B.E. (Agriculture Engineering)

2015 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE - Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)
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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the B.E. Agricultural Engineering will be able to

1. Acquire knowledge and skill in solving problems in Agriculture through engineering approach
2. Analyze and improve agricultural operations through farm mechanization, land and water management, crop processing, post-harvest handling and energy conservation
3. Develop professionalism in management, entrepreneurship, continuous learning and follow ethics to serve the society

PROGRAMME OUTCOMES (POs)

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

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

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

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

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

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

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

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

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

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

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

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

Mapping of PEOs and POs

PEO	Programme Educational Objective(s)	Program Outcome(s)
I	To acquire training and knowledge in design and engineering problems solving approach in agriculture based on understanding of engineering science including mathematics, physics and biology	(a), (b), (c) (d) and (e)
II	Acquire an adequate knowledge to make farming sustainable, self and environmentally friendly. They analyze agricultural operation and weigh the use of new technique and methods to increase yields, improve land use and conserve resource like seed, water, fertilizer, pesticide and fuel	(a), (b),(c), (d), (e), (f), (h) and (i)
III	To improvise better ways to minimize the crop loss from field damage during handling, sorting, processing and packaging	(a),(b),(c), (d) and (e)
IV	To acquire good knowledge in ICT(Information and Communication Technology), teamwork and instrumentation.	(d),(f),(g), (h) (i) and (j)

CURRICULUM 2015

B.E. AGRICULTURE ENGINEERING
Minimum Credits to be Earned: 177

FIRST SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA101	MATRICES AND CALCULUS*	I, II	a,b	3	2	0	4	50	50	100	BS
15PH102	ENGINEERING PHYSICS*	I, II	a	2	0	2	3	50	50	100	BS
15CH103	ENVIRONMENTAL SCIENCE*	I, II	g	2	0	2	3	50	50	100	HSS
	LANGUAGE ELECTIVE I#	-	-	-	-	-	3	100	-	100	HSS
15GE105	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERINGΔ	I, II	a	2	0	2	3	50	50	100	ES
15AG106	FUNDAMENTALS OF SOIL SCIENCE	I, II	a, b	2	0	2	3	50	50	100	PC
15GE107	WORKSHOP PRACTICEΩ	I, II	a, e	0	0	2	1	50	50	100	ES
			Total	11	2	10	20	**400**	**300**	**700**	-

SECOND SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA201	VECTOR CALCULUS AND COMPLEX ANALYSIS*	I, II	a,b	3	2	0	4	50	50	100	BS
	PHYSICS ELECTIVE*	-	-	-	-	-	4	50	50	100	BS
	CHEMISTRY ELECTIVE*	-	-	-	-	-	4	50	50	100	BS
	LANGUAGE ELECTIVE II#	-	-	-	-	-	3	100	-	100	HSS
15AG205	ENGINEERING GEOLOGY AND SOIL MECHANICS	I, II	g	2	0	2	3	50	50	100	PC
15GE206	COMPUTER PROGRAMMINGΨ	I, II	a, c	3	0	2	4	50	50	100	ES
15GE207	ENGINEERING GRAPHICSλ	I, II	a, b, d, e	0	0	4	2	50	50	100	ES
			Total	8	2	8	24	**400**	**300**	**700**	-

* Common to all branches of B.E./B.Tech
# Common to all branches of B.E./B.Tech (Continuous Assessment)
Δ Common to AE,AG,AU,CE,ME,MTRS, BT,TT,FD (I Semester) and to CSE,FT,IT (II Semester)
Ω Common to AE, AG,AU,ME,MTRS, BT,FT,TT ,FD (I Semester) and to CE,CSE,ECE,EEE,EIE,IT (II Semester)
Ψ Common to CE (I Semester) and to AE,AG,AU, ME,MTRS, BT,FT,TT,FD (II Semester)
λ Common to CE,CSE,ECE,EEE,EIE,IT (I Semester) and to AE, AG,AU,ME,MTRS, BT,FT,TT, FD (II Semester)

THIRD SEMESTER											
Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA301	FOURIER SERIES AND TRANSFORMS[α]	I, II	a,b	3	2	0	4	50	50	100	BS
15AG302	ENGINEERING THERMODYNAMICS	I, II	a,b,c,e,f,g,i,j.l	3	2	0	4	50	50	100	ES
15AG303	ENGINEERING MECHANICS	I, II	a,b,c,e,f,g,i,j.l	3	2	0	4	50	50	100	ES
15AG304	FLUID MECHANICS AND MACHINERY	I, II	a,b,c,d,i,j.k	3	0	0	3	50	50	100	ES
15AG305	ENGINEERING SURVEY	I, II	a,b,d,e,g,i,j,l	3	0	0	3	50	50	100	ES
15AG306	SOIL AND WATER CONSERVATION ENGINEERING	I, II	a,b,e,f,g,h	2	2	0	3	50	50	100	PC
15AG307	FLUID MECHANICS AND MACHINERY LABORATORY	I, II,III	a,b,c,d,i,j,k,l	0	0	2	1	50	50	100	ES
15AG308	ENGINEERING SURVEY LABORATORY	I, II,III	a, b,d,e,g,i,l	0	0	2	1	50	50	100	ES
15AG309	MINI PROJECT I	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE310	LIFE SKILLS: BUSINESS ENGLISH[Φ]	III	j	0	0	2	-	100	-	100	EEC
Total				17	8	8	24	**600**	**400**	**1000**	-
FOURTH SEMESTER											
Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA401	NUMERICAL METHODS AND STATISTICS[β]	I, II	a,b,c,f,i,j,l	2	2	0	3	50	50	100	BS
15AG402	THEORY OF MACHINES	I, II	a,b,c,e,f,g,i,j,l	3	0	0	3	50	50	100	ES
15AG403	HEAT AND MASS TRANSFER	I, II	a,b,c,e,f,g,i,j,l	2	0	2	3	50	50	100	ES
15AG404	STRENGTH OF MATERIALS	I, II	a,b,c,e,f,g,i,j,l	3	2	0	4	50	50	100	ES
15AG405	DESIGN OF FARM STRUCTURES	I, II	a,b,c,f,g,h,i,j,l	3	0	0	3	50	50	100	PC
15AG406	IRRIGATION AND DRAINAGE ENGINEERING	I, II	a,b,c,d,e,g,i,j,l	3	0	0	3	50	50	100	PC
15AG407	CROP HUSBANDRY LABORATORY	I, II, III	a,b,c,d,e,f,g,i,j,l	0	0	4	2	50	50	100	PC
15AG408	IRRIGATION AND DRAINAGE ENGINEERING LABORATORY	I, II, III	a,b,c,d,e,g,i,j,l	0	0	2	1	50	50	100	PC
15AG409	MINI PROJECT II	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE410	LIFE SKILLS: VERBAL ABILITY[Φ]	III	j	0	0	2	-	100	-	100	EEC
Total				16	4	12	23	**600**	**400**	**1000**	-

[α] Common to all branches of B.E./B.Tech. except CSE

[Φ] Common to all branches of B.E./B.Tech (Non-Credit Course)

[β]Common to AG,AU,ME,MTRS,EEE,EIE,BT,TT,FT,FD

FIFTH SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15AG501	UNIT OPERATIONS IN FOOD PROCESS ENGINEERING	I, II	a,b,c,d,e,g,i,j,l	3	0	0	3	50	50	100	PC
15AG502	TRACTORS AND FARM ENGINES	I, II	a,b,c,d,e,g,i,j,l	3	0	0	3	50	50	100	PC
15AG503	FARM IMPLEMENTS AND EQUIPMENT	I, II	a,b,c,d,e,,i,j,l	3	0	2	4	50	50	100	PC
15AG504	HYDROLOGY	I, II	a,b,c,d,e,g,i,j,l	3	2	0	4	50	50	100	PC
	ELECTIVE I	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE II	-	-	-	-	-	3	50	50	100	PE
15AG507	UNIT OPERATIONS IN FOOD PROCESS ENGINEERING LABORATORY	I, II, III	a,b,c,d,e,g,i,j,l	0	0	2	1	50	50	100	PC
15AG508	TRACTORS AND FARM ENGINES LABORATORY	I, II, III	a,b,c,d,e,g,i,j,l	0	0	2	1	50	50	100	PC
15AG509	TECHNICAL SEMINAR I	II, III	i,j	0	0	2	1	50	50	100	EEC
15AG510	MINI PROJECT III	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE511	LIFE SKILLS: APTITUDE I[Φ]	III	a,b	0	0	2	-	100	-	100	EEC
Total				12	2	12	24	**650**	**450**	**1100**	-

SIXTH SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			
		PEOs	POs					CA	ES	Total	Category
15AG601	TRANSFER OF TECHNOLOGY	II, III	f,g,h,i,j,l	2	0	0	2	50	50	100	PC
15AG602	CROP PROCESS ENGINEERING	I, II	a,b,c,d,e,g,i, j,l	3	0	0	3	50	50	100	PC
15AG603	DESIGN OF AGRICULTURAL MACHINERY	I, II	a,b,c,d,e,g.i, j,l	3	0	0	3	50	50	100	PC
15AG604	DESIGN OF MICRO IRRIGATION SYSTEMS	I, II	a,b,c,d,e,g,i, j,l	2	2	0	3	50	50	100	PC
	ELECTIVE III	-		-	-	-	3	50	50	100	PE
	ELECTIVE IV	-		-	-	-	3	50	50	100	PE
15AG607	CROP PROCESS ENGINEERING LABORATORY	I, II, III	a,b,c,d,e,g,i, j,l	0	0	2	1	50	50	100	PC
15AG608	COMPUTER AIDED MODELING LABORATORY	I, II, III	a,b,c,d,e,i,j,l	0	0	2	1	50	50	100	PC
15AG609	TECHNICAL SEMINAR II	II,III	j	0	0	2	1	50	50	100	EEC
15AG610	MINI PROJECT IV	II,III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE611	LIFE SKILLS: APTITUDE II[Φ]	III	a,b	0	0	2	-	100	-	100	EEC
Total					10	2	10	21	**650**	**450**	**1100**

[Φ] Common to all branches of B.E./B.Tech (Non-Credit Course)

SEVENTH SEMESTER											
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**	**Maximum Marks**			
		PEOs	**POs**					**CA**	**ES**	**Total**	**Category**
15GE701	AGRICULTURAL ECONOMICS[$]	III	a,b,c,e,k,l	3	0	0	3	50	50	100	HSS
15AG702	FOOD AND DAIRY ENGINEERING	I, II	a,b,c,d,e,g,i,j,k,l	3	0	0	3	50	50	100	PC
15AG703	RENEWABLE ENERGY RESOURCES	I, II	a,b,c,d,e,g,i,j,k,l	3	0	2	4	50	50	100	PC
15AG704	RS AND GIS FOR NATURAL RESOURCE MANAGEMENT	I, II	a,b,c,d,e,g,i,j,k,l	3	0	2	4	50	50	100	PC
	ELECTIVE V	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE VI	-	-	-	-	-	3	50	50	100	PE
15AG707	FOOD AND DAIRY ENGINEERING LABORATORY	I, II, III	a,b,c,d,e,g,i,j,k,l	0	0	2	1	50	50	100	PC
15AG708	OPERATION AND MAINTENANCE OF TRACTOR AND FARM IMPLEMENTS LABORATORY	I, II, III	a,b,c,d,e,,i,j,l	0	0	2	1	50	50	100	PC
15AG709	MINI PROJECT V	II,III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE710	LIFE SKILLS : COMPETITIVE EXAMS[Φ]	III	a,b,l	0	0	2	-	100	-	100	EEC
Total				12	0	12	23	**600**	**400**	**1000**	-

EIGHT SEMESTER											
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**	**Maximum Marks**			
		PEOs	**POs**					**CA**	**ES**	**Total**	**Category**
	ELECTIVE VII	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE VIII	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE IX	-	-	-	-	-	3	50	50	100	PE
15AG804	PROJECT WORK	I,II,III	a-l	-	-	-	9	50	50	100	EEC
Total				-	-	-	**18**	**200**	**200**	**400**	-

[$] Common to CSE,ECE,EEE,EIE,IT (VI Semester) and to AE, AG,AU,CE,ME,MTRS,BT,FT,TT, FD (VII Semester)

[Φ] Common to all branches of B.E./B.Tech (Non-Credit Course)

ELECTIVES							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
LANGUAGE ELECTIVES							
15LE101	BASIC ENGLISH I	III	j	3	0	0	3
15LE102	COMMUNICATIVE ENGLISH I	III	j	3	0	0	3
15LE201	BASIC ENGLISH II	III	j	3	0	0	3
15LE202	COMMUNICATIVE ENGLISH II	III	j	3	0	0	3
15LC203	CHINESE	III	j	3	0	0	3
15LF203	FRENCH	III	j	3	0	0	3
15LG203	GERMAN	III	j	3	0	0	3
15LH203	HINDI	III	j	3	0	0	3
15LJ203	JAPANESE	III	j	3	0	0	3
PHYSICS ELECTIVES							
15PH201	PHYSICS OF MATERIALS	I	a	3	0	2	4
15PH202	APPLIED PHYSICS	I	a	3	0	2	4
15PH203	MATERIALS SCIENCE	I	a	3	0	2	4
15PH204	PHYSICS OF ENGINEERING MATERIALS	I	a	3	0	2	4
15PH205	SOLID STATE PHYSICS	I	a	3	0	2	4
CHEMISTRY ELECTIVES							
15CH201	ENGINEERING CHEMISTRY	I	a	3	0	2	4
15CH202	APPLIED CHEMISTRY	I	a	3	0	2	4
15CH203	APPLIED ELECTROCHEMISTRY	I	a	3	0	2	4
15CH204	INDUSTRIAL CHEMISTRY	I	a	3	0	2	4
15CH205	WATER TECHNOLOGY AND GREEN CHEMISTRY	I	a	3	0	2	4
DISCIPLINE ELECTIVES							
15AG001	BUILDING MATERIALS, ESTIMATION AND COSTING	I, II	a,c,e,i,j,l	3	0	0	3
15AG002	REFRIGERATION AND AIR CONDITIONING	I, II	a,b,c,d,e,f, i,j,k,l	3	0	0	3
15AG003	STORAGE AND PACKAGING TECHNOLOGY	I, II	a,b,c,d,e,g, i,k,l	3	0	0	3
15AG004	TECHNOLOGY OF SEED PROCESSING	I, II	a,b,c,d,e,g, i,k,l	3	0	0	3
15AG005	FAT AND OIL PROCESSING	I, II	a,b,c,d,e,g, i,k,l	3	0	0	3
15AG006	HORTICULTURAL CROP PROCESS ENGINEERING	I, II	a,b,c,d,e,g, i,k,l	3	0	0	3

15AG007	SUGAR TECHNOLOGY	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG008	BIO AND THERMO CHEMICAL CONVERSION OF BIOMASS	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG009	SOLAR AND WIND ENGINEERING	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG010	ENERGY CONSERVATION IN AGRO BASED INDUSTRY	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG011	CO-GENERATION AND WASTE HEAT RECOVERY SYSTEMS	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG012	PROTECTED CULTIVATION	I, II	a,b,c,d,e,g, i,j,k,l	3	0	0	3
15AG013	WATERSHED HYDROLOGY AND MANAGEMENT	I, II	a,b,c,d,f,g, i,j,k,l	3	0	0	3
15AG014	RESEVOIR AND FARM POND DESIGN	I, II	a,b,c,d,e,g,k,l	3	0	0	3
15AG015	HARVESTING AND THRESHING MACHINERY	I, II	a,b,c,d,e.i,j,l	3	0	0	3
15AG016	MECHANICS OF TILLAGE AND TRACTION	I, II	a,b,c,d,e.i,j,l	3	0	0	3
15AG017	PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY	I, II	a,b,c,d,e.i,j,l	3	0	0	3
15AG018	HUMAN ENGINEERING AND SAFETY	I, II,III	a,b,c,d,e,g,h, i,j,k ,l	3	0	0	3
15AG019	DISASTER MANAGEMENT	II, III	a,b,d,f,g,h, i,j,k,l	3	0	0	3
15AG020	CDM AND CARBON TRADING TECHNOLOGY	I, II	a,b,c,e,f,g,h, i,j,k ,l	3	0	0	3
15AG021	CLIMATE CHANGE AND ADAPTATION	II, III	a,b,c,e,f,g,h, i,j,k ,l	3	0	0	3
15AG022	AGRICULTURAL MARKETING	II, III	b,d,g,h, i,j,k,l	3	0	0	3
15AG023	PLANT PROTECTION	II,III	a,b,c,e,f,g,h, i,k,l	3	0	0	3
15AG024	EMERGING TECHNOLOGIES IN FOOD PROCESS ENGINEERING	I, II	a,b,c,d,e,f, i,j,k,l	3	0	0	3
15AG025	PRODUCTION TECHNOLOGY OF HORTICULTURAL CROPS LABORATORY	I, II, III	a,b,c,d,e,f,g,i,j,l	3	0	0	3
15AG026	MUSHROOM PRODUCTION TECHNOLOGY	II,III	a,b,c,e,f,g,h, i,k,l	3	0	0	3
15AG027	AGRI BUSINESS MANAGEMENT AND ENTREPRENEURSHIP	I, II, III	a,b,c,d,e,f,g,i,j,l	3	0	0	3
15AG028	AGRICULTURAL FINANCE, BANKING AND CO-OPERATION	I, II, III	a,b,c,d,e,f,g,i,j,l	3	0	0	3
ENTREPRENEURSHIP ELECTIVES							
15GE001	ENTREPRENEURSHIP DEVELOPMENT I	II	b,c,d, e, f & k	3	0	0	3
15GE002	ENTREPRENEURSHIP DEVELOPMENT II	II	b,c, h, i, j & k	3	0	0	3
PHYSICAL SCIENCE ELECTIVES							
15GE0P1	NANOMATERIALS SCIENCE	I,II	a	3	0	0	3
15GE0P2	SEMICONDUCTOR PHYSICS & DEVICES	I,II	a	3	0	0	3
15GE0P3	APPLIED LASER SCIENCE	I,II	a	3	0	0	3
15GE0C1	CORROSION SCIENCE	I,II	a	3	0	0	3
15GE0C2	ENERGY STORING DEVICES AND FUEL CELLS	I,II	a	3	0	0	3
15GE0C3	POLYMER CHEMISTRY AND PROCESSING	I,II	a	3	0	0	3

OPEN ELECTIVES							
15AG0YA	ENTREPRENEURSHIP DEVELOPMENT AND FOOD QUALITY MANAGEMENT IN FOOD INDUSTRY	II, III	b,d,g,h,i,j,k,l,	3	0	0	3
15AG0YB	HUMAN ENGINEERING AND SAFETY IN AGRICULTURE	II,III	a,b,c,d,f,g,h,l	3	0	0	3
15AG0YC	ENERGY MANAGEMENT IN AGRICULTURE	II, III	a,b,c,d,f,g,h,l	3	0	0	3
15AG0YD	FARM MECHANISATION	II, III	a,b,c,d,f,g,h,l	3	0	0	3
ONE CREDIT COURSES							
15AG0XA	OPERATION AND MAINATNCE OF MICRO IRRIGATION SYSTEM	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XB	CUSTOM HIRING CENTRE	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XC	AGRO PROCESSING CENTRE	II, III	a,b,f,g,h,i,j,k,l	1	0	0	1
15AG0XD	LANDSCAPE DESIGNING AND ARCHITECTURE	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XE	TRAINING ON THE MANUFACTURE OF AGRICULTURAL IMPLEMENTS	II, III	a,b,c,g,h,i,k,l	1	0	0	1
15AG0XF	TRAINING ON MAINTENANCE ASPECTS OF TRACTOR/COMBINE HARVESTER/POWER TILLER	II, III	a,b,f,g,h,i,j,k,l	1	0	0	1

ADDITIONAL ONE CREDIT COURSES (I to III Semesters)					
15GE0XA	HEALTH & FITNESS	-	-	-	1
15GE0XB	FOUNDATION COURSE IN COMMUNITY RADIO TECHNOLOGY	-	-	-	1
15GE0XC	VEDIC MATHEMATICS	-	-	-	1
15GE0XD	INTRODUCTION TO ALGORITHMS	-	-	-	1
15GE0XE	ETYMOLOGY	-	-	-	1
15GE0XF	HINDUSTANI MUSIC	-	-	-	1
15GE0XG	CONCEPT, METHODOLOGY AND APPLICATIONS OF VERMICOMPOSTING	-	-	-	1
15GE0XH	AGRICULTURE FOR ENGINEERS	-	-	-	1
15GE0XI	INTRODUCTION TO DATA ANALYSIS USING SOFTWARE	-	-	-	1
15GE0XJ	ANALYSIS USING PIVOT TABLE	-	-	-	1

VALUE ADDED COURSES		-
15AGV01	ORGANIC FARMING	-
15AGV02	EXTENSION EDUCATION AND TRANSFER OF TECHNOLOGY	-
15AGV03	COCONUT PROCESSING AND VALUE ADDITION	-
BRIDGE COURSES		-
15AGB01	BASIC ENGLISH I	-
15AGB02	VECTOR CALCULUS AND COMPLEX ANALYSIS	-

SUMMARY OF CREDIT DISTRIBUTION

S.No	Category	Credits per semester								Total Credit	Credits in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	7	12	4	3	-	-	-	-	26	15	15%	20%
2	ES	4	6	16	10	-	-	-	-	36	20	15%	20%
3	HSS	6	3	-	-	-	-	3	-	12	7	5%	10%
4	PC	3	3	3	9	16	13	13	-	60	34	30%	40%
5	PE	-	-	-	-	6	6	6	9	27	15	10%	15%
6	EEC	-	-	1	1	2	2	1	9	16	9	10%	15%
Total		20	24	24	23	24	21	23	18	177	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

15MA201 VECTOR CALCULUS AND COMPLEX ANALYSIS

3 2 0 4

Course Objectives

- Implement the Complex Analysis, an elegant method in the study of heat flow, fluid dynamics and electrostatics.
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of Calculus viz: Differentiation, Integration and Vectors.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Determine & apply the important quantities associated with vector fields such as the divergence, curl and scalar potential.
2. Students will be able to apply the theoretical aspects of vector integral calculus in their core areas.
3. The students will be able to recognize the differentiation properties of vectors.
4. The students will be able to identify the complex functions and their mapping in certain complex planes.
5. The students will be able to use the concepts of integration to complex functions in certain regions.

UNIT I **10 Hours**

VECTOR CALCULUS

Gradient -Divergence -Curl - Directional derivative- Solenoidal -Irrotational vector fields -Line Integral -Surface integrals.

UNIT II **9 Hours**

INTEGRAL THEOREMS OF VECTOR CALCULUS

Green's theorem in a plane- Stoke's Theorem- Gauss divergence theorem- Applications involving cubes and parallelepiped.

UNIT III **8 Hours**

ANALYTIC FUNCTIONS

Analytic Functions- Necessary and Sufficient conditions of Analytic Function- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method -Applications to the problems of Potential Flow.

UNIT IV **8 Hours**

MAPPING OF COMPLEX FUNCTIONS

Physical interpretation of mapping- Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).

UNIT V **10 Hours**

INTEGRATION OF COMPLEX FUNCTIONS

Cauchy's Fundamental Theorem - Cauchy's Integral Formula - Taylor's and Laurent's series- Classification of Singularities - Cauchy's Residue Theorem.

SELF STUDY

Applications to Electrostatic and Fluid Flow.

Total: 75 Hours

Reference(s)

1. C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-HillPublishing Company Ltd, 2003
2. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi 2015
3. J. A. Brown and R. V. Churchill, Complex Variables and Applications , Sixth Edition, McGraw Hill,New Delhi, 1996
4. B. S. Grewal, Higher Engineering Mathematics, Forty third Edition, Khanna Publications , New Delhi 2014
5. Peter V. O. Neil, Advanced Engineering Mathematics, Seventh Edition ,Cengage Learning India Private Limited, 2012
6. Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India,2007

15AG205 ENGINEERING GEOLOGY AND SOIL MECHANICS

2 0 2 3

Course Objectives

- To acquire the knowledge on engineering geology and basic geomorphic processes
- To impart knowledge on applied geomorphology and hydrogeology
- To gain knowledge on soil mechanics and the procedures to test the soil interns of dam and reservoir construction

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃƒÂ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

Course Outcomes (COs)

1. Understand the basic geomorphic processes
2. Apply suitable technique/procedure in dam and reservoir construction
3. Assess the concepts of hydraulics soil process of through
4. Realize the concepts of soil of water relationship students will be able to
5. Analyze the fundamental concepts of soil strength

UNIT I **8 Hours**

GEOLOGY AND APPLIED GEOLOGY

Introduction to Geology and Engineering Geology - importance - Earth's layers -Geological structures - Geomorphology - Concepts - Processes and Forms - Fluvial and Eolian Geomorphology-Drainage analysis-Watershed characteristics - Channel Geomorphology-Drainage pattern - Hydrogeology-Hydrological cycle - Water table-Aquifer - Groundwater flow - Well hydraulics - water quality

UNIT II **6 Hours**

SITE INVESTIGATION AND CONSTRUCTION

Hydrogeological Investigations - surface and sub surface - Approach - Content -Cost - Desk study - Field reconnaissance - Field investigations - Construction records - Reservoirs construction-Dams and

Dam Sites - Parambikulam -Aliyar Project - Geology of Tamil Nadu - Remote Sensing and GIS applications in Water Resources Project Monitoring.

UNIT III **6 Hours**

FLOW HYDRAULICS THROUGH SOIL

Permeability - Darcy's law-discharge velocity Ã¢?? validity of DarcyÃ¢??s law- seepage velocity - Factors affecting permeability - Hydraulics of laminar flow through soils-Seepage - Drainage Ã¢?? Properties of Flow net - Determination of specific gravity - soil consistency - Atterberg limits Ã¢?? liquid limit, plastic limit and shrinkage limit Ã¢?? relative density of cohesion less soil

UNIT IV **4 Hours**

COMPACTION AND CONSOLIDATION

Compaction - objectives -relationship with water content- the Standard Proctor compaction test - factors affecting compaction-methods of compaction in field - Compressibility -coefficient of Compressibility - Consolidation of soils -stages of consolidation.

UNIT V **6 Hours**

STRENGTH OF SOILS

Shear strength concept of shearing resistance and shearing strength - Coulomb's law - Mohr's circle of stresses - Earth pressure at rest - active pressure - passive pressure - Bearing capacity of soils- method of improving the bearing capacity of soils

SELF STUDY

Geology of sedimentary basins in Tamil Nadu-Case study-consolidation of soil-ground improvement

1 **3 Hours**

EXPERIMENT 1

Determination of field density by core cutter method and sand replacement method

2 **3 Hours**

EXPERIMENT 2

Mechanical analysis of soil sieving

3 **3 Hours**

EXPERIMENT 3

Hydrometer analysis for grain size distribution

4 **3 Hours**

EXPERIMENT 4

Determination of Atterberg limits of soil consistency

5 **3 Hours**

EXPERIMENT 5

Determination of hydraulic conductivity by constant permeameter and variable head permeameter

6 **3 Hours**

EXPERIMENT 6

Proctor compaction test of soils

7 **3 Hours**

EXPERIMENT 7

Consolidation test of soils

8 **3 Hours**

EXPERIMENT 8

Direct shear test of soil

9 **3 Hours**

EXPERIMENT 9

Problems on Bearing Capacity, Permeability, Compaction and Compressibility

10 **3 Hours**

EXPERIMENT 10

Field visit Landslides areas and control measures

Total: 60 Hours

Reference(s)

1. A.Parthasarathy, V.Panchapakesan and R.Nagarajan, A textbook of Engineering Geology, Wiley publication, 2013.
2. F.G.Bell, A text book of Engineering Geology, Second Edition, Elsevier, 2007.
3. F.G.H Blyth and M.H Freitas, A textbook of Geology for Engineers, 7th Edition, Elsevier Publication, 2006.
4. B.C.Punmia, Soil Mechanics and Foundation, Laxmi publishers, New Delhi,2004.
5. S.K. Garg, Soil mechanics, Khanna publishers, New Delhi, 2005.
6. V.N.S. Murthy, A textbook of Soil Mechanics and Foundation Engineering, Sri Kripa Technical Consultants, Bangalore, 2008.

15GE206 COMPUTER PROGRAMMING 3 0 2 4

Course Objectives

- To learn the basics of computer organisation.
- To study the basics of C primitives, operators and expressions.
- To understand the different primitive and user defined data types.

Programme Outcomes (POs)

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

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

Course Outcomes (COs)

1. Develop solutions using problem solving techniques and number system conversions
2. Develop programs using operators, type conversion and input-output functions
3. Apply decision making and looping statements in writing C programs
4. Apply the concepts of arrays and strings in developing C programs
5. Design applications using structures and functions in C

UNIT I **8 Hours**

INTRODUCTION TO COMPUTERS

Introduction to computers - Characteristics of Computers - Evolution of Computers - Computer Generations - Basic Computer Organization - Number System - Problem Solving Techniques - Features of a Good Programming Language.

UNIT II **9 Hours**

INTRODUCTION TO C PROGRAMMING

Overview of C-Structure of C program-Keywords-Constants- Variables-Data types-Type conversion Operators and Expressions: Arithmetic-Relational-Logical-Assignment- Increment and Decrement-Conditional-Bitwise -Precedence of operators-Managing I/O operations-Formatted I/O-Unformatted I/O.

UNIT III **10 Hours**

CONTROL STATEMENTS

Decision Making and Branching: simple if statement-if else statement-nesting of if else Statement-Switch Statement.Decision Making and Looping: while statement-do while statement-for statement-Nested for statement Jump Statements: goto-break-continue-return statement

UNIT IV **9 Hours**

ARRAYS AND STRINGS

Arrays: Introduction, one dimensional array, declaration - Initialization of one dimensional array, two-dimensional arrays, initializing two dimensional arrays, multi dimensional arrays. Strings: Declaring and initializing string variables- Reading strings from terminal - writing string to screen - String handling functions.

UNIT V **9 Hours**

STRUCTURES AND FUNCTIONS

Structures and Unions: Introduction-defining a structure- declaring structure variables-accessing structure members- structure initialization-Unions-Enumerated data type
User Defined Functions: Elements of user defined functions -Definition of functions-return values and their types- function calls-function declaration-categories of function -call by value and call by reference-recursion-Preprocessor directives and macros.

FOR FURTHER READING

Creating and manipulating document using word - Mail merge - Creating spread sheet with charts and formula using excel - developing power point presentation with Animations - C graphics using built in functions

1 **3 Hours**

EXPERIMENT 1

Write a C program to perform arithmetic operations on integers and floating point numbers.

2 **3 Hours**

EXPERIMENT 2

Write a C program to implement ternary operator and relational operators.

3 **3 Hours**

EXPERIMENT 3

Write a C program to find the greatest of three numbers using if-else statement.

4 **3 Hours**

EXPERIMENT 4

Write a C program to display the roots of a quadratic equation with their types using switch case.

5 **3 Hours**

EXPERIMENT 5

Write a C program to generate pyramid of numbers using for loop.

6 **4 Hours**

EXPERIMENT 6

Write a C program to perform Matrix Multiplication

7 **3 Hours**

EXPERIMENT 7

Write a C program to check whether the given string is Palindrome or not.

8 **4 Hours**

EXPERIMENT 8

Write a C program to find the factorial of given number.

9 **4 Hours**

EXPERIMENT 9

Design a structure to hold the following details of a student. Read the details of a student and display them in the following format Student

details: rollno, name, branch, year, section, cgpa.

Total: 75 Hours

Reference(s)

1. Pradeep K. Sinha, Priti Sinha, Computer Fundamentals, BPB publications, 2008
2. Ashok. N. Kamthane, Computer Programming, Second Edition, Pearson Education, 2012
3. E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012
4. Herbert Schildt, C -The complete Reference, Tata McGraw-Hill, 2013
5. Byron Gottfried, Programming with C, Schaum's Outlines, Tata Mcgraw-Hill, 2013

15GE207 ENGINEERING GRAPHICS 0 0 4 2

Course Objectives

- To learn conventions and use of drawing tools in making engineering drawings.
- To draw orthographic projections of points, line and solids.
- To draw the section of solids and development of surfaces of the given objects.
- To draw the isometric projections and perspective projections of the given solids.
- To introduce CAD software to draw simple two dimensional drawings.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Recognize the conventions and apply dimensioning concepts while drafting simple objects.
2. Draw the orthographic projection of points, line, and solids.
3. Draw the section of solid drawings and development of surfaces of the given objects.
4. Draw the isometric and perspective projection of the given objects.
5. Draw the simple two dimensional drawings using computer aided drawing tool.

1 **12 Hours**

CONVENTIONS AND BASIC DRAWINGS

Importance - conventions - ISO and BIS - drawing tools and drawing sheets - lettering, numbering, dimensioning, lines and Symbols-Conic sections - types constructions -ellipse, parabola and hyperbola - eccentricity and parallelogram method.

2 **14 Hours**

ORTHOGRAPHIC PROJECTIONS

Principles - first and third angle projections - Points - first angle projection of points, straight lines - parallel, perpendicular and inclined to one reference plane, solid - cylinders, pyramids, prisms and cones.

3 **12 Hours**

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACE

Section of solids - simple illustrations. Development of surfaces - cylinders, pyramids, prisms, cones and simple truncated objects.

4 **12 Hours**

ISOMETRIC AND PERSPECTIVE PROJECTIONS

Importance - orthographic to isometric projection - simple and truncated solids- perspective projections of simple solids.

5 **10 Hours**

INTRODUCTION TO COMPUTER AIDED DRAWING (NOT FOR END SEMESTER EXAMINATION)

Basics commands of AutoCAD - two dimensional drawing, editing, layering and dimensioning - coordinate Systems -Drawing practice - orthographic views of simple solids using AutoCAD.

Total: 60 Hours

Reference(s)

1. K Venugpoal, Engineering Drawing and Graphics, Third edition, New Age International, 2005.
2. Basant Agrawal, Mechanical drawing, Tata McGraw-Hill Education, 2008.
3. Engineering Drawing Practice for Schools & Colleges, BUREAU OF INDIAN STANDARDS-SP46, 2008.
4. N. D. Bhatt and V. M. Panchal, Engineering Drawing, Charotar Publishing House Pvt. Limited, 2008.
5. K.V.Natarajan, A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 2013.
6. George Omura, Brian C. Benton, Mastering AutoCAD 2015 and AutoCAD LT 2015: Autodesk Official Press, Wiley Publisher, 2015.

15MA401 NUMERICAL METHODS AND STATISTICS

2 2 0 3

Course Objectives

- By enrolling and studying this course the students will be able to understand the methods to solve polynomial equations and Implement the mathematical ideas for interpolation numerically
- Summarize and apply the methodologies involved in solving problems related to ordinary and partial differential equations
- Apply the concepts testing of hypothesis in their core areas
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. The students will be able to classify the equations into algebraic, transcendental or simultaneous and apply the techniques to solve them numerically
2. The students will be able to demonstrate and obtain the differentiation and integration of functions using the numerical techniques
3. The students will be able to obtain the solutions of all types of differential equations, numerically.
4. The students will be able to apply basic statistical inference techniques, including confidence intervals, hypothesis testing to science/engineering problems.
5. The students will be able to design an experiment for an appropriate situation using ANOVA technique.

UNIT I **6 Hours**

SOLUTION OF EQUATIONS

Solution of algebraic and transcendental equations: Newton- Raphson method - Solution of system of linear equations: Gauss elimination method - Inverse of a matrix: Gauss-Jordan method- Eigen values of a matrix by Power method.

UNIT II **5 Hours**

INTERPOLATION, DIFFERENTIATIONAND INTEGRATION

Interpolation: Newton's forward and backward interpolation formulae - Numerical differentiation: Newton's forward and backward interpolation formulae. Numerical integration: Trapezoidal rule- Simpson's rules for single integrals- Two point Gaussian quadrature formula.

UNIT III **7 Hours**

SOLUTIONS OF DIFFERENTIAL EQUATIONS

Solution of first order ordinary differential equations: Fourth order Runge- Kutta method - Solution of partial differential equations: Elliptic equations: PoissonÃ¢??s equation- Parabolic equations by Crank Nicholson method- Hyperbolic equations by explicit finite difference method.

UNIT IV **6 Hours**

TESTING OF HYPOTHESIS

Sampling distributions- Large sample test: Tests for mean- Small sample tests: Tests for mean (t test), F- test- Chi-square test for Goodness of fit and Independence of attributes

UNIT V **6 Hours**

DESIGN OF EXPERIMENTS

Completely randomized design - Randomized block design - Latin square design.

SELF STUDY

Collection of data and use the testing of hypothesis to analyze the characteristics of the data.

Total: 60 Hours

Reference(s)

1. 1.Grewal B. S, Numerical Methods in Engineering and Science with Programms in C & C++, Ninth Edition, Khanna Publications, 2010.
2. 2.Sankara Rao. K, Numerical Methods for Scientists and Engineers, Third Edition, PHI Learning Private Limited, New Delhi, 2009.
3. 3.Gerald C. F and Wheatley P.O, Applied Numerical Analysis, Seventh Edition, Pearson Education, New Delhi, 2004.
4. 4.Johnson R.A, Miller and FreundÃ¢??s Probability and Statistics for Engineers, Seventh Edition, Prentice Hall of India, New Delhi, 2005.
5. 5.Walpole R.E, Myers R.H, Myers R.S.L and Ye K, Probability and Statistics for Engineers and Scientists, Seventh Edition, Pearsons Education, Delhi, 2002.
6. Burden R. L and Douglas Faires J, Numerical Analysis Theory and Applications, CengageLearning, Ninth Edition, 2005.

15AG402 THEORY OF MACHINES 3 0 0 3

Course Objectives

- To impart the knowledge on the concept of simple mechanisms
- To gain the familiarity on gears, gear trains, cams and fly wheel
- To learn about working principle and applications of governors

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. students will able to Assess the concepts and types of motions and joints
2. Apply the knowledge of kinematic pairs and linkages in real time situations
3. Design and select suitable types of gears, friction drives, cam and fly wheel
4. Recognize the CAM and fly whelt application in particular region of machines
5. Analyze the forces in governor and gyroscope

UNIT I **9 Hours**

INTRODUCTION TO MECHANISM

Definition of a machine-kinematic pair-types-links-types of constrained motion- types of joints-degrees of freedom. Kinematic chain-Classification of kinematic pairs-four bar chain, slider crank chain and their inversions. Mechanical advantages - velocity and acceleration in mechanisms. Determination of velocity and acceleration by relative velocity method for simple four bar mechanism

UNIT II **9 Hours**

FRICTION AND FRICTION DRIVES

Introduction to brakes and clutches Ã¢?? types and applications Power drives-belt drives-types-belt materials. Length of belt-power transmitted-velocity ratio- flat and v-belts. Effect of centrifugal tension-creep and slip on power transmission.

UNIT III **9 Hours**

GEAR AND GEAR TRAINS

Gears-law of gearing-velocity of sliding between two teeth in a mesh. Involute and cycloidal profile for gear teeth. Types of gears- spur gear- gears trains -simple, compound, reverted and epicyclic - determining velocity ratio by tabular method.

UNIT IV **9 Hours**

CAM AND FLYWHEEL

Cam and follower-types-application knife edge, roller and flat faced follower -profiles for uniform velocity and acceleration. Simple harmonic, cycloidal motion. Turning moment diagrams-coefficient of fluctuation of speed and energy- fly wheel and its applications.

UNIT V **9 Hours**

GOVERNORS

Types of governors-constructional details and analysis of Watt, Porter and Proel governors. Sensitiveness, stability, hunting, isochronisms, power and effort of a governor.

SELF STUDY

Automatic Control of Systems-Different types of controls-process control-kinetic control-regulator-transducer-types of control systems-open loop and closed loop monitored systems-carburetor-lag in response-transfer functions.

Total: 45 Hours

Reference(s)

1. S. Rattan, Theory of Machines, Tata McGraw Hill Publishing Company pvt Ltd, New Delhi, 2009
2. R. L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw Hill Publishing Company Pvt Ltd. New Delhi, 2005.
3. Ashok, G. Ambekar, Mechanism and Machine Theory, Prentice Hall of India, New Delhi, 2009.
4. John J. Uichker and Joesph E. Shigley, Theory of Machines and Mechanism, Tata McGraw Hall Publishing Company Pvt Ltd., New Delhi,2005.
5. Sadhu Singh, Theory of Machines, Pearson Education, New Delhi, 2007.
6. R.S.Khurmi and J.K. Gupta, Theory of Machines, Eurasia publishing House Pvt Ltd, New Delhi, 2005.

15AG403 HEAT AND MASS TRANSFER 2 0 2 3

Course Objectives

- To impart the knowledge on heat transfer mechanisms in fluids and solids, and their applications in various heat transfer equipment
- To analyze heat exchangers and methods of evaluating the performance
- To introduce non-dimensional numbers and their effects in governing various modes of mass transfer

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃƒÂ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

Course Outcomes (COs)

1. Understand conduction, students will able to in different geometries
2. Asses the concepts and types of convertion in heat transfer mechanism
3. Recognize the radiation problems in various gcomeries
4. Analyze the performance of heat exchangers and evaporators
5. Understand the various modes of mass transfer and apply them in engineering problems

UNIT I **6 Hours**

CONDUCTION

Basic concepts - Mechanism of Heat transfer. Conduction - Fourier's Law, General differential equation in Cartesian and cylindrical coordinates, one dimensional steady state heat conduction, conduction through plane wall, cylinders and spherical systems.

UNIT II **8 Hours**

CONVECTION

Basic Concepts - Heat transfer coefficients, boundary layer concept. Types of convection - Forced convection, dimensional analysis, non-dimensional numbers, external flow, flow over plates, cylinders and spheres, internal flow, laminar and turbulent flow, combined laminar and turbulent.

UNIT III **4 Hours**

RADIATION

Laws of Radiation - Stefan-Boltzmann Law, Kirchhoff's Law Black body radiation - Grey body radiation - Shape factor algebra - Radiation shields.

UNIT IV **6 Hours**

HEAT EXCHANGERS

Heat exchangers - Types, heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU (number of transfer units) Method - Overall Heat Transfer Coefficient

UNIT V **6 Hours**

MASS TRANSFER

Mass transfer - introduction - Fick's law for molecular diffusion - molecular diffusion in gases - equimolar counters diffusion in gases- diffusion through a varying cross sectional area- diffusion coefficients for gases - molecular diffusion in liquids.

FOR FURHTER READING

Application of Heat and Mass transfer in Food Processing industries

1 **2 Hours**

EXPERIMENT 1

Calculate the thermal conductivity of lagged pipe

2 **2 Hours**

EXPERIMENT 2

Determination of thermal conductivity of metal rod

3 **2 Hours**

EXPERIMENT 3

Calculate the thermal conductivity of insulating material

4 **2 Hours**

EXPERIMENT 4

Determine the thermal conductivity of composite material

5 **2 Hours**

EXPERIMENT 5

Determine the thermal conductivity of guarded hot plate

6 **4 Hours**

EXPERIMENT 6

Determination of heat transfer co-efficient by natural convection

7 **4 Hours**

EXPERIMENT 7

Determination of heat transfer co-efficient by forced convection

8 **4 Hours**

EXPERIMENT 8

Determination of heat exchanger test - parallel and counter flow

9 **4 Hours**

EXPERIMENT 9

Determination of emissivity using emissivity apparatus

10 **4 Hours**

EXPERIMENT 10

Determination of Stefan-Boltzmann constant

Total: 60 Hours

Reference(s)

1. P.L.Bellaney, Thermal Engineering. Khanna Publishers, New Delhi, 2001
2. C.J.Geankoplis, Transport Process and Unit Operations, Prentice-Hall of India Private Limited, New Delhi,1999
3. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age International private limited, New Delhi, 2010
4. Yunus A. Cengel, Heat and Mass Transfer: a Practical Approach, Tata McGraw Hill publishing Company private limited, New Delhi, 2007
5. J. P. Holman, Heat Transfer, Tata McGraw Hill publishing Company private limited, New Delhi, 2009
6. C. P. Kothandaraman and S. Subramanyan, Fundamentals of Heat and Mass Transfer, New Age International private limited, New Delhi, 2014

15AG404 STRENGTH OF MATERIALS 3 2 0 4

Course Objectives

- To impart knowledge on stress, strain and elastic modulus concepts in various components with sound mathematical principles.
- To provide knowledge on finding shear force, bending moment, deflection and slopes in various types of beams with different load conditions and to the machine components like shafts, columns, springs and their applications.
- To know method of testing the mechanical properties of materials related to hardness, compression, tension, shear and impact.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃƒÂ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

Course Outcomes (COs)

1. Apply the concepts of mechanics of deformable solids in different applications.
2. Solve solid mechanics related engineering problems in systematic methods.
3. Determine mechanical properties of materials and structural elements by experiments and analyze/synthesize test results
4. posses knowledge on deflection of beams and columns
5. posses knowledge on torsion in sraft and helical spring

UNIT I **9 Hours**

STRESS, STRAIN AND DEFORMATION OF SOLIDSSTRESS, STRAIN AND DEFORMATION OF SOLIDS

Introduction to material properties. Stresses and strains due to axial force, shear force, impact force and thermal effect-stepped and composite bars-uniformly varying cross section. Stress-strain curve for ductile and brittle materials - Hooke's law - Factor of safety - Poisson's ratio. Elastic constants and their relationship

UNIT II **9 Hours**

ANALYSIS OF STRESSES IN TWO DIMENSIONS

State of stresses at a point - Normal and shear stresses on inclined planes - Principal planes and stresses - Plane of maximum shear stress - Mohr's circle for biaxial stress with shear stress. Hoop and longitudinal stresses in thin cylindrical and spherical shells - Changes in dimensions and volume

UNIT III **9 Hours**

LOADS AND STRESSES IN BEAMS

Types of beams- Supports and Loads - Shear force and Bending Moment in beams - Cantilever, simply supported and overhanging beams - Point of contra flexure. Theory of simple bending - bending and shear stress - stress variation along the length and section of the beam - Section modulus.

UNIT IV **9 Hours**

DEFLECTION OF BEAMS AND COLUMNS

Slope and Deflection of cantilever, simply supported and overhanging beams-Double integration method and Macaulay's method. Columns - types- Equivalent length - Euler's and Rankine's formulae - Slenderness.

UNIT V **9 Hours**

TORSION IN SHAFT AND HELICAL SPRING

Analysis of torsion of circular solid and hollow shafts-stepped shaft-compound shaft- Shear stress distribution-angle of twist and torsional stiffness. Closed coil helical spring- stresses and deflection under axial load-Maximum shear stress in spring section including Wahl Factor-problems - applications.

FOR FURTHER READING

Fatigue,shear flow,shear center,thick wall pressure vessels and bending of curved beams.open coil spring-stresses and deflection

Total: 75 Hours

Reference(s)

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning Pvt Ltd, New Delhi, 2010
2. S.S.Rattan, Strength of Materials, Tata McGraw Hill, Delhi, Second Edition, 2011
3. D. K. Singh, Mechanics of Solids, Pearson Education New Delhi,2006.
4. W.A. Nash, Theory and problems in Strength of Materials, Schaum Outline Series,McGraw-Hill Book Co,New York,1995.
5. F. P. Beer and R. Johnston, Mechanics of Materials, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi,Third edition,2002.
6. B. K. Sarkar, Strength of Materials, Tata McGraw Hill Publishing Company Pvt. Ltd, New
7. Delhi, Second Reprint, 2007.

15AG405 DESIGN OF FARM STRUCTURES 3 0 0 3

Course Objectives

- To develop theoretical and practical knowledge on the various components of a farmstead
- To understand the application of RCC in various farmstead structures and solve problems including sewage disposal structures
- To gain the knowledge on the design of different types and components of farm structures
- To impart knowledge on design and construction of farm structures

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Able to design the poultry house, dairy barn and aquaculture systems
2. Able to design the different types of farm feed and storage structures
3. Able to describe the components of farm fencing
4. Able to design the water supply system and septic tanks
5. Able to apply the knowledge on design of RCC structures in farmstead structures

UNIT I **9 Hours**

FARMSTEAD PLANNING AND FARM HOUSES

Different types of farm buildings- farm site selection- building arrangement. Planning and designing dairy barns- stall barns and loose houses- milking parlor-waste management -poultry housing requirements- common types of poultry houses and their planning- introduction to aquacultural systems

UNIT II **9 Hours**

FARM FEED AND GRAIN STORAGE STRUCTURES

Indigenous food grain storage structures - need for good storage- modern grain storage and concrete bins- threshing and drying floors. Silo-requirement- Types of silo, over ground, underground and others. Design of silos- covered an open spaces - Machinery sheds - Site selection - Types and shapes of building - Space requirements. Farm shops, building requirement and space requirement. Farm trusses- Types; King post truss, queen post truss and trusses for workshops and other conditions and their design.

UNIT III **9 Hours**

FARM FENCING AND ROADS

Fencing, types of fences-fence posts. Survey and planning of fences- survey and planning of roads - alignment of roads - slope of roads - plain and hilly roads - camber - Geometrical design - Pavement design - Construction, repair and maintenance - Typical rural culverts of different sizes, their hydraulic and structural design and construction.

UNIT IV **9 Hours**

WATER SUPPLY AND SEWAGE DISPOSAL

Sources of water supply - Estimation of quantity for different consumption - capacity requirements of storage tanks - distribution systems - Design of septic tanks and sanitary structures

UNIT V **9 Hours**

DESIGN OF RCC STRUCTURES

Properties of Reinforced concrete - Basic assumptions - Modular ratio - Singly reinforced beam - fundamental assumptions - Equivalent area of R.C.C. section - Design of Singly reinforced beam - main reinforcement - vertical stirrups. Design of one way slabs - main and distribution reinforcement calculation and construction

FOR FURTHER READING

Case studies-Farm structure construction-Instrumentation and automation in Green house-Green house technology -Global context- India

Total: 45 Hours

Reference(s)

1. T.P.Ojha and A.M.Michael, Principles of Agricultural Engineering, Vol-1, Jain brothers, New Delhi,2006
2. H.N. Van Lier, Ã¢??CIGR Handbook of Agricultural Engineering, Vol. I- Land and Water Management EngineeringÃ¢??, ASAE, USA. 1999
3. E. H. Bartali and W.Frederick, Ã¢??CIGR Handbook of Agricultural Engineering, Vol. II- Animal Production and Aquacultural EngineeringÃ¢??, ASAE, USA. 1999
4. M.Raghupathi, Ã¢??Design of steel structuresÃ¢?? Tata McGraw Hill Pub. Com. New Delhi 110 006 2005
5. B.C.Punmia, Ã¢??Reinforced concrete structures Ã¢?? Vol. IÃ¢?? Laxmi publications, 7/21, Ansari Road, Dhryaganj, New Delhi 110 002, 2005
6. Christian Von Zabeltitz and W.O.Baudoin,"Green houses and shelter structures for tropical regions", FAO plant production and protection paper, Rome,1999

15AG406 IRRIGATION AND DRAINAGE ENGINEERING

3 0 0 3

Course Objectives

- To acquire a fundamental understanding of different irrigation methods
- To learn about the importance of drainage in crop production and the need to control water logging and salinization
- To develop skills on design of different irrigation and drainage systems
- To gain the knowledge on management of irrigation and drainage systems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Able to describe the water resources terminologies and losses of irrigation
2. Able to determine water requirements of crops and the irrigation schedule for different crops
3. Able to design and construct the irrigation structures
4. Able to execute the command area development works
5. Able to design, monitor and maintain drainage systems

UNIT I **9 Hours**

WATER RESOURCE

Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation - duty and delta - Rooting characteristics-Moisture use of crop, Evapotranspiration - ET - Penman-montieth equation, Blaney-criddle method.

UNIT II **9 Hours**

IRRIGATION REQUIREMENT

Crop water requirement, Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies

UNIT III **9 Hours**

METHODS OF IRRIGATION

Methods of Irrigation - Border irrigation, Infiltration, Flow Retardance, Advances of water front, Recession flow, Hydraulics and design & furrow irrigation, Deep percolation losses, Run off losses, Hydraulics and design -Land grading - Land levelling methods

UNIT IV **9 Hours**

COMMAND AREA DEVELOPMENT

Command area - Concept, Components of CADA - CADA programmes in Tamil Nadu - On Farm Development works,Materials for lining water courses and field channel, Water control and diversion structure Execution - maintenance and economics of OFD WORKS, Farmer's committee and its role for water distribution and system operation, Strategic outlet command - stream size for efficient warabandhi and rotational irrigation system.

UNIT V **9 Hours**

AGRICULTURAL DRAINAGE AND SYSTEM

Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy's law - infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation

FOR FURTHER READING

GIS- concept-use of GIS for identifying the areas that need drainage-design of drainage systems based on the data obtained through remote sensing from satellites.

1 **2 Hours**

EXPERIMENT 1

Identification of different crops, seeds, manures and fertilizers

2 **2 Hours**

EXPERIMENT 2

Working out seed rate and fertilizer schedule for major crops of wet, garden and dry lands

3 **2 Hours**

EXPERIMENT 3

Study of meteorological instruments

4 **2 Hours**

EXPERIMENT 4

Study of farm tools and implements

5 **2 Hours**

EXPERIMENT 5

Study on different methods of seed treatment, sowing and planting

6 **2 Hours**

EXPERIMENT 6

Visit to wet land to learn important cropping systems and Hi Tech nursery

7 **2 Hours**

EXPERIMENT 7

Visit to irrigated dryland cropping systems and irrigation methods

8 **2 Hours**

EXPERIMENT 8

Horticultural tools and implements used for various operations.

9 **2 Hours**

EXPERIMENT 9

Study on Commercial propagation techniques in horticultural crops - layering and cutting.

10 **2 Hours**

EXPERIMENT 10

Study of Propagation methods- budding and grafting and pruning in horticultural crops

11 **2 Hours**

EXPERIMENT 11

Study on irrigation, fertilizer application and weed management practices in horticultural crops

12 **2 Hours**

EXPERIMENT 12

Study on maturity indices for harvesting of horticultural crops

13 **2 Hours**

EXPERIMENT 13

Study on maintenance of lawn, hedges and edges through machineries and Plant propagation structures

14 **2 Hours**

EXPERIMENT 14

Visit to private orchards to identify different features of orchard.

15 **2 Hours**

EXPERIMENT 15

Visit of to a regulated market

Total: 75 Hours

Reference(s)

1. A.M.Michael, 2010. Irrigation - Theory and practice, Vikas publishers, New Delhi
2. Ravikumar. V, M.V.Ranghaswami, K.Appavu and S.Chellamuthu, 2011, Microirrigation& Irrigation Pumps, Kalyani publishers, Ludhiana
3. Dilip Kumar Majumdar, Irrigation water Management-Principles and Practice, Prentice-Hall of India Pvt. Ltd, New Delhi, 2006 Agrobios publishers, Ludhiana, 2001.
4. Michael Raviv and Heinrich Lieth. J. ,2013, Soil less culture, Theory and Practice, Elsevier
5. Jack Keller and RondBleisner 1990. Sprinkler and Trickle irrigation, Van Nostrand Reinhold, New York
6. Modi, P.N. and Seth, S.M. 2010, Hydraulics and fluid mechanics, Standard book house, New Delhi

15AG407 CROP HUSBANDRY LABORATORY 0 0 4 2

Course Objectives

- To study about field crops and cultivation aspects.
- To learn the management of crops including soil management and to control the diseases to increase the food production
- To acquire the knowledge on the nursery production of herbaceous and woody plants for landscape design and management

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Possess the knowledge on the agronomic practices for raising different crops and intensive cultivation through use of improved varieties and the liberal use of irrigation and fertilizers to increase the food production.
2. Utilize the knowledge on rainfed and dry land agriculture and precision farming.
3. Possess the knowledge on the commercial production of high-value horticultural crops such as fruits, vegetables, cut flowers, potted plants, bedding plants, and bulbs and floral design.
4. Possess the knowledge on harvesting methods, pre cooling, packaging and storage of horticultural crops.

1 **4 Hours**

EXPERIMENT 1

Identification of different crops, seeds, manures and fertilizers

2 **4 Hours**

EXPERIMENT 2

Practicing cultivation of rice / maize / pulse crops to raise in new Agri. field area from seed to harvest

3 **4 Hours**

EXPERIMENT 3

Identification of meteorological instruments

4 **4 Hours**

EXPERIMENT 4

Identification of farm tools and implements, primary and secondary tillage

5 **4 Hours**

EXPERIMENT 5

Practicing different methods of sowing and planting

6 **4 Hours**

EXPERIMENT 6

Cultivation techniques of rice / cereals / pulses crops

7 **4 Hours**

EXPERIMENT 7

Cultivation techniques of oil seed crops and fiber crops

8 **4 Hours**

EXPERIMENT 8

Cultivation of sugar and fodder crops

9 **4 Hours**

EXPERIMENT 9

Cropping systems: Monoculture, inter, mixed, relay, strip and multiple cropping systems, advantages

10 **4 Hours**

EXPERIMENT 10

Irrigation, fertilizer application and weed management practices

11 **4 Hours**

EXPERIMENT 11

Assessing maturity indices for harvesting of agricultural crops

12 **4 Hours**

EXPERIMENT 12

Workout the cost of cultivation of major field crops.

13 **4 Hours**

EXPERIMENT 13

Harvesting and post Ã¢?? harvest technology in field crops.

14 **4 Hours**

EXPERIMENT 14

Visit to multi crop station

15 **4 Hours**

EXPERIMENT 15

Visit to private fields

Total: 60 Hours

Reference(s)

1. Chandrasekaran, B., K. Annadurai and E. Somasundaram, A Text book of Agronomy, Scientific publishers, Jodhpur, 2007.
2. P.Balasubramain and SP. Palniappan, Principles and Practices of Agronomy, Agrobios publishers, Ludhiana, 2001.
3. T.Yellamanda Reddy and G.H. Sankara Reddi, Principles of Agronomy, Kalyani publishers, Ludhiana, 2005
4. S.Sankaran and V.T Subbaiah Mudaliar, Principles of Agronomy, The Bangalore Printing and Pub. Co., Bangalore, 1993.
5. SP. Palaniappan, and S. Sivaraman, Cropping systems in the tropics- Principles and Management, New Age international publishers, New Delhi, (2nd edition), 1998.
6. George Acquaah, Horticulture-principles and practices, Prentice-Half of India Pvt. Ltd., New Delhi, 2002.

15AG408 IRRIGATION AND DRAINAGE ENGINEERING LABORATORY **0 0 2 1**

Course Objectives

- To acquire a fundamental understanding of different irrigation methods
- To learn about the importance of drainage in crop production and the need to control water logging and salinization
- To develop skills on design of different irrigation and drainage systems
- To gain the knowledge on management of irrigation and drainage systems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Design and construct irrigation structures
2. Possess a good understanding of the factors related to drainage, essential to design, construct and manage a drainage system.
3. Design, monitor and maintain drainage systems
4. Determine water requirements of crops and the irrigation schedule for different crops

1 **2 Hours**

EXPERIMENT 1

Study of River basins, irrigation projects, irrigation tanks and water resources in Tamil Nadu.

2 **2 Hours**

EXPERIMENT 2

Determination of soil moisture by different methods -gravimetric and tensiometer, block and neutron probe method.

3 **2 Hours**

EXPERIMENT 3

Problems on duty of water - Duty and delta relationship

4 **2 Hours**

EXPERIMENT 4

Estimation of water requirement by different methods

5 **2 Hours**

EXPERIMENT 5

Estimation of Evapotranspiration

6 **2 Hours**

EXPERIMENT 6

Land Levelling Ã¢?? Plane method from climatologically data

7 **2 Hours**

EXPERIMENT 7

Determination of irrigation efficiencies and design of basin and furrow irrigation systems

8 **2 Hours**

EXPERIMENT 8

Problems on irrigation efficiencies and design of border irrigation systems

9 **2 Hours**

EXPERIMENT 9

Design of Basin and Furrow irrigation - Problems

10 **2 Hours**

EXPERIMENT 10

Design of underground pipeline system.

11 **2 Hours**

EXPERIMENT 11

Problems on Irrigation scheduling

12 **2 Hours**

EXPERIMENT 12

OFD works in command areas

13 **2 Hours**

EXPERIMENT 13

Design of surface and sub-surface drainage systems.

14 **2 Hours**

EXPERIMENT 14

Field visit to command areas and observation of OFD works.

15 **2 Hours**

EXPERIMENT 15

Measurement of water flow using V- notch, rectangular notch, circular notch and parshall flume

Total: 30 Hours

Reference(s)

1. Dilip Kumar Majumdar, Irrigation water Management-Principles and Practice, Prentice-Hall of India Pvt Ltd, New Delhi, 2006

2. J.N. Luthin, Drainage Engineering, John Wiley and Sons, New York, 1966.
3. A.M. Michael, Irrigation -Theory and Practice, Vikas publishing house, New Delhi, 1990.
4. V.V.N. Murthy, Land and water management, Kalyani publishing, New Delhi, 1998.

15AG409 MINI PROJECT II **0 0 2 1**

Course Objectives

Programme Outcomes (POs)

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

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

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

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

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

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

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

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

k. Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃƒÂ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.problems pertaining to agriculture

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

Course Outcomes (COs)

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

Total: 0 Hours

15GE410 LIFE SKILLS: VERBAL ABILITY **0 0 2 0**

Course Objectives

- Read and understand business passages
- Employ various types of sentences in Business Correspondence
- Equip students with strategies for vocabulary development

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. The students will be able to: Read and understand business related articles
2. Identify errors in the given sentences
3. Attempt vocabulary related questions in competitive exams
4. Write coherent business letters, e-mails, reports and proposals
5. Write instructions and descriptions related to business contexts

1 **15 Hours**

UNIT 1

Synonyms - Antonyms - Word groups - Verbal analogies - Etymology - Critical Reasoning - Cloze Test - One Word Substitutes - Idioms and Phrases - Text and Paragraph Completion

2 **15 Hours**

UNIT 2

Sentence formation - Paragraph formation- Change of voice - Change of Speech - Reading Comprehension - Sentence Equivalence - Jumbled Sentences - Spotting Errors - Homophones - Homonyms - Commonly Mispronounced/Misspelt Words

Total: 30 Hours

Reference(s)

1. Raymond Murphy. ENGLISH GRAMMAR IN USE - A SELF-STUDY REFERENCE AND PRACTICE BOOK FOR INTERMEDIATE LEARNERS OF ENGLISH.IVed. United Kingdom: Cambridge University Press. 2012.
2. Lewis, Norman. WORD POWER MADE EASY. Goyal Saab Publisher, 2011.
3. BARON'S THE OFFICIAL GUIDE FOR NEW GMAT REVIEW 2015. New Jersey : John Wiley & Sons, Inc.

15AG601 TRANSFER OF TECHNOLOGY 2 0 0 2

Course Objectives

- To familiarize with proper communication techniques
- To expose the students to different extension teaching methods
- Utilizing all the electronic media for transfer of technology

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Able to Communicate in proper ways
2. Familiar with various extension teaching methods and communication gadgets
3. Trained in use of electronic media for transfer of technology
4. Strengthen to build experiential learning
5. Trained to able to participate in all extension activities

UNIT I **6 Hours**

UNIT I COMMUNICATION

Communication, meaning, definition, types; Communication models; elements and their characteristics; Barriers in communication.

UNIT II **6 Hours**

UNIT II EXTENSION TEACHING METHODS

Extension teaching methods, meaning, definition, functions, classification (individual, group, mass contact methods), merits and demerits; Audio aids, Visual aids and Audio Visual aids, definition, classification, purpose, planning, selection, combination, use; Training, definition, types, training functions of FTC, KVK, EEI, MANAGE, NAARM.

UNIT III **6 Hours**

UNIT III E-EXTENSION

e-Extension, Community Radio, Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact disk (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC, consultancy clinics, Geographical Information System (GIS); Agricultural journalism (Print media), definition, principles, importance, ABC of news, types of news.

UNIT IV **6 Hours**

UNIT IV EXPERIENTIAL LEARNING, SYSTEMS THINKING

Experiential Learning (EL), concept, three types of learning, KolbÃ¢??s Cycle; Systems Thinking: concept, importance, Hard System vs. Soft System, Four World Views; Modelling the Farm System: production system, human activity system, marketing system, natural resource system, management system, Supra systems.

UNIT V **6 Hours**

UNIT V PARTICIPATORY EXTENSION, DIFFUSION OF INNOVATIONS

Participatory Extension Approaches: RRA, PRA; Diffusion of Innovations: definition, elements; Innovation: definition, attributes; Adoption: meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; Consequences of innovations.

FOR FURTHER READING

The Challenger case study: Bhopal Gas Tragedy: The Three Mile Island and Chernobyl case studies: Fundamental Rights, Responsibilities and Duties of Indian Citizens: Sample code of ethics like IETE, ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management.

Total: 30 Hours

Reference(s)

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, 2014.
2. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
3. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited, New Delhi, 2006.
4. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey, 2004.
5. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
6. http://www.slideworld.org/slidestag.aspx/human-values-and-professional-ethics

15AG602 CROP PROCESS ENGINEERING 3 0 0 3

Course Objectives

- To understand better the processing of cereals, pulses, oil seeds and horticultural crops
- To know the physical and thermal properties of grains
- To understand in-depth knowledge on the theory, methods, and equipment for the various unit operations of crop processing

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Possess better exposure to the different engineering properties of biological materials and their importance
2. Recognize the working principles of grain cleaning and grading devices and able to select suitable equipment for cereal grains, oilseeds, and pulses
3. Identify conveying and storage systems used for agricultural products and apply knowledge on properties of product to identify systems for the better processing
4. Apply the knowledge on the various properties of the cereals, pulses, and oil seeds for processing
5. Identify post-harvest operations for horticultural crops utilize the skills on post- harvest machines to increase the market value of the processed food products

UNIT I **8 Hours**

UNIT I INTRODUCTION

Post harvest engineering: introduction, objectives, post harvest losses of cereals, pulses and oilseeds, importance, optimum stage of harvest. Threshing: traditional methods, mechanical threshers: types, principles and operation. Engineering properties of food materials, moisture content measurement: direct and indirect methods, moisture meters, equilibrium moisture content.

UNIT II **10 Hours**

UNIT II CLEANING, GRADING AND DRYING

Principles, air screen cleaners: types, adjustments. Cylinder separator, spiral separator, magnetic separator, colour sorter, inclined belt separator, length separators, effectiveness of separation and performance index. Different types of graders for cereals, pulses and oil seed crops. Drying: principles and theory of drying, thin layer and deep bed drying, hot air drying, methods of producing hot air, types of grain dryers, selection, construction, operation and maintenance of dryers, design of dryers.

UNIT III **9 Hours**

UNIT III MATERIAL HANDLING AND STORAGE

Material handling: belt conveyor, screw conveyor, chain conveyor, bucket elevators, pneumatic conveying. Direct and indirect types of damages, sources of infestation, traditional and modern types of storage structures: vertical, horizontal and underground storage, storage structure designs.

UNIT IV **9 Hours**

UNIT IV PROCESSING OF CEREALS, PULSES AND OILSEEDS

Paddy processing: parboiling of paddy, methods, merits and demerits, dehusking of paddy: methods, merits and demerits; rice polishers: types, constructional details, polishing, layout of modern rice mill, performance evaluation of modern mills. Wheat milling, pulse milling methods. Oil seed processing. Sugarcane crushing, extraction recovery and processing of jaggery. Principles and operation: maize sheller, husker sheller for maize, groundnut decorticator, castor sheller.

UNIT V **9 Hours**

UNIT V PROCESSING OF FRUITS AND VEGETABLES

Physical and thermal properties of fruits and vegetables, maturity indices for fruits, cleaning and grading of fruits and vegetables. Electronic colour sorting of fruits and vegetables. Unit operation of fruit processing: blanching of fruits and vegetables, thermal processing of fruit pulps. Controlled and Modified atmospheric storage and shrink film storage of fruits and vegetables.

FOR FURTHER READING

Project preparation, Solar drying of grains, agro processing industries, project preparation

1 **2 Hours**

EXPERIMENT 1

Study on physical and chemical properties of biomass

2 **2 Hours**

EXPERIMENT 2

Design of KVIC model biogas plant and Deenbandhu model biogas plant

3 **2 Hours**

EXPERIMENT 3

Study on purification of biogas - CO2 and H2S removal

4 **2 Hours**

EXPERIMENT 4

Evaluation of thermal efficiency of biogas stove

5 **2 Hours**

EXPERIMENT 5

Performance evaluation of biogas run dual fuel diesel engine

6 **2 Hours**

EXPERIMENT 6
Estimation of manurial value of biodigested slurry

7 **2 Hours**

EXPERIMENT 7
Design of UASB reactor

8 **2 Hours**

EXPERIMENT 8
Determination of BOD of a liquid effluent

9 **2 Hours**

EXPERIMENT 9
Determination of COD of a liquid effluent

10 **2 Hours**

EXPERIMENT 10
Study on briquetting and calculation of stoichiometric air requirement of biomass

11 **2 Hours**

EXPERIMENT 11
Determination of thermal efficiency of wood burning stoves

12 **2 Hours**

EXPERIMENT 12
Performance evaluation of agro residue gasifier

13 **2 Hours**

EXPERIMENT 13
Study of producer gas run IC engine

14 **2 Hours**

EXPERIMENT 14
Study on pyrolysis plant and waste heat recovery calculation

15 **2 Hours**

EXPERIMENT 15
Visit to biomass based power plant

Total: 75 Hours

Text Book(s)

1. P.K. Srivastava, B.D. Shukla and T.P. Ojha, Technology and application of biogas, Jain Brothers, New Delhi, 1993

Reference(s)

1. N.N. Mohsenin, Physical Properties Of Plant And Animal Materials, Gordon and Breach publishers, New York, 1986

2. K.M.Sahay and K.K. Singh.Unit Operations of Agricultural Processing, Vikas Publication House Pvt. Ltd.,2012
3. A.Chakraverty. Post Harvest Technology of Cereals,Pulses and Oil Seeds.Oxford and IBH Publing Co. Pvt.Ltd.,2012
4. W.L. McCabe and J.C. Smith, Unit Operations in Chemical Engineering, McGraw Hill Kogakusha Ltd, Tokyo, 2001
5. A.N. Mathur and N.S. Rathore, Biogas production Management and Utilisation, Himanshu Publications, New Delhi, 1993

15AG603 DESIGN OF AGRICULTURAL MACHINERY

3 0 0 3

Course Objectives

- To learn design considerations and their applications in agricultural tractors and typical machines
- To understand the standards and procedures for designing of primary and secondary tillage implements
- To understand the standards and procedures for calibration of seed drill, planter and tractor safety measures

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Possess the knowledge on design considerations of farm machinery
2. Possess the knowledge on design and construction of primary tillage implements
3. Possess the knowledge on design and construction of secondary tillage implements
4. Recognize the working principles of seed drill and planters
5. Possess the knowledge on tractor safety measures.

UNIT I **9 Hours**

UNIT I INTRODUCTION

Modern trends, principles, procedures, fundamentals and economic considerations for design and development of farm power and machinery systems. Design considerations, procedure and their applications in agricultural tractors & typical machines. Reliability criteria in design and its application.

UNIT II **9 Hours**

UNIT II CONSTRUCTION OF PRIMARY TILLAGE IMPLEMENTS

Design of coulters, shares, mould boards. Construction of mould board working surface. Design of landside, frog, jointer. Forces acting on plough bottom and their effect on plough balance, trailed, semi mounted and mounted plough. Draft on ploughs, resistance during ploughing. Design disk ploughs, concave disk working tools, forces acting on disc ploughs.

UNIT III **9 Hours**

UNIT III CONSTRUCTION OF SECONDARY TILLAGE IMPLEMENTS

Machines and implements for surface and inter row tillage, peg toothed harrow, disk harrows, rotary hoes, graders, rollers, cultivators, design of V shaped sweeps, rigidity of working tools. Rotary machines, trajectory of motion of rotary tiller tynes, forces acting, power requirement. Machines with working tools executing an oscillatory motion.

UNIT IV **9 Hours**

UNIT IV CALIBRATION OF SEED DRILL/PLANTER

Methods of sowing and planting, machines, agronomic specifications. Sowing inter-tilled crop. Grain hoppers, seed metering mechanism, furrow openers and seed tubes. Planting and transplanting, paddy transplanters, potato planters. Machines for fertilizer application, discs type broadcasters. Organic fertilizer application, properties of organic manure, spreading machines. Liquid fertilizer distributors.

UNIT V **9 Hours**

UNIT V TRACTOR SAFETY MEASURES

Safety devices for tractors & farm implements. Cabs & HVAC designs- designs of ROPS & FOPS, seat belts and helmets. Safety locations of PTO, belt pulley and hitch linkages and shield Ã¢?? safe tractor operation- maintenance inspection for safety.

FOR FURTHER READING

Design of power screws, Lubrication theory, Static and Dynamic loadings.

1 **2 Hours**

EXPERIMENT 1

Performance evaluation of potato harvester

2 **2 Hours**

EXPERIMENT 2

Performance evaluation of tapioca harvester

3 **2 Hours**

EXPERIMENT 3

Performance evaluation of paddy harvester - operational adjustments, maintenance and safety aspects

4 **2 Hours**

EXPERIMENT 4

Performance evaluation of a power operated paddy thresher

5 **2 Hours**

EXPERIMENT 5

Performance evaluation of Digging holes with power tiller operated digger

6 **2 Hours**

EXPERIMENT 6

Performance evaluation of a power operated chaff cutter

7 **2 Hours**

EXPERIMENT 7

Study of operation of sugarcane planter and harvester

8 **2 Hours**

EXPERIMENT 8

Study of Operation of multicrop threshers

9 **2 Hours**

EXPERIMENT 9

Vertical conveyor reaper - operation - performance evaluation

10 **2 Hours**

EXPERIMENT 10

Evaluation of husker sheller for maize

11 **2 Hours**

EXPERIMENT 11

Study on working of mower and reapers

12 **2 Hours**

EXPERIMENT 12

Study on working of different systems of a combine harvesters and their evaluation

13 **2 Hours**

EXPERIMENT 13

Visit to farm implements manufacturing company

14 **2 Hours**

EXPERIMENT 14

Evaluation of a groundnut thresher

15 **2 Hours**

EXPERIMENT 15

Evaluation of fruit harvesters

Total: 75 Hours

Reference(s)

1. V. B. Bhandari, Design of Machine Elements, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2010
2. Faculty of Mechanical Engineering, PSG College of Technology, Design Data Book, M/s.Kalaikathir Achchagam, 2013
3. J. E. Shigley and C. R. Mischke, Mechanical Engineering Design, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2011
4. R. C. Juvinall and K. M. Marshek, Fundamentals of Machine Component Design, John Wiley & Sons, New Delhi, 2011
5. R. L. Norton, Design of Machinery, Tata McGraw-Hill Publishing Company Pvt Ltd., New Delhi, 2004
6. W. Orthwein, Machine Component Design, Jaico Publishing Co, 2013

15AG604 DESIGN OF MICRO IRRIGATION SYSTEMS

2 2 0 3

Course Objectives

- To understand the basic concepts, tools, and skills used to deliver water efficiently and effectively on both a field and garden scale
- To learn about the role of irrigation water in agriculture, and the environmental factors that influence the type, frequency, and duration of irrigation
- To learn about the resources and essential skills needed to determine the proper timing and volume of irrigation, using both qualitative and quantitative methods

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Able to describe the different types of pumps and water lifting devices
2. Able to design the impeller, casing and other parts of pumps
3. Able to estimate water budgets used to develop irrigation schedules
4. Able to design drip and sprinkler irrigation system
5. Able to describe the advanced types of irrigation

UNIT I **6 Hours**

UNIT I TYPES OF PUMPS AND OTHER WATER LIFTING DEVICES

Indigenous water lifts, types and their working. Types of pumps: Positive displacement and variable displacement pumps. Reciprocating pump, principle, components, single acting and double acting, work done, coefficient of discharge, slip.

UNIT II **6 Hours**

UNIT II CENTRIFUGAL, SUBMERSIBLE AND TURBINE PUMPS

Centrifugal pump: classification, principle and working, fundamental equations of centrifugal pumps, ideal, virtual and manometric heads of centrifugal pumps, net positive suction head, work done by centrifugal pump. Pump characteristics and efficiencies, priming and cavitation in centrifugal pumps, multistage centrifugal pumps. Design of impellers and casing, selection of centrifugal pumps. Submersible, Turbine pumps, Mixed flow, Axial flow, jet and Airlift pumps. Pump selection and installation, pump troubles and remedies

UNIT III **6 Hours**

UNIT III WATER BUDGETING AND DRIP IRRIGATION

Micro irrigation: classification, Irrigation scheduling, Water Budgeting with microirrigation. Hydraulics of micro irrigation, components. Valves, planning factors. Wetting pattern, crop geometries.

UNIT IV **6 Hours**

UNIT IV DRIP AND SPRINKLER IRRIGATION DESIGN

Sprinkler irrigation, components, performance. Uniformity and efficiency of sprinkler systems, sprinkler discharge. Distance of throw. Distribution pattern, application rate. Droplet size. Sprinkler selection and spacing, capacity of sprinkler system. Design of laterals, tapered. Design of Main lines, pump capacity. Operation and maintenance of sprinkler irrigation system.

UNIT V **6 Hours**

UNIT V SPECIAL TYPES OF IRRIGATION

Greenhouse irrigation system, design. Lift irrigation system: Design, subsurface drip irrigation. Soil less culture, Fertigation, Automation.

FOR FURTHER READING

Project preparations: Design and draw the layout of a drip/sprinkler irrigation system for 10 acres, preparation of project proposal for the installation and commissioning of irrigation systems

Total: 60 Hours

Text Book(s)

1. Richey, Hand Book of Agricultural Engineering, Published by McGraw Hill, NYC 1961

Reference(s)

1. V.Ravikumar and M.V.Ranghaswami, Micro irrigation and irrigation pumps. Kalyani Publishers, Ludhiana. 2011
2. A.M.Michael, Irrigation Ã*f*?Ã,Â¢?? theory and practice, Vikas publishers, New Delhi, 2010
3. Jack Keller and Rond Belisher, Sprinkler and Trickle irrigation, Van Nostrand Reinhold, New York, 1990
4. I.J. Kavassik, Engineers Guide to Centrifugal pumps, McGraw Hill Book Company, 1964
5. L.J. James, Farm Irrigation System Design, John Wiley & Sons, 1988

15AG607 CROP PROCESS ENGINEERING LABORATORY

0 0 2 1

Course Objectives

- To understand better the processing of cereals, pulses, oil seeds and horticultural crops
- To know the physical and thermal properties of grains
- To understand in-depth knowledge on the theory, methods, and equipment for the various unit operations of crop processing

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Determine the different engineering properties of biological materials and their importance
2. Design different post harvest equipments for cereals and oil seeds
3. Determine the efficiency of various grain cleaning and milling equipments

1 **2 Hours**

EXPERIMENT 1

Determination of moisture content of grains, potato slice by oven-dry method and draw the drying characteristic curves

2 **2 Hours**

EXPERIMENT 2

Determination of size, true density, bulk density and porosity of grains

3 **2 Hours**

EXPERIMENT 3

Determination of coefficient of friction internal and external for different grains

4 **2 Hours**

EXPERIMENT 4

Determination of angle of repose of different grains

5 **2 Hours**

EXPERIMENT 5

Determination of milling quality of different grains

6 **3 Hours**

EXPERIMENT 6

Determination of shelling efficiency of groundnut decorticator

7 **2 Hours**

EXPERIMENT 7

Evaluation of thermal efficiency and heat utilization factor in a grain drier

8 **2 Hours**

EXPERIMENT 8

Determination of drying characteristics of grains

9 **2 Hours**

EXPERIMENT 9

Visit to a processing industry to study bucket elevator and screw conveyor

10 **2 Hours**

EXPERIMENT 10

Performance evaluation of paddy parboiling drum

11 **2 Hours**

EXPERIMENT 11

Evaluation of efficiency of a grain cleaning cum grading machine

12 **2 Hours**

EXPERIMENT 12

Evaluation of shelling efficiency of rubber roll sheller and cone polisher

13 **2 Hours**

EXPERIMENT 13

Determining the oil content of oil seeds using Soxhlet apparatus

14 **2 Hours**

EXPERIMENT 14

Determination of drying characteristics of fruits and vegetables

15 **2 Hours**

EXPERIMENT 15

Visit to modern rice mill/ pulse/ oil milling industries

Total: 31 Hours

15AG608 COMPUTER AIDED MODELING LABORATORY

0 0 2 1

Course Objectives

- To impart training to draw orthographic views of machine components using CAD Modelling Software
- To develop the skill to create three dimensional models from orthographic views using CAD Modelling Software
- To create three dimensional assembly models and their animation using standard CAD packages

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Draw two dimensional drawings of engineering components using standard CAD Modelling package
2. Develop a three dimensional assembly model consisting of many components with tolerances.
3. Generate animations from three dimensional assembly models by applying various motion constraints.

1 **2 Hours**

EXPERIMENT 1

Introduction to modeling software:Practicing sketching, Dimensioning and Modelling Tools and Creating simple 3D models by using any CAD Modelling Software

2 **4 Hours**

EXPERIMENT 2

Create a orthographic views of machine components from isometric component drawing

3 **2 Hours**

EXPERIMENT 3

Create a two dimensional sketch diagrams of simple machine components

4 **4 Hours**

EXPERIMENT 4

Create a three dimensional assembly model of bearing from detailed orthographic drawings

5 **2 Hours**

EXPERIMENT 5

Create a three dimensional assembly model of coupling from detailed orthographic drawings

6 **4 Hours**

EXPERIMENT 6

Create a three dimensional assembly model of I C Engine components from detailed orthographic drawings

7 **2 Hours**

EXPERIMENT 7

Create a three dimensional assembly model of gear box from detailed orthographic drawings

8 **2 Hours**

EXPERIMENT 8

Create a three dimensional assembly model of two wheeler suspension system from detailed orthographic drawings

9 **2 Hours**

EXPERIMENT 9

Create a three dimensional assembly model of valves from detailed orthographic drawings

10 **4 Hours**

EXPERIMENT 10

Create a three dimensional assembly model of simple mechanism and animate its working in modeling software

11 **2 Hours**

EXPERIMENT 11

Create a three dimensional assembly model of simple energy conversion/power transmission system and animate its working using modeling software

Total: 30 Hours

15AG609 TECHNICAL SEMINAR II **0 0 2 1**

Course Objectives

- To develop self-learning skills of utilizing various technical resources to make a technical presentation
- To promote the technical presentation and communication skills.
- To impart the knowledge on intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds.
- To promote the ability for Interacting and sharing attitude.
- To encourage the commitment-attitude to complete tasks.

Programme Outcomes (POs)

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

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

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

Course Outcomes (COs)

1. Refer and utilize various technical resources available from multiple fields
2. Improve the technical presentation and communication skills
3. Analyze the importance of intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds
4. Interact and share their technical knowledge to enhance the leadership skills
5. Prepare report and present oral demonstrations

Total: 0 Hours

15AG610 MINI PROJECT IV **0 0 2 1**

Course Objectives

- To develop skills to formulate a technical project.
- To give guidance on the various tasks of the project and standard procedures.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To give guidance on the various procedures for validation of the product and analyse the cost effectiveness
- To provide guidelines to prepare technical report of the project.

Course Outcomes (COs)

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

Total: 0 Hours

15GE611 LIFE SKILLS: APTITUDE II **0 0 2 0**

Course Objectives

- The undergraduate students to such methods and practices that help, develop and nurture qualities such as character, effective communication, aptitude and holding ethical values

Programme Outcomes (POs)

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

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

Course Outcomes (COs)

1. Perform arithmetical operations with complex numbers
2. Explain the meanings of a relation defined on a set, an equivalent relation and a partition of a set
3. Calculate percentages in real life contexts , find any percentage of a given whole using their knowledge of fraction multiplication and increase / decrease a given whole by a percentage
4. Demonstrate the situations like motion in as straight line,Boats and Streams, Trains, Races and clocks
5. Evaluate the Counting techniques, Permutation and Combination, Recursion and generating functions

1 **3 Hours**

NUMBER SYSTEMS

Introduction - definition- classification on Numbers -power cycles and remainders - short cut process - concept of highest common factor - concept of least common multiple - divisibility - number of zeros in an expression

2 **3 Hours**

PERCENTAGES

Introduction - definition and Utility of percentage - importance of base/denominator for percentage calculations - concept of percentage values through additions - fraction to percentage conversion table

3 **3 Hours**

AVERAGES

Introduction - average of different groups - addition or removal of items and change in average- replacement of some of the items

4 **3 Hours**

RATIO, PROPORTIONS AND VARIATION

Introduction- Ratio- properties-dividing a given number in the given ratio - comparison of ratios - proportions - useful results on proportion- continued proportion - relation among the quantities more than two - variation

5 **3 Hours**

PROFIT AND LOSS

Gain/Loss and percentage gain or percentage loss-multiplying equivalents to find sale price - relation among cost price, sale price, gain/loss and percentage gain or percentage loss - an article sold at two different selling price - two different articles sold at same selling price - percentage gain or percentage loss on selling price - percentage gain or percentage loss on whole property

6 **3 Hours**

TIME AND WORK

Introduction - Basic concepts -Concepts on working with different efficiency - Pipes and Cisterns - Work Equivalence (Man Days) -Alternative approach

7 **3 Hours**

TIME, SPEED AND DISTANCE

Definition - Basics of Time, Speed and Distance - Relative speed - Problems based on Trains? Problems based on Boats and Streams -Problems based on Races - time taken with two difference modes of transport - time and distance between two moving bodies

8 **3 Hours**

PERMUTATION AND COMBINATION

Definition - Fundamental rules - Theorems on Permutation - Theorems on Combination

9 **3 Hours**

PROBABILITY

Concept and importance of probability - underlying factors for Real- Life estimation of probability - Basic facts about probability - some important consideration while defining event.

10 **3 Hours**

MIXTURES AND ALLIGATION

Definition - alligation rule - mean value (cost price) of the mixture - some typical situations where allegation can be used.

Total: 30 Hours

Reference(s)

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
3. Dr.R S Aggarwal, Quantitative Aptitude, Seventh Revised Edition, S.Chand Publishing Company Ltd, 2013.
4. Edgar Thorpe , Course In Mental Ability And Quantitative Aptitude For Competitive Examinations, Third Edition, Tata McGraw-Hill Publishing Company Ltd, 2013
5. Arun Sharma, How to prepare for Quantitative Aptitude for the CAT, Fifth Edition, Tata McGraw-Hill Publishing Company Ltd, 2013

15GE0C3 POLYMER CHEMISTRY AND PROCESSING

3 0 0 3

Course Objectives

- Impart knowledge on the basic concepts of polymers and its mechanism
- Use the appropriate polymerization techniques to synthesize the polymers and its processing
- Select the suitable polymers for various applications

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Illustrate the types of mechanism of polymerization reactions and analyze the natural and synthetic polymers
2. Identify the suitable polymerization techniques to synthesize the high quality polymers
3. Characterize the polymers to identify the structural, thermal ,mechanical and electrical features for specific applications
4. Apply the polymer processing methods to design polymer products
5. Identify and analyze the polymers used in electronic and biomedical applications

UNIT I **10 Hours**

POLYMERS AND ELASTOMERS

Classification of polymers - Mechanism: Addition polymerization - free radical polymerization - cationic, anionic and co-ordination (Ziegler-Natta) polymerization, copolymerization, condensation polymerization (nylon-6,6) ring opening polymerization (nylon-6). Elastomers: Natural rubber - vulcanization - synthetic rubber: styrene -butadiene rubber (SBR), butyl, neoprene, thiocol rubbers. High performance polymers: polyethers, polyether ether ketone(PEEK), polysulphones, polyimides.

UNIT II **8 Hours**

POLYMERIZATION TECHNIQUES

Homogeneous and heterogeneous polymerization - bulk polymerization (PMMA, PVC) solution polymerization - polyacrylic acid, suspension polymerization (ion-exchange resins) - emulsion polymerization (SBR) - advantages and disadvantages of bulk and emulsion polymerization. Melt solution and interfacial poly-condensation.

UNIT III **8 Hours**

CHARACTERIZATION AND TESTING

Characterization of polymers by Infrared Spectroscopy (IR) and Nuclear Magnetic Spectroscopy (NMR) - Thermal properties by TGA and DSC, Testing tensile strength, Izod impact, Compressive strength, Rockwell hardness, Vicot softening point. Test for electrical resistance, dielectric constant, dissipation factor, arc resistance and dielectric strength - water absorption.

UNIT IV **9 Hours**

POLYMER PROCESSING

Moulding: Compression - injection - extrusion and blow mouldings. Film casting - calendering. Thermoforming and vacuum formed polystyrene - foamed polyurethanes. Fibre spinning: melt, dry and wet spinning. Fibre reinforced plactics fabrication: hand-layup - filament winding and pultrusion.

UNIT V **10 Hours**

SPECIALITY POLYMERS

Preparation and properties of heat resistant and flame retardant polymers. Polymers for electronic applications: liquid crystalline, conducting and photosensitive polymers. Polymer for biomedical applications: artificial organs, controlled drug delivery, hemodialysis and hemofiltration.

FOR FURTHER READING

Biodegradable polymers

Total: 45 Hours

Reference(s)

1. V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar, Polymer Science, New Age International (P) Ltd., New Delhi, 2015.
2. Joel R. Fried, Polymer Science and Technology, Prentice Hall of India (P). Ltd., 2014
3. F. W. Billmeyer, Text Book of Polymer Science, John Wiley & Sons, New York, 2007
4. Barbara H. Stuart, Polymer Analysis, John Wiley & Sons, New York, 2008
5. George Odian , Principles of Polymerization, John Wiley & Sons, New York, 2004
6. R. J. Young and P. A. Lovell, Introduction to Polymers, CRC Press, New York, 2011

15GE0P3 APPLIED LASER SCIENCE 3 0 0 3

Course Objectives

- Impart knowledge on laser science
- Explore different strategies for producing lasers
- Create expertise on the applications of lasers in various fields

Programme Outcomes (POs)

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

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

Course Outcomes (COs)

1. Illustrate the transition mechanisms and the components of a laser system
2. Compare the different types of lasers based on pumping method, active medium and energy levels
3. Compute the rotation of earth, velocity and distance using lasers and apply the same for day today applications
4. Analyze the role of lasers in surgical and endoscopy applications
5. Apply the laser techniques in industrial applications

UNIT I **9 Hours**

LASER FUNDAMENTALS

Introduction - principle - Einstein's prediction - spontaneous emission - stimulated emission - Einstein's relations - A and B coefficients - population inversion - condition for large stimulated emission - spontaneous and stimulated emission in optical region - light amplification. Components of lasers: active medium - pumping - pumping mechanisms - resonant cavity.

UNIT II **9 Hours**

CHARACTERISTICS AND TYPES OF LASERS

Introduction - directionality - intensity - coherence - monochromaticity. Classification of lasers - principle, construction, working, energy level diagram and applications of CO_2 laser - dye laser - excimer laser - Nd:YAG laser - semiconductor laser.

UNIT III **9 Hours**

LASERS IN SCIENCE

Harmonic generation - stimulated Raman emission - lasers in chemistry - laser in nuclear energy - lasers and gravitational waves - LIGO - rotation of the earth - measurement of distance - velocity measurement - holography.

UNIT IV **9 Hours**

LASERS IN MEDICINE AND SURGERY

Eye laser surgery - LASIK - photocoagulations - light induced biological hazards: Eye and skin - homeostasis - dentistry - laser angioplasty - laser endoscopy - different laser therapies.

UNIT V **9 Hours**

LASERS IN INDUSTRY

Applications in material processing: laser welding - hole drilling - laser cutting. Laser tracking: LIDAR. Lasers in electronics industry: ranging - information storage - bar code scanner. Lasers in defence: laser based military weapons - laser walls.

FOR FURTHER READING

Q-switching - mode locking - thermo-optic effects - astronomy lasers - fighting crime with lasers - laser engraving.

Total: 45 Hours

Reference(s)

1. K. Thiyagarajan and A. K. Ghatak, LASERS: Fundamentals and Applications, Springer, USA, 2015.
2. M. N. Avadhanulu, An Introduction to Lasers Theory and Applications, S. Chand Publisher, 2013.
3. W. Koechner, M. Bass, Solid State Lasers: a graduate text, Springer Verlag, New York, 2006.
4. K. P. R. Nair, Atoms, Molecules and Lasers, Narosa Publishing House, 2009.
5. K. R. Nambiar, Lasers: Principles Types and Applications, New Age International Publications, 2006.
6. A. Sennaroglu, Solid-State Lasers and Applications, CRC Press, 2006.

15GE0XB FOUNDATION COURSE IN COMMUNITY RADIO TECHNOLOGY **1 0 0 1**

Course Objectives

- develop, debug and execute python program
- provide solutions for real world applications

Course Outcomes (COs)

1. understand the use of scripting and the contributions of scripting languages and develop own programs
2. Gain an understanding of the built in objects of Python and apply it to build projects

UNIT I **5 Hours**

INTRODUCTION

Introduction - Comments - IO operations - Data types - Operators - Variables -Control Structures - String Handling

UNIT II **6 Hours**

COLLECTIONS AND FILE HANDLING

Functions - Recursion - Lists - Tuples - Sets - Dictionaries -File Handling Operations Opening and closing files - Reading and writing files - Renaming and deleting files - Directories in Python

UNIT III **7 Hours**

EXCEPTION HANDLING AND OOPS

Handling Runtime Errors - Exception Handling Exceptions - Handling exceptions - Raising exceptions - user-defined exceptions

Object Oriented Programming in Python - Classes and Objects - Methods - Principles of Object Orientation - Inheritance - Polymorphism - Encapsulation

UNIT IV **1 Hours**

OPERATION ON STRING VARIABLES

In-built string methods - string formatting operations

UNIT V **1 Hours**

ADDITIONAL DATA STORAGE OBJECTS

Lists - Tuples - Sets - Dictionaries

UNIT VI **2 Hours**

MODULARITY AND CODE REUSABILITY

FUNCTIONS

Defining a function - Calling a function - Pass by reference - Function arguments - return - statements - Scope of variables - Recursion - Import statement - from...import statement - from...import * statement

UNIT VII **4 Hours**

ADVANCED CONCEPTS

File Handling Operations

Opening and closing files - Reading and writing files - Renaming and deleting files - Directories in Python

Handling Runtime Errors - Exception Handling Exceptions - Handling exceptions - Raising exceptions - user-defined exceptions Object Oriented Programming in Python - Classes and Objects - Methods - Principles of Object Orientation - Inheritance - Polymorphism - Encapsulation

Total: 26 Hours

Reference(s)

1. Rick van Hattem,Mastering Python,Packt Publishing,2016
2. Paul Barry,Head First Python, 2nd edition, O'Reilly Media,2015
3. Mark Lutz,Learning Python, O'Reilly Media, 5th edition, 2013
4. https://docs.python.org/3/tutorial/
5. http://www.diveintopython.net/toc/index.html
6. http://www.learnpython.org/

15GE0P1 NANOMATERIALS SCIENCE 3 0 0 3

Course Objectives

- Understand the fundamentals of physics of nanomaterials
- Correlate on multidisciplinary branch
- Acquire the knowledge in nanomaterials synthesis, compile and analyze data and draw conclusions at nano level

Programme Outcomes (POs)

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

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

Course Outcomes (COs)

1. Classify the size dependant properties of different nanomaterials
2. Explain different experimental methods used for the preparation of nanomaterials
3. Analyse the data using different characterization techniques
4. Illustrate the different techniques to synthesize semiconductor nanostructures and utilize them for application
5. Identify the impact of nanomaterials and their applications in Nano devices

UNIT I **9 Hours**

NANO SCALE MATERIALS

Introduction-Feynman's vision-national nanotechnology initiative (NNI) - past, present, future - classification of nanostructures,nanoscale architecture - effects of the nanometer length scale - changes to the system total energy, and the system structures- effect of nanoscale dimensions on various properties -magnetic properties of nanoscale materials -differences between bulk and nanomaterials and their physical properties.

UNIT II **9 Hours**

NANOMATERIALS SYNTHESIS METHODS

Top down processes - mechanical milling, nanolithography and types based on radiations - Bottom up process - chemical vapour deposition, plasma enhanced CVD, colloidal and sol-gel methods - template based growth of nanomaterials - ordering of nanosystems, self-assembly and self-organization - DC sputtering and RF sputtering process.

UNIT III **9 Hours**

CHARACTERIZATION TECHNIQUES

General classification of characterization methods - analytical and imaging techniques - microscopy techniques - electron microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy - diffraction techniques - X-ray spectroscopy - thermogravimetric analysis of nanomaterials.

UNIT IV **9 Hours**

SEMICONDUCTOR NANOSTRUCTURES

Quantum confinement in semiconductor nanostructures - quantum wells, quantum wires, quantum dots, super lattices-epitaxial growth of nanostructures-MBE, metal organic VPE, LPE - carbon nano

tubes- structure, synthesis and electrical properties -applications- fuel cells - quantum efficiency of semiconductor nanomaterials.

UNIT V **9 Hours**

NANOMACHINES AND NANODEVICES

Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS)-fabrication, actuators-organic FET- principle, description, requirements, integrated circuits- organic LEDÃ¢??s - basic processes, carrier injection, excitons, optimization - organic photovoltaic cells- nano motors -bio nano particles-nano - objects - applications of nano materials in biological field.

FOR FURTHER READING

Application of graphene in various field - supercapacitors - third generation solar cell-dye sensitized solar cell (DSSC) -fuel cells.

Total: 45 Hours

Reference(s)

1. Willam A. Goddard, Donald W.Brenner, Handbook of Nanoscience, Engineering, and Technology, CRC Press, 2012.
2. Charles P. Poole Jr and. Frank J. Owens, Introduction to Nanotechnology, Wiley Interscience, 2007.
3. Guozhong Cao, Y. Wang, Nanostructures and Nanomaterials-Synthesis, Properties & Applications, Imperials College Press, 2011.
4. T. Pradeep, NANO: The Essentials Understanding Nanoscience and Nanotechnology, McGraw - Hill Education (India) Ltd, 2012.
5. Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, Nanoscale Science and Technology, John Wiley and Sons Ltd, 2006
6. Viswanathan B, AuliceScibioh M, Fuel cells: Principles and Applications, University Press, 2009.

15GE0P2 SEMICONDUCTOR PHYSICS AND DEVICES

3 0 0 3

Course Objectives

- Impart knowledge in physical properties of semiconducting materials
- Analyze the factors affecting the operation of semiconductor devices
- Apply the physics of semiconductors to develop semiconductor devices

Programme Outcomes (POs)

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

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

Course Outcomes (COs)

1. Exemplify the drift and diffusion current densities due to carrier transport in semiconductors
2. Analyze the electric field and space charge width of PN junction under different biasing
3. Explain the charge flow, temperature effects, turn on and turn off transients in PN junction diode
4. Illustrate the operation of Bipolar Junction transistor at different modes and different configurations.
5. Represent the working mechanism of opto-electronic devices

UNIT I **9 Hours**

CARRIER TRANSPORT IN SEMICONDUCTORS

Carrier drift - drift current density - mobility effects on carrier density - conductivity in semiconductor - carrier transport by diffusion - diffusion current density - total current density - breakdown phenomena - avalanche breakdown.

UNIT II **9 Hours**

PHYSICS OF P-N JUNCTION

Basic structure-Built in potential barrier, Electric field and space charge width of P-N junction under zero, forward and reverse bias- Diffusion capacitance - one sided and linearly graded junctions.

UNIT III **9 Hours**

P-N JUNCTION DIODE

Qualitative description of charge flow in p-n junction - boundary condition - minority carrier distribution - ideal p-n junction current - temperature effects - applications - the turn on transient and turn off transient.

UNIT IV **9 Hours**

BIPOLAR JUNCTION TRANSISTOR

Introduction to basic principle of operation - the modes of operation - amplification - minority carrier distribution in forward active mode - non-ideal effects - base with modulation - high injection emitter band gap narrowing - current clouding - breakdown voltage - voltage in open emitter configuration and open base configuration.

UNIT V **9 Hours**

OPTO ELECTRONIC DEVICES

Optical absorption in a semiconductor, photon absorption coefficient - electron hole pair generation - solar cell - homo junction and hetero junction - Photo transistor - laser diode, the optical cavity, optical absorption, loss and gain - threshold current.

FOR FURTHER READING

Organic semiconductors- diodes - transistors-working and applications

Total: 45 Hours

Reference(s)

1. Donald A Neamen, Semiconductor Physics and Devices, Tata McGraw Hill, 2012.
2. S. M. Sze and M. K. Lee, Semiconductor Devices, Physics and Technology, John-Wiley & Sons, 2015.
3. Ben. G. Streetman and S. K. Banerjee , Solid State Electronic Devices, Pearson Education Ltd, 2015.
4. C. Kittel, Introduction to Solid State Physics, John-Wiley & Sons, 2012.
5. J. Millman and C. Halkias, Electronic Devices and Circuits, Tata McGraw Hill, 2010.
6. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications, Wiley-VCH, 2006.

15PH202 APPLIED PHYSICS 3 0 2 4

Course Objectives

- To understand conducting, semiconducting, dielectric and magnetic properties of materials and exemplify their applications
- To analyze the basic concepts of thermodynamics and heat transfer with illustrations
- To gain knowledge about acoustical standards of buildings

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Analyze the physical properties of conducting and semiconducting materials
2. Discuss the physical properties of dielectric and magnetic materials with their applications
3. Apply the thermodynamic processes and laws to compute the efficiency of heat engines
4. Compare the different heat transfer modes with real time applications of conduction
5. Explain the characteristics of music and select proper sound absorbing materials for good acoustic of buildings

UNIT I **11 Hours**

CONDUCTORS AND SEMICONDUCTORS

Conductors: Classical free electron theory - electrical and thermal conductivity- Wiedemann - Franz law - merits and demerits of classical free electron theory - band theory - density of states. Semiconductors: Elemental and compound semiconductors - intrinsic semiconductors -Fermi level and electrical conductivity - band gap energy - extrinsic semiconductors - n-type and p-type semiconductors: variation of Fermi level with temperature (qualitative) - Hall effect - applications.

UNIT II **9 Hours**

DIELECTRIC AND MAGNETIC MATERIALS

Dielectrics: Fundamental terminologies - electronic and ionic polarizations - orientation polarization mechanism (qualitative) - space charge polarization - Langevin -Debye equation - dielectric loss - applications of dielectric and insulating materials.
Magnetic Materials: Properties of dia, para and ferromagnetic materials - domain theory of ferromagnetism - hysteresis curve - hard and soft magnetic materials - applications

UNIT III **9 Hours**

THERMODYNAMICS

Zeroth law of thermodynamics - Heat - equilibrium and quasistatic process - path functions - comparison between heat and work - internal energy - first law of thermodynamics - isothermal and adiabatic process - work done - reversible and irreversible process - second law of thermodynamics - entropy - enthalpy - Carnot ideal engine and its efficiency - Carnot's theorem-actual heat engine: Diesel engine and its efficiency

UNIT IV **9 Hours**

HEAT TRANSFER

Modes of heat transfer - thermal conductivity - heat capacity and diffusivity - rectilinear flow of heat - conduction through bodies in series and parallel - determination of thermal conductivity: good conductor: Searle's method - bad conductor: Lee's disc method - applications of heat transfer: formation of ice in ponds - conductivity of earth's crust and age of earth - practical applications

UNIT V **7 Hours**

ACOUSTICS

Classification of sound based on frequency - characteristics of audible sound - reverberation time: Sabine's formula - determination of absorption coefficient - Erying's formula (qualitative). Sound insulation - sound absorbing materials - factors affecting the acoustics of building - remedies

FOR FURTHER READING

Nanomaterials and its applications

1 **2 Hours**

INTRODUCTION

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 1

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

3 **4 Hours**

EXPERIMENT 2

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.

4 **4 Hours**

EXPERIMENT 3

With the aid of traveling microscope, find the refractive index of a transparent solid and liquid material

5 **4 Hours**

EXPERIMENT 4

Determine the wavelength of polychromatic source in the visible region using spectrometer

6 **4 Hours**

EXPERIMENT 5

Based on Hall effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

7 **4 Hours**

EXPERIMENT 6

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

8 **4 Hours**

EXPERIMENT 7

Determine the V-I characteristics of a solar cell.

Total: 75 Hours

Reference(s)

1. William D. Callister, Materials Science and Engineering an Introduction, John Wiley and Sons,Inc, 2010
2. BrijLal, N. Subrahmanyam and P. S. Hemne, Heat, Thermodynamics & Statistical Physics, S. Chand & Company Ltd., New Delhi, 2012
3. Saxena, Gupta, Saxena, Mandal, Solid State Physics, Pragati Prakashan Educational Publishers, 13threvised edition, Meerut, India, 2013
4. P.K. Mittal, Applied Physics, I.K. International Publishing House Pvt. Ltd, 2008
5. Donald A. Neamen, Semiconductor Physics and Devices,McGraw-Hill, 2011

15CH202 APPLIED CHEMISTRY 3 0 2 4

Course Objectives

- understand the necessity of water softening processes
- aware the causes and consequences of corrosion
- acquaint the applications of alloying and phase rule in metallurgy
- recognise the fundamentals and applications of fuels
- characterize the chemical compounds using analytical techniques.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis:Identify, formulate, review research literature,and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. attribute the internal and external treatment methods for the removal of hardness in water for domestic and industrial applications.
2. Analyze the type of corrosion, factors influencing rate of corrosion on metals and corrosion control methods
3. Differentiate ferrous and non ferrous alloys based on its properties, applications and illustrate the importance of phase rule in the field of mettallurgy
4. Distinguish the three types of fuels based on calorific value for selected applications
5. Apply suitable analytical methods for the estimation of elements in aqueous media

UNIT I **10 Hours**

WATER PURIFICATION

Hardness of water - classification of hardness (temporary and permanent) - units of hardness (ppm, mg/l, degree Clark, degree French) - expression of hardness in terms of calcium carbonate equivalence - estimation of hardness by EDTA Method - Uses of water for industrial purpose - requirements of boiler feed water - disadvantages of using hard water in industrial boilers: scale, sludge, priming, foaming and caustic embrittlement. Removal of dissolved salts from hard water: internal conditioning (phosphate, carbonate, calgon and colloidal methods), external conditioning (ion exchange process, reverse osmosis, electrodialysis). Uses of water for domestic purpose - municipal

water treatment (screening, aeration, coagulation, sedimentation, filtration and disinfection of water - break point chlorination).

UNIT II **8 Hours**

CORROSION SCIENCE

Corrosion - chemical and electrochemical corrosion - Pilling-Bedworth rule - mechanism (types of oxide layer, oxygen absorption - hydrogen evolution) - Galvanic series -types of electrochemical corrosion: Galvanic corrosion - differential aeration corrosion (pitting, pipeline and waterline)-Factors influencing corrosion (nature of metal and environment). Corrosion control: sacrificial anode - impressed current method.Protective coatings - paint -constituents and functions.

UNIT III **9 Hours**

ALLOYS AND PHASE RULE

Alloys: purpose of alloying - function and effects of alloying elements - properties of alloys - classification of alloys. Ferrous alloys: nichrome and stainless steel. Non-ferrous alloys: brass and bronze. Heat treatment of alloys (annealing, hardening, tempering, normalising, carburizing and nitriding).

Phase rule: phase - component - degree of freedom - phase rule - phase diagram - applications- one component system (water system). Reduced phase rule - two component system (lead and silver system).

UNIT IV **10 Hours**

FUELS

Classification - characteristics - calorific value - solid fuel - coal - types - analysis of coal (proximate and ultimate analysis) - processing of coal to coke - carbonization - types (low temperature and high temperature carbonization) - manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels - petroleum - refining of crude oil - knocking - octane number - cetane number. Liquid fuel from coal (Bergius process). Gaseous fuels - natural gas (CNG) - coal gas - producer gas - syn gas - shale gas.

UNIT V **8 Hours**

INSTRUMENTAL METHODS

Beer - Lamberts law. Principle, instrumentation (block diagram only) and applications: Ultra violet spectroscopy - Infrared spectroscopy - Atomic absorption spectroscopy - Colorimetry (estimation of transition metal) - Flame photometry (estimation of alkali metal).

FOR FURTHER READING

Synthesis and applications of bio-fuels.

1 **2 Hours**

EXPERIMENT 1

Preparation of N/10 oxalic acid and N/10 sodium carbonate solution.

2 **4 Hours**

EXPERIMENT 2

Water quality of BIT campus - River - Bore well water with respect to hardness, TDS and pH.

3 **4 Hours**

EXPERIMENT 3

Conductometric titration of mixture of acids (HCl CH3COOH).

4 **4 Hours**

EXPERIMENT 4

Determination of strength of hydrochloric acid in a given solution using pH meter.

5 **4 Hours**

EXPERIMENT 5

Determination of the strength of Fe(II) in the given sample by potentiometric method.

6 **4 Hours**

EXPERIMENT 6

Measurement of rate of corrosion on mild steel in aerated / neutral / acidic / alkaline medium by weight loss method.

7 **4 Hours**

EXPERIMENT 7

Estimation of copper content in brass by EDTA method.

8 **4 Hours**

EXPERIMENT 8

Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method.

Total: 75 Hours

Reference(s)

1. A. Pahari and B.Chauhan, Engineering Chemistry, Infinity Science press LLC, New Delhi, 2010.
2. M. Munjal and S.M. Gupta, Wiley Engineering Chemistry, Second edition, Wiley India Pvt. Ltd, New Delhi, 2013.
3. Willard Merritt and Dean Settle, Instrumental methods of analysis, CBS publishers, Seventh edition, 2012.
4. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishers New Delhi, 16th Edition, 2013.
5. R. Mukhopadhy and S. Datta, Engineering Chemistry, New age international Pvt. Ltd, New Delhi, 2010.
6. Shashi Chawla, Engineering Chemistry, Dhanpat Rai Publishers New Delhi, 2nd Edition, 2003.

15GE0C1 CORROSION SCIENCE 3 0 0 3

Course Objectives

- Recognize the terminologies used in corrosion science.
- Impart knowledge about the various types of corrosion and its mechanism.
- Understand the various methods of corrosion control, corrosion testing and monitoring.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. evaluate if corrosion can occur under specific operating conditions in a given equipment or construction and indicate regions of immunity, corrosion and passivity of a metal
2. compare different corrosion types on metals when exposed to air, water and at high temperatures (> 100 C)
3. identify the corrosion mechanism on steel, iron, zinc and copper metal surfaces
4. calculate the rate of corrosion on metals using electrochemical methods of testing
5. propose the correct materials, design and operation conditions to reduce the likelihood of corrosion in new equipment and constructions

UNIT I **9 Hours**

CORROSION

Importance of corrosion - spontaneity of corrosion - passivation - direct and indirect damage by corrosion - importance of corrosion prevention in industries - area relationship in both active and passive states of metals - Pilling Bedworth ratio and its significance - units of corrosion rate (mdd and mpy) - importance of pitting factor - Pourbaix digrams of Mg, Al and Fe and their advantages and disadvantages.

UNIT II **7 Hours**

TYPES OF CORROSION

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion. High temperature oxidation, kinetics of protective film formation and catastrophic oxidation corrosion.

UNIT III **9 Hours**

MECHANISM OF CORROSION

Hydrogen embrittlement - cracking - corrosion fatigue - filliform corrosion - fretting damage and microbes induced corrosion - corrosion mechanism on steel, iron, zinc and copper metal surfaces - thick layer and thin layer scale formation - in situ corrosion scale analysis.

UNIT IV **10 Hours**

CORROSION RATE AND ITS ESTIMATION

Rate of corrosion: factors affecting corrosion - electrochemical methods of polarization - Tafel extrapolation polarization, linear polarization, impedance techniques - weight loss method - susceptibility test - testing for intergranular susceptibility and stress corrosion. Visual testing - liquid penetrant testing - magnetic particle testing - eddy current testing.

UNIT V **10 Hours**

CORROSION CONTROL METHODS

Fundamentals of cathodic protection - types of cathodic protection. Stray current corrosion problems and its prevention. Protective coatings: anodic and cathodic coatings - metal coatings: hot dipping (galvanizing, tinning and metal cladding) - natural inhibitors. Selection of sacrificial anode for corrosion control.

FOR FURTHER READING

Corrosion issues in supercritical water reactor (SCWR) systems.

Total: 45 Hours

Reference(s)

1. Mouafak A. Zaher, Introduction to Corrosion Engineering, CreateSpace Independent Publishing Platform, 2016.
2. E.McCafferty, Introduction to Corrosion Science, Springer; 2010 Edition, January 2010.
3. R. Winstone Revie and Herbert H. Uhlig, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, 4th Edition, John Wiley & Science, 2008.
4. Mars G. Fontana, Corrosion Engineering, Tata McGraw Hill, Singapore, 2008.
5. David E.J. Talbot (Author), James D.R. Talbot, Corrosion Science and Technology, Second Edition (Materials Science & Technology), CRC Press; 2nd Edition, 2007.
6. http://corrosion-doctors.org/Corrosion-History/Eight.htm

15GE0C2 ENERGY STORING DEVICES AND FUEL CELLS

3 0 0 3

Course Objectives

- Understand the concept, working of different types of batteries and analyze batteries used in electric vehicles.
- Identify the types of fuel cells and to relate the factors of energy and environment.
- Analyze various energy storage devices and fuel cells.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Analyze the parameters required for operation of a cell to evaluate the capacity of energy storage devices
2. Identify the electrodes, electrolyte and cell reactions of different types of primary, secondary batteries and infer the selection criteria for commercial battery systems with respect to commercial applications
3. Differentiate fuel cells based on its construction, production of current and applications
4. Identify different methods for the production of hydrogen fuel and its environmental applications
5. Relate energy and environmental based on the importance and types of renewable energy for sustainable development

UNIT I **6 Hours**

BASICS OF CELLS AND BATTERIES

Components - classification - operation of a cell - theoretical cell voltage - capacity - specific energy - energy density of practical batteries - charge efficiency- charge rate - charge retention - closed circuit voltage, open circuit voltage current density - cycle life - discharge rate-over charge-over discharge.

UNIT II **10 Hours**

BATTERIES FOR PORTABLE DEVICES AND ELECTRIC VEHICLES

Primary batteries- zinc-carbon, magnesium, alkaline, manganous dioxide, mercuric oxide, silver oxide batteries - recycling/safe disposal of used cells. Secondary batteries - introduction, cell reactions, cell representations and applications - lead acid, nickel-cadmium and lithium ion batteries - rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide, lithium anode cell, photogalvanic cells. Battery specifications for cars and automobiles.

UNIT III **10 Hours**

TYPES OF FUEL CELLS

Importance and classification of fuel cells - description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate and direct methanol fuel cells.

UNIT IV **10 Hours**

HYDROGEN AS A FUEL

Sources and production of hydrogen - electrolysis - photocatalytic water splitting - biomass pyrolysis -gas clean up - methods of hydrogen storage- high pressurized gas - liquid hydrogen type - metal hydride - hydrogen as engine fuel - features, application of hydrogen technologies in the future - limitations.

UNIT V **9 Hours**

ENERGY AND ENVIRONMENT

Future prospects of renewable energy and efficiency of renewable fuels - economy of hydrogen energy - life cycle assessment of fuel cell systems. Solar Cells: energy conversion devices, photovoltaic and photoelectrochemical cells - photobiochemical conversion cell.

FOR FURTHER READING

Energy conservation, Over utilization, Energy demanding activities.

Total: 45 Hours

Reference(s)

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