ng You	r Findin	igs, Heo	lging a	nd Criti	cising, Paraphrasing	and P	lagiar	ism,
Sections of	a Paper, A	bstracts, l	Introdu	ction.		_						
Unit III											6 H	ours
											011	Juis
Review of	the Literatu	ure, Metho	ods, Re	sults, E	Discussi	on, Cor	clusior	is, The	Final Check.			
Unit IV											9 H	ours
Key skills	are neede	d when	writii	ng a	Title,	key s	kills a	are ne	eded when writing	, an	Abst	ract,
key skills	are need	ded whe	en wr	ıtıng	an In	troducti	on, sl	kills n	eeded when writing	ng a	i Re	view
of the Liter	ature.											

UNIT	V	6 Hours						
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed wh								
writing	, the Discussion, skins are needed when writing the Conclusions.							
	Total	30 Hours						
Refere	nces							
1.	Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books	s)						
2.	Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press							
3.	Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.							
4.	Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrech London, 2011.	t Heidelberg						

24XE02		COST M	IANA	GEME	NT OF	ENGI	NEER	ING PI	ROJECTS	L T P C
									A ago game and Do tham	
	P	re-requis			<u> </u>	/ M	ada of		Assessment Pattern	Waightaga(9/
• B	asics of cos	st aspects	and s	tages of	of proje	ct M	oue of	Assessi	nell Assessment	100
es	lecution.						mostor	End Ev	aminations	100
Course	bioativos					30	mester		ammations	
		1.1 .		· 1	1' 00		C	• ,	1.,	
• 1	o understanc	the cost	concep	ots and c	lifferen	t stages	s of pro	ject exe	cution and its activiti	les.
• T	o understand	l cost beh	aviour,	manag	ement a	and its o	quantita	tive tec	chniques.	
Program	me Outcom	es (POs)								
PO1	An ability to practical pro	to indepe blems.	ndently	carry	out res	search	/ inves	stigatior	and development	work to solve
<b>PO3</b> Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.										
PO4	Efficiently	design,	build	and d	evelop	syste	m app	lication	software for dis	stributed and
	centralized of	computing	g enviro	onment	s in var	ying do	mains a	and plat	forms.	
PO5	Understand	the wor	king o	of curr	ent In	dustry	trends	, the	new hardware arcl	hitectures, the
	software co	mponent	s and	design	solutio	ons for	real	world j	problems by Comm	unicating and
	effectively	working	with p	rofessio	onals in	vario	us engi	neering	fields and pursue	research
	orientation f	or a lifeld	ong pro	fession	al devel	opmen	t in con	nputer a	and automation arena	S.
0.0										
Course O	utcomes (C	OS)								
I ne stude	nts will be a	ble to								
CO1	Apply the c	cost conce	epts in o	decision	n makin	g.				
CO2	Analyze the	e various	stages	of proje	ect exec	ution a	nd its a	ctivities	5.	
CO3	Analyze the	e cost beh	aviour	and var	rious ty	pes of o	costing.			
CO4	Analyze the	e cost ma	nageme	ent and	budget	related	decisio	ons.		
Articulat	ion Matrix									
Anticulat		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6		
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									l	
Unit I	Co	st Conce	pts in I	Decisio	n-Maki	ng				6 Hours
D 1					1 .	1.0		•.		
Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.										
Unit II	Pro	oject								9 Hours
Meaning, conception Detailed I document	Different t n to commi Engineering s Project tea	types, wh ssioning. activities m: Role c	Projec Projec . Pre p of each	manage t execu roject e membe	e, cost tion as executio er. Impo	overru conglo on main rtance	ns cen omeration cleara Project	tres, va on of to inces ar site: Da	arious stages of pro echnical and nontech nd ata required with sign	oject execution: mical activities.

## Unit IIICost Behaviour and Profit Planning Marginal Costing9 Hours

Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning.

Unit IV	Total Quality Management and Theory of Constraints	9 Hours

Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V	Quantitative Techniques for Cost Management	9 Hours

Relevant provision of factories Act and rules and other statues applicable to textile industry effluent treatment and waste disposal in textile industry

Total 30 Hours

References

- 1. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.
- 2. Charles T. Horngren and George Foster, Advanced Management Accounting
- 3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
- 4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

24XE03					STRE	ESS MA	ANAGI	EMENI	Γ		L 2	T P	C
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• ]		ome	suess by	practic	ing yog	а.							
Program	me Out	tcom	es (POs)										
1 og un			(1 00)										
PO1	An ahi	lity t	to indepe	ndently	/ carry	out re	search	/ inves	tigation	n and development	work	to solv	
101	practica	al pro	blems.	macinti	carry	out ic	scaren	/ 111003	anganoi	i and development	WOIK	10 3017	
PO2	An abil	ity to	write an	d prese	nt a sub	stantia	l techni	cal repo	ort/docu	iment.			
Course	Jutcom		( <b>O</b> g)	<u>^</u>				-					
The stude	ente will	$\frac{1}{1}$ be a	ble to										
The study	citts with	be a											
CO1	Devel	on he	ealthy min	nd in a l	healthy	body th	nus imp	roving	social ł	nealth also.			
CO2	Impro	ve Ef	fficiency	of the b	ody by	practic	ing brea	athing e	exercise	es and yoga.			
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Articula	tion Ma	trix											
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Unit I												10 Ho	urs
<b>N N N N</b>													
Definitio	ons of Eig	ght p	arts of yo	ga. (As	htanga)	)							
Unit II												10 Uo	1100
Unit II												10 110	ui 5
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santosh.	tapa, swa	adhva	av. ishwa	rpranid	han.	iiiiba, b	atya, a	sine ya,	orunna	aenarya ana aparigra	iia, ii)	Shadel	ia,
,	<b>1</b> ,	<u> </u>	<b>,</b>	1									
Unit III												10 Ho	urs
Asan and	d Pranay	vam, i	i) Variou	s yog p	oses a	nd their	benefi	ts for n	nind &	body ii)Regularizat	ion of	breathi	ng
technique	es and its	s effe	ects-Type	s of pra	nayam.								
										781	-1	20.11	
Defenen	000									101		30 Ho	urs
Kelerend	ces												
1. Y	Yogic A Curriculu	sanas 1m of	s for Gro f Enginee	up Trai ring &	ning-Pa Techno	art-I Jaı ology P(	nardan G Cours	Swami ses [Vo	Yogab lume-I]	hyasi Mandal, Nagp  [ 47 ].	ur. M	odel	
2. F I	Rajayoga Departmo	a or o ent),	conquerii Kolkata.	ng the	Internal	l Natur	e by Sv	wami V	/ivekan	anda, AdvaitaAshra	ma (F	Publicati	on
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24XE04		DISASTER MANAGEMENT											
	Р	re-requis	site			[		,	Assessment Pattern				
• Di	<u>-</u> saster risk r	eduction				М	ode of	Assess	nent	Wei	ghtag	e(%)	
• D1 • Th	e strengths	and weak	nesses	of disa	ster	C	ontinuo	us Inter	nal Assessment		100		
ma	anagement a	approache	es.	01 0150	5001	Se	mester	End Ex	aminations		100		
Course O	biectives	11				1~							
• Le	arn to dem	onstrate a	a critica	al unde	rstandi	ng of k	ey con	cepts ir	n disaster risk reducti	on a	nd		
hu	numanitarian response.												
• Cr pe	itically eval rspectives.	uate disas	ster risl	k reduc	tion and	d huma	nitarian	respon	se policy and practice	e fron	n mult	iple	
• De tyj	• Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.												
• Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.											and		
Programm	ne Outcom	es (POs)											
								<u> </u>					
PO1 A	An ability to practical prop	o independent inde	ndently	carry	out re	search	/ inves	tigatior	and development v	vork	to sol	ve	
<b>PO2</b> A	An ability to	write and	d prese	nt a sub	ostantia	l techni	cal repo	ort/docu	iment.				
Course O	utcomes (C	Os)											
The studer	nts will be a	ble to											
CO1	Illustrate th	e kev cor	cents i	n disast	er risk	reductio	on and l	humani	tarian response				
CO2	Interpret th	e strengt	hs and	weakn	esses (	of disas	ter mar	ageme	nt approaches plann	ino a	nd		
001	programmi	ng.	no una	weakin	000000	i uisus	ter mai	lugeme	in upprouenes, pluin	ing u	na		
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Articulati	on Matrix												
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		CO No	PO1	PO2	PO3	PO4	PO5	PO6	]				
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		11							1				
Unit I	Int	roduction	n								5 He	ours	
Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.													
		<u> </u>											
Unit II	Re	percussio	ons of I	Disaster	rs and	Hazaro	lS				5H	ours	
Economic Earthquake Avalanche Outbreaks	Damage, es, Volcani s Man-mad of Disease	Loss of sms and le disaste and Epide	Huma Cyclo r Nucle emics V	in and ones, T ear Rea Var and	Anima sunami actor M Confli	al Life s and leltdow cts.	, Desta Floods n, Indu	ruction , Drou	of Ecosystem. Nat ghts and Famines, 1 Accidents and Oil SI	ural Lands icks a	Disas slides and S _J	ters: and pills	

TT 14 TT	т		<i>6</i> 11						
Unit II	1	Disaster Prone Areas in India	5 Hours						
G( 1			D T						
Study of	of Seismic	Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas	eas Prone To						
Cyclon	ic And Co	astal Hazards with Special Reference 10 I sunami; Post-Disaster Diseases And E	epidemics.						
Unit I	V	Disaster Preparedness and Management	5 Hours						
Prepare	edness: Mo	onitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk:	Application						
Of Ren	note Sens	ing, Data From Meteorological And Other Agencies, Media Reports: Govern	nmental And						
Comm	unity Prepa	aredness.							
Unit V	•	Disaster Mitigation	9 Hours						
Disaste	r mitigatio	on meaning, concept and strategies of disaster mitigation, emerging trends in	n mitigation.						
Structu	ral mitigat	ion and non-structural mitigation, programs of disaster mitigation in India.	0						
	0								
		Total	30 Hours						
Refere	nces								
1.	R. Nishit Royal bo	h, Singh AK, "Disaster Management in India: Perspectives, issues and strategok Company.	gies ", New						
2.	<ol> <li>Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi</li> </ol>								
3.	Goel S. I Publicatio	"Disaster Administration And Management Text And Case Studies" ,Deep & on Pvt. Ltd., New Delhi.	Deep						

24XE05				VA	LUE E	DUCA	TION				L 2	T P	C
	 	re-reaui	site						Assessment P	attern	4	vv	
• Δ	wareness ah	out ethics	and h	ıman v	alue	M	ode of	Assess	ment	attern	Weig	htage	(%)
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Course C	bjectives												
• Ir	nterpret value	e of educ:	ation ar	nd self-	develo	nment							
- II	mbiba good r		atudont		acteroj	pinent.							
• 11			student	s. •									
• L	et the should	I know ab	out the	import	ance of	t charac	ter.						
Program	me Outcom	es (POs)											
PO1	An ability t	to indepe	ndently	carry	out re	search	/ inves	tigatio	n and develop	oment w	ork (	to solv	/e
	practical pro	blems.											
PO2	An ability to	write and	d prese	nt a sub	stantia	l techni	cal repo	ort/doc	ument.				
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Course C	Dutcomes (C	$\frac{OS}{11}$											
The stude	ents will be a	ble to											
CO1	Knowledge	of self-d	evelop	ment.									
CO2	Learn the in	mportance	e of Hu	man va	lues.								
CO3	Developing	g the over	all pers	onality	•								
Articulat	ion Matrix												
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Unit I												8 Ho	urs
Unit I												0 110	urs
Values ar	nd self-devel	opment- S	Social y	values a	and ind	ividual	attitude	es-Wor	k ethics- India	n vision	of h	amanis	m-
Moral and	d non- moral	valuatior	n-Stand	ards an	d princ	iples-V	alue juc	lgemer	its.				
					<u> </u>	^	•	-					
Unit II												7 Hor	urs
Importance	ce of cultivat	ion of va	lues- Se	ense of	duty D	evotion	- Self-r	eliance	e- Confidence-	Concent	ratio	1-	
Truthfuln	ess- Cleanlir	ness-Hone	esty- H	lumanit	y- Pow	ver of fa	aith- Na	ational	Unity- Patriot	tism- Lo	ove fo	or natu	re-
Discipline	е.												
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Unit III												ð H0	urs
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Universal	hrotherhood	and relia	na IXIIIO	nicos- <i>F</i> derance	-True f	aun 111 friendeb	in-Han	niness	Vs suffering- 1	ove for	truth	n- Aware	of
self-destr	uctive habits	-Associat	ion and	l Coope	ration-	Doing l	best for	saving	nature.	570 101			
								35					

Unit IV		7 Hours
Character and Co	ompetence -Holy books vs Blind faith, Self-management and Good health.	Science of
reincarnation, Eq	uality, Nonviolence ,Humility, Role of Women. All religions and same message	e, Mind your
Mind, Self-contro	l. Honesty, Studying effectively.	-
	Total	30 Hours
References		
1. Chakrobor	ty, S.K. "Values and Ethics for organizations Theory and practice", Oxford	University
Press, Ne	w Delhi.	2

24XE06				PED	<b>DAGO</b>	GY STU	UDIES			L	T P	C
	р	ro-roquis	site						Assessment Pattern	4	UU	U
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Course Ob	iectives					50	mester	Liid LA				
D.							·			1	1	
• Re und	lertaken by	the DfID	, other	agenci	es and i	opic to researcl	ners	progra	mmer design and po	ncy n	laking	
• Ide	ntify critica	al evidenc	e gaps	to guid	le the d	evelopr	nent.					
Programm	e Outcom	es (POs)										
<b>PO1</b> A p	n ability t ractical pro	o indepe blems.	ndently	carry	out re	search	/ inves	stigation	and development	work	to solv	e
Course Ou	tcomes (C	Os)										
The studen	ts will be a	ble to										
CO1	What peda	gogical p	oractice	es are b	being u	sed by	teache	rs in fo	ormal and informal	classr	ooms i	n
CO2	What is the with what r	e evidence opulation	e on th of lea	e effect rners?	tiveness	s of the	se peda	igogical	l practices, in what c	conditi	ons, and	d
<b>CO3</b>	How can te	eacher ed	ucatior	(curri	culum a	and pra	cticum)	) and th	ne school curriculum	and	guidanc	e
1	naterials be	est suppor	rt effec	tive peo	lagogy	? overa	ll perso	nality			2	
L					0 01							
Articulatio	on Matrix											
				•	•	•	•	•	-			
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	1									
		2	1									
		3	1									
Tin:4 T	Int	raduation	r n ond l	Mathad	lology						<b>9</b> II.o.	
Unit I		roductio		vietnot	lology						0 1101	115
Aims and a Curriculum Searching.	ationale- F - Teacher	Policy bac education	ckgrour n-Conc	nd- Cor eptual	rceptua framew	l frame vork- R	work a esearch	nd term 1 questi	ninology-Theories of ions-Overview of m	learni ethodo	ing- ology a	ind
Unit II	Th	ematic O	vervie	W							7 Hou	urs
Pedagogica Curriculum	l practices , Teacher e	are being ducation.	g used	by teac	hers in	formal	and in	formal	classrooms in devel	oping	countrie	es,
Unit III	Evi	idence on	the E	ffective	eness of	f Pedag	ogical	Practic	es		8 Hot	urs
	·											
Methodolo (curriculum pedagogy. Pedagogic	gy for the and pract Theory of a theory and	in depth icum) and change, S pedagogi	trength d the s trength cal app	: qualit chool, ( and na roaches	y asses curricul ature of s, Teacl	ssment lum and the boo ners" at	of incl d guida dy of ev titudes a	luded s nce ma vidence and beli	tudies. How can tea terials best support for effective pedago iefs and Pedagogic st	acher effecti ogical, rategio	education ve practice es.	on es,

Unit I	V Professional Development	7 Hours							
		, 110415							
Alignment with classroom practices and follow up, Support Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.									
	Total	30 Hours							
Refere	nces								
1.	Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare 261.	, 31 (2): 245-							
2.	Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal o Studies, 36 (3): 361-379	f Curriculum							
3.	Akyeampong K (2003) Teacher training in Ghana - does it count. Multi-site teacher educa project (MUSTER) country report 1. London: DFID	ation research							
4.	Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learn maths and reading in Africa: Does teacher preparation count? International Journal Development, 33 (3): 272-282	ning of basic Educational							
5.	Alexander RJ (2001) Culture and pedagogy: International comparisons in primary educa and Boston: Blackwell.	ation. Oxford							

6. Chavan M (2003) Read India: A mass scale, rapid, "learning to read" campaign.

24XE07	07 BUSINESS ANALYTICS										T P	C	
	Pr	e-reauis	site						Assessment Pattern	2	00	U	
• Br	siness analy	tics with	in an o	roaniza	tion	M	ode of	Assess	nent	Wei	ghtage	e(%)	
	isiness anary	ties with	in un o	iguiliza		Co	ontinuo	us Inter	nal Assessment		100		
						Se	mester	End Ex	aminations				
Course O	ojectives												
• Ill	ustrate the ro	le of bus	siness a	nalvtic	s withir	n an org	anizatio	on.					
• Ar	alyze data u derlying bus	using sta	tistical	and da	ata min rganiza	ing tech	hniques	and u	nderstand relationshi	ps be	tween	the	
• To	gain an un	derstand	ing of t mana	how m	anager	s use b makin	usiness	analyt	ics to formulate and	solve	e busii	ness	
• To	To become familiar with processes needed to develop, report, and Analyze business data.												
• Us an	Use decision-making tools/Operations research techniques and Manage business process using analytical and management tools.												
Programm	ne Outcome	s (POs)											
PO1 A	An ability to independently carry out research / investigation and development work to solve practical problems.												
PO4 Eff	ficiently des	sign, bu omputing	ild an g enviro	d developments	elop sy s in var	ystem ying do	applica mains a	tion search stand	oftware for distr forms.	ribute	d a	ınd	
PO6 M	oftware con ffectively worientation for odel a con inderstanding	nponents vorking or a lifelo mputer g of the t	s and with ong prot based radeoff	design profess fessiona auton	solution solution solution al devel nation ved in c	in van in van opmen systen digital t	real v rious e t in con n and ransform	world j ngineer nputer a desig mation.	problems by Comm ring fields and pu and automation arena n algorithms that	s.	ting a resear	ind rch the	
Course On The studer	itcomes (CC	<b>Ds)</b> le to											
CO1	Implement t	he know	ladra c	f data a	nalutio	0							
CO1	Apply the al	$\frac{1000}{1000}$	hink cr	itically	in mak	ing dec	isions l	pased of	n data and deep analy	vtics			
CO3	Analyze the business dec	ability ision-ma	to use aking.	technic	cal skil	ls in p	redicati	ve and	prescriptive modelli	ing to	suppo	ort	
CO4	Determine th	he ability	to trar	nslate d	ata into	clear, a	actional	ole insig	ghts.				
CO5	Analyze the	decision	proble	ems in t	ousiness	s analyt	ics.						
Articulati	on Matrix												
		CO. No.	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6					
	F	1	2			2	1	1					
	F	2	2			2	2	1					
	F	3	- 1			1							
	ŀ	4	1			-							
	F	5	2			1							
	L	·	_			-			ļ				

Unit I Business Analytics and Statistical Tools	6 Hours
Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Re Business Analytics Process and organisation, competitive advantages of Business Analytics-Stat Statistical Notation, Descriptive Statistical methods, Review of probability distribution and dat sampling and estimation methods overview.	lationship of istical Tools: a modelling,
Unit II Trendiness and Regression Analysis	6 Hours
Modelling Relationships and Trends in Data, simple Linear Regression. Important Resource Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing ar Data, Business Analytics Technology.	es, Business ad Exploring
Unit III Organization Structures of Business Analytics	6 Hours
analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimiza         Unit IV       Forecasting Techniques         Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series	tion. 6 Hours or Stationary with
Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Mo	dels.
Unit V Decision Analysis	6 Hours
Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, De The Value of Information, Utility and Decision Making.	cision Trees,
Total	30 Hours
References	
<ol> <li>Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, D. Schniederjans, Christopher M. Starkey, Pearson FT Press</li> </ol>	ara G.
2. Business Analytics by James Evans, persons Education.	