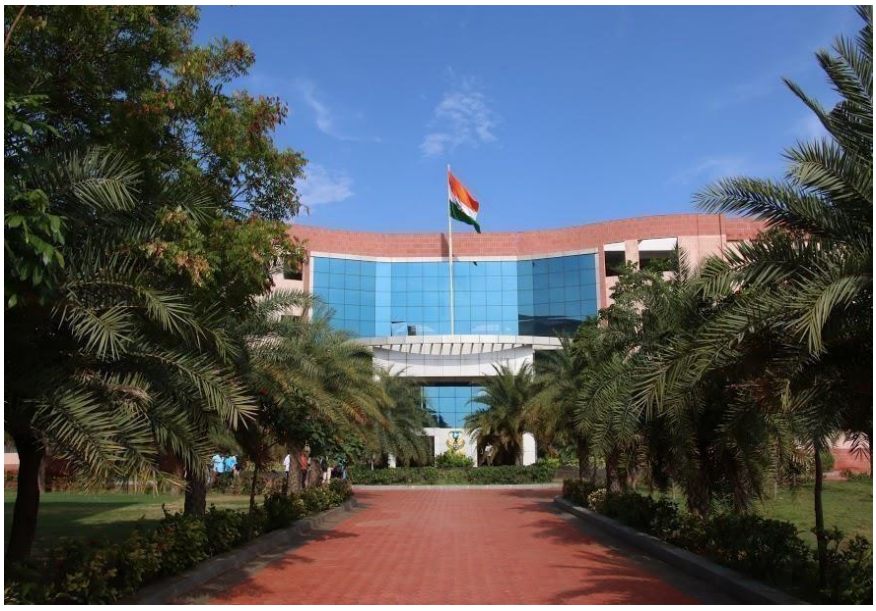
SRI SHAKTHI

INSTITUTE OF ENGINEERING AND TECHNOLOGY, (AUTONOMOUS)

L&T BYPASS ROAD, COIMBATORE - 62

DEPARTMENT OF AGRICULTURAL ENGINEERING



CURRICULUM AND SYLLABI

B.E. in Agriculture Engineering

REGULATION 2019

SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, COIMBATORE
(AUTONOMOUS)

DEPARTMENT OF AGRICULTURAL ENGINEERING

VISION AND MISSION OF THE INSTITUTION

Vision

To make the institution one of our nation's great engineering schools, recognized nationally and internationally for excellence in teaching, research and public service. We seek to be the preferred destination for students, practitioners seeking an engineering education, employers hiring engineering graduates and organizations seeking engineering knowledge.

Mission

To Provide an encouraging environment to develop the intellectual capacity, critical thinking, creativity and problem solving ability of the students.

VISION AND MISSION OF THE DEPARTMENT

Vision

Educating and empowering the students to become successful agricultural engineers and entrepreneurs to elicit research capability that applies science and technology to enhance agricultural productivity, farm mechanization, irrigation engineering, conservation of water, energy and post-harvest handling and value addition with a sound knowledge of agricultural principles.

Mission

M1: To train and prepare the students with general knowledge and expertise in the fields of agricultural sciences, soil and water conservation, post-harvest technology and agro energy.

M2: To set up the required facilities in the laboratories to satisfy the needs of industry and R&D.

M3: To build expertise on the different facets of agricultural engineering to make graduates grow as entrepreneurs, scientists, educators and sustainable food production technologists which meet the food needs of the ever-increasing population of our country

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B. E. AGRICULTURE ENGINEERING
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1	:	acquire basic knowledge required for the industries connected with micro irrigation, tractor manufacture, agricultural machinery manufacture, food processing and water management.
PEO2	:	attain and practice technical skills to pursue higher studies in India and abroad in different disciplines of Agricultural Engineering.
PEO3	:	imbibe practical skills and real-time problem-solving capabilities to enable them to become entrepreneurs
PEO4	:	gain sound knowledge in the emerging trends such as IT, IoT, ICT so as to enable them to apply their knowledge in robotics, automation and smart farming systems to achieve higher crop productivity.
PEO5	:	develop confidence for appearing in various competitive examinations such as UPSC, TNPSC and banks examinations so that the students become technocrats and administrators.

PROGRAMME OUTCOMES:

Engineering Graduates will be able to:

PO1	a	Engineering knowledge: Apply the knowledge of mathematics, science, engineering, fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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.
PO4	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.
PO5	e	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an Understanding of the limitations.
PO6	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.
PO7	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.
PO8	h	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	i	Individual and team work: Function effectively as an individual, and as a member or leader in

		diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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.
PO12	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.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO1	Professional skills: To ensure education necessary to understand agriculture engineering solutions in global and social context to improve agriculture.
PSO2	Problem solving skills: To have the ability to solve complex problems related to farm mechanization, soil and water conservation, post-harvest technology, renewable and non-renewable resource technologies, landscape architecture and modern irrigation techniques.
PSO3	

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMMEOUTCOMES

A broad relation between the programme objective and the **Outcomes** is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	2	2	2	3	2	2	2	2	2	2	2	1
2	0	0	1	1	1	1	1	1	1	1	1	1
3	1	1	2	2	3	2	2	0	2	2	2	2
4	2	1	1	1	2	2	1	0	3	3	3	2
5	2	2	2	3	3	2	2	0	2	2	3	2

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMMEOUTCOMES

A broad relation between the Program Specific **Objectives** and the **Outcomes** is given in the following table

PROGRAMME SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	2	2	1	2	3	0	2	0	0	0	2	1
2	2	2	1	2	1	1	2	0	2	1	2	1
3	1	0	3	0	1	2	2	1	0	0	0	2

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MAPPING OF **COURSE OUTCOMES** WITH PROGRAMME **OUTCOMES**
A broad relation between the **Course Outcomes** and Programme **Outcomes** is given in the following table

COURSE OUTCOMES		PROGRAMME **OUTCOMES**											
Sem	Course Name	A	B	C	D	E	F	G	H	I	J	K	L
I	Communicative English									✓	✓		✓
	Matrices and Calculus for Agriculture Engineering	✓	✓					✓					
	Applied Physics for Engineering	✓	✓								✓		
	Computational Thinking And Problem Solving	✓	✓	✓	✓								✓
	Engineering Drawing	✓	✓		✓	✓			✓	✓			
	Communicative English Laboratory	✓	✓		✓	✓				✓			
	Applied Physics for Engineering Laboratory	✓	✓	✓	✓		✓		✓	✓		✓	
	Computational Thinking And Problem Solving Laboratory	✓	✓										
	Engineering Drawing Laboratory									✓	✓		✓
	Crop Production Laboratory - I	✓	✓										
	Introduction to Agricultural Engineering	✓	✓	✓					✓	✓	✓		
	Engineering Exploration – I										✓		
	Language – Tamil; Language - Malayalam Foundation English												
II	English for Engineers									✓	✓		✓
	Laplace Transform and Advanced Calculus for Agriculture Engineering									✓	✓		✓
	Engineering Chemistry	✓	✓										
	C Programming	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
	Crop Production - II	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓
	English for Engineers Laboratory	✓	✓		✓	✓	✓	✓		✓	✓		
	Engineering Exploration- II	✓	✓		✓		✓	✓		✓	✓		
	Chemistry Laboratory for agriculture engineering	✓	✓	✓	✓	✓	✓	✓					✓
	C Programming Laboratory	✓	✓		✓								✓
	Crop Production II - Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Practices and Certification in 2D Drawings	✓	✓	✓						✓			✓
III	Transforms and Numerical Methods for Agriculture Engineering	✓	✓				✓	✓			✓		
	Strength of Materials for Agriculture Engineering	✓	✓		✓	✓	✓			✓	✓		
	Design of Farm Structures	✓	✓		✓	✓	✓	✓		✓	✓		
	Working Principles of Machines	✓			✓	✓	✓	✓		✓	✓		
	Emerging Trends of Unit Operations in	✓	✓	✓	✓		✓	✓		✓	✓		

Approved by BoS Chairman

	Agricultural Processing												
	Design, Analysis and Simulation of Machine Elements - I	✓	✓	✓	✓	✓	✓	✓					
	Career Enhancement Programme - I				✓								✓
	Engineering Exploration- III	✓	✓	✓	✓	✓							
	Strength of Materials for Agriculture Engineering Laboratory	✓	✓		✓		✓					✓	
	Design of Farm Structures Laboratory	✓	✓	✓	✓	✓	✓	✓					✓
	Working Principles of Machines Laboratory	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓
	Emerging Trends of Unit Operations in Agricultural Processing Laboratory	✓	✓	✓	✓		✓		✓	✓		✓	
IV	Probability and Statistics for Agriculture Engineering	✓	✓	✓	✓	✓						✓	✓
	Thermodynamics	✓	✓	✓	✓	✓							
	Fluid Mechanics and Hydraulics	✓	✓	✓	✓	✓				✓	✓		
	Surveying and Levelling	✓	✓	✓		✓		✓		✓	✓		
	Post-Harvest Engineering of Cereals, Pulses and Oil Seeds	✓	✓	✓	✓		✓	✓				✓	✓
	Design, Analysis and Simulation of Machine Elements - II		✓		✓	✓							
	Career Enhancement Programme - II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Engineering Exploration- IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Thermodynamics Laboratory	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓
	Fluid Mechanics and Hydraulics Laboratory	✓	✓		✓	✓				✓			
	Surveying and Levelling Laboratory	✓	✓	✓	✓	✓	✓	✓				✓	✓
	Post-Harvest Engineering of Cereals, Pulses and Oil Seeds Laboratory	✓	✓		✓	✓				✓			
V	Solar System Design and Wind Energy Engineering	✓	✓	✓				✓			✓		✓
	Farm Tractors	✓	✓	✓	✓		✓					✓	✓
	Design of Basic Machine Elements	✓	✓	✓	✓	✓				✓	✓	✓	✓
	Irrigation Automation and Drainage Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Hydrology and Water Resources Engineering	✓	✓	✓	✓	✓						✓	✓
	IoT in Agriculture	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Professional Elective – I												
	Career Enhancement Programme III	✓	✓	✓	✓						✓		
	Engineering Exploration - V	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
	Renewable Energy Laboratory	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
	Irrigation Automation and Drainage Engineering Laboratory	✓	✓	✓	✓		✓		✓	✓		✓	
	Hydrology and Water Resources Engineering Laboratory									✓	✓		✓
VI	Farm Machinery and Equipment	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
	Remote Sensing and Geographical Information Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Bio Energy - Principles and Applications	✓			✓	✓					✓	✓	✓

	Fundamentals of PLC and SCADA	✓	✓	✓	✓	✓	✓	✓					✓
	Soil and Water Conservation Engineering	✓	✓	✓				✓	✓	✓	✓	✓	✓
	Professional Elective – II												
	Open Elective - I												
	Farm Machinery and Equipment Laboratory	✓	✓	✓	✓	✓	✓			✓	✓	✓	
	Remote Sensing and Geographical Information Systems Laboratory	✓	✓	✓		✓						✓	✓
	Bio Energy Laboratory	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
	PLC and SCADA Laboratory	✓			✓	✓					✓	✓	✓
	Mini Project	✓	✓	✓	✓					✓	✓		✓
	Career Enhancement Programme - IV	✓	✓	✓	✓						✓		
VII	Agricultural Economics, Extension and Management	✓	✓	✓	✓	✓				✓	✓		✓
	Professional Elective – III												
	Open Elective II												
	Project Phase I	✓	✓	✓	✓	✓	✓	✓				✓	
	Study Tour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VIII	Professional Elective – IV												
	Professional Elective – V												
	Project Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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SEMESTER I								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19ENTL101T	Communicative English	HS	5	2	0	0	2
2	U19MATH101	Matrices and Calculus for Agriculture Engineering	BS	6	3	1	0	4
3	U19PHTL101T	Applied Physics for Engineering	BS	5	2	0	0	3
4	U19CSTL101T	Computational Thinking And Problem Solving	ES	5	3	0	0	3
5	U19AETL101T	Engineering Drawing	PC	3	1	0	0	1
6	U19AETH101T	Introduction to Agricultural Engineering	PC	3	2	0	0	2
7	U19LATH101, U19LATH102	Language-Tamil. Language- Malayalam	HS	4	2	0	0	2
PRACTICALS								
8	U19ENTL101L	Communicative English Laboratory	HS	6	0	0	2	1
9	U19PHTL101L	Applied Physics for Engineering Laboratory	BS	4	0	0	2	1
10	U19CSTL101L	Computational Thinking And Problem Solving Laboratory	ES	3	0	0	2	1
11	U19AETL101L	Engineering Drawing Laboratory	PC	4	0	0	2	1
12	U19AEPC101	Crop Production Laboratory - I	BS	4	0	0	4	2
13	U19CCEX101	Engineering Exploration – I	EEC	4	1	0	2	2
		TOTAL		49	16	1	14	25

SEMESTER II								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19ENTL202T	English for Engineers	HS	4	2	0	0	2
2	U19MATH210	Laplace Transforms and Advanced Calculus for Agriculture Engineering	BS	6	3	1	0	4
3	U19CHTL204T	Engineering Chemistry	BS	5	3	0	0	3
4	U19CSTL203T	C Programming	ES	5	3	0	0	3
5	U19AETL202T	Crop Production - II	PC	6	1	0	2	2
6								
PRACTICALS								
7	U19ENTL202L	English for Engineers Laboratory	HS	3	0	0	2	1
8	U19CHTL204L	Engineering Chemistry Laboratory	BS	3	0	0	2	1
9	U19CSTL203L	C Programming Laboratory	ES	3	0	0	2	1
10	U19AETL202L	Crop Production - II Laboratory	PC	3	0	0	2	1
11	U19AEPC202	Practices and Certification in 2D Drawings	PC	3	0	0	3	2
12	U19CCEX202	Engineering Exploration- II	EEC	4	1	0	2	2
		TOTAL		44	13	1	14	22

SEMESTER III								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19CCEX303	Engineering Exploration – III	EEC	3	0	0	2	1
2	U19MATH319	Transforms and Numerical Methods for Agriculture Engineering	BS	5	3	1	0	4
3	U19AETL303T	Strength of Materials for Agriculture Engineering	ES	5	3	0	0	3
4	U19AETL304T	Design Of Farm Structures	ES	4	1	0	0	1
5	U19AETL305T	Working Principles Of Machines	PC	6	3	0	0	3
6	U19AETL306T	Emerging Trends Of Unit Operations In Agriculture Processing	PC	4	2	0	0	2
PRACTICALS								
7	U19AETL303L	Strength Of Materials For Agriculture Engineering Laboratory	ES	3	0	0	2	1
8	U19AETL304L	Design Of Farm Structures Labaratory	ES	3	0	0	4	2
9	U19AETL305L	Working Principles Of Machines Laboratory	PC	3	0	0	2	1
10	U19AETL306L	Emerging Trends Of Unit Operations In Agriculture Processing Laboratory	PC	3	0	0	2	1
11	U19AEPC303L	Design, Analysis and Simulation of Machine Elements-1	PC	4	0	0	4	2
12	U19CCLC301	Career Enhancement Program - I	EEC	3	0	0	2	1
		TOTAL		46	12	2	16	22

SEMESTER IV								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19MATH426	Probability and Statistics for Agriculture Engineering	BS	4	3	0	0	3
2	U19AETL407T	Thermodynamics	ES	5	3	0	0	3
3	U19METL306T	Fluid Mechanics and Hydraulics	ES	5	2	0	0	2
4	U19AETL408T	Surveying and Leveling	ES	4	2	0	0	2
5	U19FTTL401T	Post Harvest Technology of Cereals,Pulses and Oil seeds	ES	4	3	0	0	3
PRACTICALS								
6	U19AETL407L	Thermodynamics Laboratory	ES	3	0	0	2	1
7	U19METL306L	Fluid Mechanics and Hydraulics Laboratory	ES	3	0	0	2	1
8	U19AETL408L	Surveying and Leveling Laboratory	ES	3	0	0	2	1
9	U19FTTL401L	Post Harvest Technology of Cereals,Pulses and Oil seeds Laboratory	ES	3	0	0	2	1
10	U19AELC404	Design, Analysis and simulation of Machine elements- II	PC	6	0	0	4	2
11	U19CCLC402	Career Enhancement Programme- II	EEC	3	0	0	2	1
12	U19CCEX404	Engineering Exploration- IV	EEC	3	0	0	2	1
		TOTAL		46	13	0	14	21

SEMESTER V								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19AETL509T	Solar System Design and Wind Energy Engineering	ES	4	2	0	0	2
2	U19AETH503	Farm Tractors	PC	4	3	0	0	3
3	U19AETH502	Design of Basic Machine Elements	PC	5	3	1	0	4
4	U19AETL510T	Irrigation Automation and Drainage Engineering	PC	5	3	0	0	3
5	U19AETL511T	Hydrology and Water Resources Engineering	PC	4	2	0	0	2
6	U19AETH504	IoT in Agriculture	PC	4	2	1	0	3
7	U19AEPEXXX	Professional Elective I	PE	4	3	0	0	3
PRACTICALS								
8	U19AETL509L	Renewable Energy Laboratory	ES	3	0	0	2	1
9	U19AETL510L	Irrigation Automation and Drainage Engineering Laboratory	PC	3	0	0	2	1
10	U19AETL511L	Hydrology and Water Resources Engineering Laboratory	PC	3	0	0	2	1
11	U19CCLC503	Career Enhancement Programme -III	EEC	3	0	0	2	1
12	U19CCEX505	Engineering Exploration - V	EEC	3	0	0	2	1
		TOTAL		45	18	2	9	25

SEMESTER VI								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19AETL612T	Farm Machinery and Equipment	PC	4	3	0	0	3
2	U19AETL613T	Remote Sensing and Geographical Information Systems	PC	5	2	0	0	2
3	U19AETL614T	Bio Energy - Principles and Applications	PC	3	2	0	0	2
4	U19AETL615T	Fundamentals of PLC and SCADA	PC	3	2	0	0	2
5	U19AETH605	Soil and Water Conservation Engineering	PC	3	3	1	0	4
6	U19CEOEXXX	Open Elective - I	OE	4	3	0	0	3
7	U19AEPEXXX	Professional Elective II	PE	5	3	0	0	3
PRACTICALS								
8	U19AETL612L	Farm Machinery and Equipment Laboratory	PC	2	0	0	1	1
9	U19AETL613L	Remote Sensing and Geographical Information Systems Laboratory	PC	2	0	0	1	1
10	U19AETL614L	Bio Energy Laboratory	PC	2	0	0	1	1
11	U19AETL615L	PLC and SCADA Laboratory	PC	2	0	0	1	1
12	U19AEPR601	Mini Project	EEC	2	0	0	3	2
13	U19CCLC604	Career Enhancement Programme - IV	EEC	3	1	0	0	1
		TOTAL	Total	49	17	0	16	26

SEMESTER VII								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19AETH706	Agricultural Economics, Extension and Management	PC	4	3	0	0	3
2	U19CEOEXXX	Open Elective - I	OE	4	3	0	0	3
3	U19AEPEXXX	Professional Elective III	PE	4	3	0	0	3
PRACTICALS								
4	U19AEPR702	Project Work Phase - I	EEC	18	0	0	4	2
5	U19AEIV701	Study Tour	EEC	12	0	0	4	2
			TOTAL	42	9	0	10	13

SEMESTER VIII								
SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	U19AEPEXXX	Professional Elective IV	PE	4	3	0	0	3
2	U19AEPEXXX	Professional Elective V	PE	4	3	0	0	3
PRACTICALS								
3	U19AEPR802	Project Work Phase – II	EEC	9	0	0	12	6
			TOTAL	21	9	0	3	12

TOTAL NUMBER OF CREDITS: 166

HUMANITIES AND SOCIAL SCIENCES (HS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
I	U19ENTL101T	Communicative English	HS	4	2	0	2	2
I	U19ENTL101L	Communicative English Laboratory	HS	2	0	0	2	1
I	U19LATH101, U19LATH102	Language-Tamil. Language-Malayalam	HS	2	2	0	0	2
II	U19ENTL202T	English for Engineers	HS	4	2	0	0	2
II	U19ENTL202L	English for Engineers Laboratory	HS	2	0	0	2	1

BASIC SCIENCES (BS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
I	U19MATH101	Matrices and Calculus for Agriculture Engineering	BS	6	3	1	0	4
I	U19PHTL101T	Applied Physics for Engineering	BS	5	2	0	0	3
I	U19PHTL101L	Applied Physics for Engineering Laboratory	BS	4	0	0	2	1
I	U19AEPC101	Crop Production Laboratory - I	BS	4	0	0	4	2
II	U19MATH210	Laplace Transforms and Advanced Calculus for Agriculture Engineering	BS	6	3	1	0	4
II	U19CHTL204T	Engineering Chemistry	BS	5	3	0	0	3
II	U19CHTL204L	Engineering Chemistry Laboratory	BS	3	0	0	2	1
III	U19MATH319	Transforms and Numerical Methods for Agriculture Engineering	BS	5	3	1	0	4
IV	U19MATH426	Probability and Statistics for Agriculture Engineering	BS	4	3	0	0	3

ENGINEERING SCIENCES (ES)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
I	U19CSTL101T	Computational Thinking And Problem Solving	ES	5	3	0	0	3
I	U19CSTL101L	Computational Thinking And Problem Solving Laboratory	ES	3	0	0	2	1
II	U19CSTL203T	C Programming	ES	5	3	0	0	3
II	U19CSTL203L	C Programming Laboratory	ES	3	0	0	2	1
III	U19AETL303T	Strength of Materials for Agriculture Engineering	ES	5	3	0	0	3
III	U19AETL304T	Design Of Farm Structures	ES	4	1	0	0	1
III	U19AETL303L	Strength Of Materials For Agriculture Engineering Laboratory	ES	3	0	0	2	1
III	U19AETL304L	Design Of Farm Structures Labaratory	ES	3	0	0	4	2
IV	U19AETL407T	Thermodynamics	ES	5	3	0	0	3
IV	U19METL306T	Fluid Mechanics and Hydraulics	ES	5	2	0	0	2
IV	U19AETL408T	Surveying and Leveling	ES	4	2	0	0	2
IV	U19FTTL401T	Post Harvest Technology of Cereals,Pulses and Oil seeds	ES	4	3	0	0	3
IV	U19AETL407L	Thermodynamics Laboratory	ES	3	0	0	2	1
IV	U19METL306L	Fluid Mechanics and Hydraulics Laboratory	ES	3	0	0	2	1
IV	U19AETL408L	Surveying and Leveling Laboratory	ES	3	0	0	2	1
IV	U19FTTL401L	Post Harvest Technology of Cereals,Pulses and Oil seeds Laboratory	ES	3	0	0	2	1
V	U19AETL509T	Solar System Design and Wind Energy Engineering	ES	4	2	0	0	2
V	U19AETL509L	Renewable Energy Laboratory	ES	3	0	0	2	1

PROFESSIONAL CORE (PC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
I	U19AETL101T	Engineering Drawing	PC	3	1	0	0	1
I	U19AETH101T	Introduction to Agricultural Engineering	PC	3	2	0	0	2
I	U19AETL101L	Engineering Drawing Laboratory	PC	4	0	0	2	1
II	U19AETL202T	Crop Production - II	PC	6	1	0	2	2
II	U19AETL202L	Crop Production - II Laboratory	PC	3	0	0	2	1
II	U19AEPC202	Practices and Certification in 2D Drawings	PC	3	0	0	3	2
III	U19AETL305T	Working Principles Of Machines	PC	6	3	0	0	3
III	U19AETL306T	Emerging Trends Of Unit Operations In Agriculture Processing	PC	4	2	0	0	2
III	U19AETL305L	Working Principles Of Machines Laboratory	PC	3	0	0	2	1
III	U19AETL306L	Emerging Trends Of Unit Operations In Agriculture Processing Laboratory	PC	3	0	0	2	1
III	U19AEPC303L	Design, Analysis and Simulation of Machine Elements-1	PC	4	0	0	4	2
IV	U19AELC404	Design, Analysis and simulation of Machine elements- II	PC	6	0	0	4	2
V	U19AETH503	Farm Tractors	PC	4	3	0	0	3
V	U19AETH502	Design of Basic Machine Elements	PC	5	3	1	0	4
V	U19AETL510T	Irrigation Automation and Drainage Engineering	PC	5	3	0	0	3
V	U19AETL511T	Hydrology and Water Resources Engineering	PC	4	2	0	0	2
V	U19AETH504	IoT in Agriculture	PC	4	2	1	0	3
V	U19AETL510L	Irrigation Automation and Drainage Engineering Laboratory	PC	3	0	0	2	1
V	U19AETL511L	Hydrology and Water Resources Engineering Laboratory	PC	3	0	0	2	1
VI	U19AETL612T	Farm Machinery and Equipment	PC	4	3	0	0	3
VI	U19AETL613T	Remote Sensing and Geographical Information Systems	PC	5	2	0	0	2

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
VI	U19AETL614T	Bio Energy - Principles and Applications	PC	3	2	0	0	2
VI	U19AETL615T	Fundamentals of PLC and SCADA	PC	3	2	0	0	2
VI	U19AETH605	Soil and Water Conservation Engineering	PC	3	3	1	0	4
VI	U19AETL612L	Farm Machinery and Equipment Laboratory	PC	2	0	0	1	1
VI	U19AETL613L	Remote Sensing and Geographical Information Systems Laboratory	PC	2	0	0	1	1
VI	U19AETL614L	Bio Energy Laboratory	PC	2	0	0	1	1
VI	U19AETL615L	PLC and SCADA Laboratory	PC	2	0	0	1	1
VII	U19AETH706	Agricultural Economics, Extension and Management	PC	4	3	0	0	3

PROFESSIONAL ELECTIVES (PE)

(This can be based on the department as few department the elective starts from fourth semester. Please prepare this based on the curriculum)

SEMESTERS V, VI, VII and VIII

Course Code	Course Title	Category	Contact Periods	L	T	P	C
Dairy and Food Engineering (PE I)							
U19AEPE001	Heat and Mass Transfer	PE	5	3	0	0	3
U19AEPE002	Dairy and Food Engineering – Principles and Products	PE	5	3	0	0	3
U19AEPE003	Refrigeration and Cold Chain Management	PE	5	3	0	0	3
U19AEPE004	Drying and separation methods	PE	5	3	0	0	3
Agricultural Process Engineering (PE II)							
U19AEPE005	Food Processing andPreservation	PE	5	3	0	0	3
U19AEPE006	Process Engineering of Fruits and Vegetables	PE	5	3	0	0	3
U19AEPE007	Storage and Packaging Technology	PE	5	3	0	0	3
U19AEPE008	Food Quality and Safety	PE	5	3	0	0	3
Irrigation and Drainage Engineering (PE III)							
U19AEPE009	Precision Farming	PE	5	3	0	0	3
U19AEPE010	Protected Cultivation	PC	5	3	0	0	3
U19AEPE011	Ground water wells and pumps	PE	5	3	0	0	3
U19AEPE012	Minor irrigation and CommandArea Development	PE	5	3	0	0	3

Course Code	Course Title	Category	Contact Periods	L	T	P	C
Farm Power and Machinery (PE IV)							
U19AEPE013	Special Farm Equipment	PE	5	3	0	0	3
U19AEPE014	Mechanics of Tillage and traction	PE	5	3	0	0	3
U19AEPE015	Farm Power and Machinery management	PE	5	3	0	0	3
U19AEPE016	Ergonomics in Farm Machinery	PE	5	3	0	0	3
Soil and Water Conservation Engineering (PE V)							
U19AEPE017	On farm Water Management	PE	5	3	0	0	3
U19AEPE018	Watershed Management	PE	5	3	0	0	3
U19AEPE019	Ground water management	PE	5	3	0	0	3
U19AEPE020	Water Harvesting and Soil Conservation structures	PE	5	3	0	0	3
U19AEPE021	Principles of Soil Engineering	PE	5	3	0	0	3

OPEN ELECTIVES (OE)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	U19CHOE001	Environmental Studies	OE	5	3	0	0	3
2	U19CEOE004	Disaster Preparedness And Management	OE	5	3	0	0	3
3	U19FTOE004	Beverage Technology	OE	5	3	0	0	3
4	U19EDOE01	Intellectual Property Rights	OE	5	3	0	0	3

*The elective list for all the semester to be tabulated

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
I	U19CCEX101	Engineering Exploration I	EEC	3	1	0	2	2
II	U19CCEX202	Engineering Exploration II	EEC	3	1	0	2	2
III	U19CCEX303	Engineering Exploration III	EEC	3	0	0	2	1
III	U19CCLC301	Career Enhancement Program-I	EEC	2	0	0	2	1
IV	U19CCEX404	Engineering Exploration IV	EEC	3	0	0	2	1
IV	U19CCLC402	Career Enhancement Program-II-Personality Development II	EEC	2	0	0	2	1
V	U19CCEX505	Engineering Exploration V	EEC	3	1	0	2	1
V	U19CCLC503	Career Enhancement Program - III	EEC	1	1	0	0	1
VI	U19CCLC604	Career Enhancement Program – IV	EEC	1	1	0	0	1
VI	U19AEPR601	Mini Project	EEC	5	0	0	3	2
VII	U19AEPR702	Project Work Phase - I	EEC	18	0	0	4	6
VII	U19AEIV701	Study Tour	EEC	12	0	0	4	4
VIII	U19AEPR802	Project Phase II	EEC	9	0	0	12	6

SUMMARY

S.No	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1	HS	5	3							8	4.82%
2	BS	10	8	4	3					25	15.06%
3	ES	4	4	7	14	3				32	19.28%
4	PC	4	5	9	2	17	17	3		57	34.34%
5	PE					3	3	3	6	15	9.03%
6	OE						3	3		6	3.61%
7	EEC	2	2	2	2	2	3	4	6	23	13.86%
TOTAL										**166**	

SEMESTER I

U19ENTL101T	COMMUNICATIVE ENGLISH (Common to all Programmes)	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To enhance learners' listening skills so as to help them to comprehend conversations and lectures in diverse contexts.
- To develop the speaking skills of learners with fluency and appropriacy to express their ideas, views, and opinions in varied formal and informal contexts and social situations.
- To inculcate the habit of reading using different types of reading strategies for understanding contextual situations.
- To develop the learners to write various writing forms effectively and coherently in an appropriate style.
- To develop linguistic competence and performance to express ideas effectively and appropriately in different contexts.

PREREQUISITES

- Nil

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO BUSINESS COMMUNICATION 6

Parts of Speech - Jumbled words - Making mild Suggestions/offers/invitations - Discourse Markers - Letter writing (Request / Complaint / Thanking).

UNIT II EXTENDED WRITING 6

Seeking advice / Information politely - Root words - Present Tense - Reading Comprehension (MCQ) - Paragraph writing.

UNIT III READING COMPREHENSION 6

Past Tense - Phrasal Verbs - Jargon - Making polite requests - Reading and comprehending newspaper articles - Hints Development.

UNIT IV EXTENDED GRAMMAR CONCEPTS 6

Future Tense - Determiners - Making inquiries/requests indirectly and politely - Indicating Preference - Reading Comprehension (Short questions) - Constructing conversations (Formal and Informal).

UNIT V TECHNICAL COMMUNICATION 6

Pointing out mistakes and unpleasant things politely - Asking yes or no type questions and wh-questions indirectly and politely - Misspelled words - Cloze reading - Picture Description – Jumbled sentences.

Total: 30 Hours

Course Outcome

At the end of the course, students should be able to

CO1 Listen and comprehend technical and non-technical spoken experts critically and functionally.
CO2 Write different forms of writing effectively and apparently create an advanced level of writing in English.
CO3 Read different genres of text, analyzing and interpreting it by guessing the meaning from the context and employing it for new ideas, to learn and present.
CO4 Speak fluently using the appropriate vocabulary, modulation, articulation, and pronunciation.
CO5 Familiarize the soft skills needed for employability and gain a functional understanding of the language.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1							2	2	2	3		2			2
CO2								1	2	3		2			2
CO3						2		2	3	3		2			2
CO4							3	2	1	3		3			3
CO5						3	3	3	3	3		3			3

TEXTBOOKS

T1. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning, USA: 2007.

T2. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student‘s Book). Cambridge University Press, New Delhi: 2005.

REFERENCE BOOKS

R1. Carter, R., & McCarthy, M. (2006). Cambridge grammar of English: A comprehensive guide: spoken and written English grammar and usage. Cambridge University Press.

R2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.

R3. Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press. 2018.

WEB RESOURCES

W1. http://www.bbc.co.uk/worldservice/learningenglish/language/

W2. http://www.bbc.co.uk/learningenglish/english/features/pronunciation/introduction

W3. http://toefl.uobabylon.edu.iq/papers/itp_2015_1817487.pdf

U19ENTL101L COMMUNICATIVE ENGLISH LABORATORY L T P C

(Common for all branches) **0 0 2 1**

LAB COMPONENT CONTENTS

1. Organs of Speech
2. Pronunciation – Vowels
3. Pronunciation – Diphthongs
4. Pronunciation - Consonants
5. Word Transcription
6. Pronunciation tips
7. Word stress

Total:15 Hours

U19MATH101 **Matrices and Calculus for Agriculture Engineering** **L T P C**

3 1 0 4

COURSE OBJECTIVES:

Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of Matrix Theory, Differential Calculus, Integral Calculus and Ordinary Differential Equations which are being widely used in Agricultural Engineering studies.

PRE-REQUISITES

- Basic concepts of Matrices
- System of linear equations
- Limits and continuity
- Basic concepts of Differentiation
- Basic concepts of Integration

UNIT I – MATRICES 9+3

Consistency of linear system of equations – Rouche's theorem– Linear transformations – Vectors – Linear dependence – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (excluding proof) – Applications of Matrices in Agricultural Engineering.

UNIT II – DIAGONALIZATION OF A REAL SYMMETRIC MATRICES 8+3

Cayley - Hamilton theorem (excluding proof) – Orthogonal matrix – Diagonalization of matrices – Reduction of Quadratic form to Canonical form by orthogonal transformation -Applications of Diagonalization of a real symmetric matrices in Agricultural Engineering.

UNIT III – DIFFERENTIAL CALCULUS AND ITS GEOMETRICAL APPLICATIONS 9+3

Derivatives – Curvature – Radius of curvature in Cartesian and Parametric forms – Simple problems – Centre of curvature – Circle of curvature – Involutes and Evolutes of Parabola –Applications of Differential Calculus in Agricultural Engineering.

UNIT IV – INTEGRAL CALCULUS AND MULTIPLE INTEGRALS 9+4

Definite and Indefinite integrals – Substitution rule – Integration by parts – Double integrals – Area enclosed by plane curves –Triple integrals in Cartesian coordinates – Applications of Integrals in Agricultural Engineering.

UNIT V – ORDINARY DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients – Cauchy's linear equations – Simultaneous first order linear equations with constant coefficients – Applications of Ordinary Differential Equations in Agricultural Engineering.

Total: 60 hours

COURSE OUTCOMES:

At the end of the course, a student will be able to

CO1. Calculate the rank of a matrix, Eigen values, Eigen vectors and solutions of system of linear equations.

CO2. Use the applicability of Cayley - Hamilton theorem to find the inverse of a matrix and Diagonalization of matrix.

CO3. Gain knowledge to find the radius of curvature and torsion of a curve, which are used for analyzing the output data.

CO4. Gain knowledge to determine values of definite integrals exactly and apply to regions under and between curves.

CO5. Gain knowledge to solve differential equations arising in Agricultural Engineering.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1				1		2	2	2		1	2		2	
CO2		2		2		1		1		3		2		2	
CO3	2				2	2		2	3		2	2		2	
CO4			2	2			3		1	3	1	3		3	
CO5		1		1		3	3	3	3	3		3		3	

TEXT BOOKS:

T1. Grewal. B. S., "Higher Engineering Mathematics", 44 th Edition, Khanna Publishers, New Delhi, 2017.

T2. James Stewart., "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Unit IV-Sections 5.2, 5.4(excluding net change theorem), 5.5 and 7.1]

REFERENCE BOOKS:

R1. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2011.

R2. Veerarajan T., "Engineering Mathematics", Tata McGraw Hill Publishing company, New Delhi (2008)

R3. Peter V. O' Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning India Pvt .,Ltd,New Delhi,2011.

R4. Weir. M. D and Joel Hass., "Thomas Calculus", 14th Edition, Pearson India, 2017.

U19PHTL101T **Applied Physics for Agriculture Engineering** **L T P C**

2 0 0 3

COURSE OBJECTIVES

To understand the principles of electronics. The course should facilitate the student to

- Develop strong fundamentals knowledge in principle of electronics
- Provide a strong foundation in the understanding of the phenomenon of current electricity
- Develop the knowledge of students in electronic science.

THEORY

UNIT I CURRENT ELECTRICITY AND ELECTROSTATICS **9**

Electrical measurements: Potential difference – Electric current – Ohm's law – Resistance –Resistances in series and parallel – Kirchhoff's laws Gauss's theorem and its applications Coulomb's law – Mechanical force experienced by unit area of a charged sphere – Electrified soap bubble – Electrical images (Basics Only).Capacitors: Capacity of a conductor- Energy of a charged conductor- Sharing of energy between two capacitors - Principle of a capacitor capacity of a spherical and cylindrical capacitors-Capacitors in seriesand in parallel

UNIT II MAGNETIC INDUCTION **9**

Biot-Savart law – Ampere's circuital law – Lorentz force - Electromagnetic Induction: Faraday's laws – Lenz's law - Fleming's right hand thumb rule – Self-inductance – Self inductance of a long solenoid – Determination of self-inductance by Rayleigh's method –Mutual inductance – mutualinductance between two solenoids – Determination of mutual inductance

UNIT III ELECTRODYNAMICS 9

Electromotive force – ohms law – Faradays law – Induced electric field – Energy in magnetic fields – Maxwell's equation in free space – Magnetic charge - Maxwell's equation in matter –Boundary conditions - Conservation laws – Conservation of energy – Poynting's theorem -conservation of momentum

UNIT IV ELECTROMAGNETIC WAVES & INTERACTION WITH MATTER 9

Electromagnetic waves in vacuum – Energy and momentum of EMW – EMW in matter –Propagation in linear media – Reflection and transmission at Normal incidence – Reflection and Transmission at Oblique incidence – Implications: Laws of incidence and reflectance, snell's law, Brewster law – Fresnel's equations – wave guides- rectangular waveguide.

UNIT V APPLIED OPTICS **9**

Properties of laser radiation and their significance-wavelength, power, monoc Periodsomaticity, coherence, Einstein Theory of stimulated emission-Types of lasers working media and their radiation characteristics-Power, wavelength and operational modes of Nd-YAG, excimer, diode lasers. Optical fiber – principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – types of optical fibers – applications – fiber optic communication system – medical endoscopy.

Total: 45 hours

U19PHTL101L **Applied Physics for Engineering Laboratory** **L T P C**

0 0 2 1

- Determination of band gap of semiconductor
- Determination of thermal conductivity of a bad conductor -Lee's Disc method
- Semiconductor laser - Determination of wavelength and particle size.
- Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
- Uniform Bending - Determination of Young's Modulus.
- Determination of wavelength of mercury spectrum – spectrometer grating

Total: 30 hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the phenomenon of current electricity and electrostatics

CO2 : Have a fundamental knowledge of a magnetic induction

CO3 : Understand the concept, electrodynamics and its principle

CO4 : Know the concept of EM wave and its interaction with matter.

CO5 : Have an understanding of the laser, production, and concept of fiber optic

CO/PO MAPPING													**CO/PSO Mapping**		
CO	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1			2			2	2	2			2		1	
CO2		2			1			1	2	3	1	2	2	2	
CO3			2	2		2		2		3		2		2	
CO4	2		1		1		3		1		2	3	1	3	
CO5		1				3	3	3	3	3		3		3	

TEXT BOOKS

T1. S.J.Gupta, Sanjeev Gupta, Modern Engineering Physics, Dhanpat Rai Publication, New Delhi

T2. S.O.Kasap, Principle of Electronic Materials and Device, Mc Graw Hill Publications

T3 Brijlal and Subramaniam, Electricity and Magnetism, Ratan Prakashan Educational & University Publishers, 1992,Edition: 19th

T4. ”LABORATORY MANUAL IN APPLIED PHYSICS”-Second editionH.Sathyaseelam-New age International

REFERENCE BOOKS

R1. H. J. Pain, The Physics of Vibrations and Waves, John Wiley, (2005), 6th Edition

R2. David Halliday, Robert Resnick and Jearl Walker, Fundamentals of Physics, John Wiley & SonsDelhi , 9th Edition , 2010

WEB RESOURCES

W1. http://ocw.mit.edu/courses/#physics

W2. http://nptel.ac.in/courses/115106090

U19CSTL101T **Computational Thinking And Problem Solving** **L T P C**

3 0 0 3

COURSE OBJECTIVE:

The course aims to provide

• Exposure to problem-solving through programming.

• To train the student to the basic concepts of the C-programming language.

• Give the student hands-on experience with the concepts

UNIT-I- INTRODUCTION TO COMPUTER PROBLEM SOLVING **9**

Introduction, The problem Solving Aspect, Top-Down Design, Implementation of Algorithms, Program Verification, The efficiency of algorithms, The Analysis of Algorithms. Introduction, Information and data, Data encoding. Logic: Boolean logic, Applications of propositional logic

UNIT-II PROBLEM SOLVING AND ALGORITHMIC THINKING AND PROBLEM SOLVING TECHNIQUES **9**

Problem definition, logical reasoning, problem decomposition, abstraction. Flowchart: Name binding, Selection, Repetition, Modularization. Data Organization: List and Arrays. Simple algorithms, Factoring and recursion techniques, Search and sort techniques, Text processing and pattern matching

UNIT-III C PROGRAMMING FUNDAMENTALS **9**

Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic, Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions. If, If-Else, SwitchStatement and Examples. Loop Control Statements: For, While, Do While and Examples. Continue Break and Goto statements.

UNIT-IV ARRAYS& STRINGS: **9**

Arrays - Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear Search, Selection Sort. Strings - Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions

UNIT-V FUNCTIONS: **9**

Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, and Methods of Parameter Passing. Recursion- Recursive Functions. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

Total: 30 hours

U19CSTL101L **Computational Thinking and Problem Solving Laboratory** **L T P C**

0 0 2 1

LAB COMPONENT

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Simple statements and expressions
4. Scientific problem-solving using decision making and looping.
5. Simple programming for arrays.
6. Solving problems using String functions
7. Programs with user defined functions – Includes Parameter Passing
8. Program using Recursive Function

Total: 30 hours

COURSE OUTCOMES:

After the course the students are expected to be able to:

CO1: Identify situations where computational methods and computers would be useful, various types of data representations.

CO2: Given a computational problem, identify and abstract the programming task involved, approach the programming tasks using techniques learned and write pseudo-code.

CO3: Understand the basic of C programming, choosethe right data representation formats based on the requirements of the problem.

CO4: Design and implement applications in C using arrays and strings

CO5: Develop and implement applications in C using function

CO/PO MAPPING													**CO/PSO Mapping**		
CO	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1		2		1		2	2		3		2	1	2	
CO2		2		2				1	2	3	1	2		2	
CO3			3		1	2		2	3			2	2		
CO4	1	2		2	2		3			3	2	3		3	
CO5			1			3	3	3	3	3		3			

TEXT BOOK:

T1.Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill

T2. Programming With C, Schaum Series

REFERENCE BOOKS:

R1. The ‘C’ programming language by Kernighan and Ritchie, Prentice Hall

R2. Computer Programming in ‘C’ by V. Rajaraman , Prentice Hall

R3. Programming and Problem Solving by M. Sprankle, Pearson Education

R4. How to solve it by Computer by R.G. Dromey, Pearson Education

R5. http://www2.its.strath.ac.uk/courses/c

U19AETL101T **Engineering Drawing** **L T P C**

1 0 0 1

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.

THEORY

UNIT I CONVENTIONS AND BASIC DRAWINGS **9**

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

UNIT II ORTHOGRAPHIC PROJECTIONS **9**

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

UNIT III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACE **9**

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

UNIT IV ISOMETRIC AND PERSPECTIVE PROJECTIONS **9**

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

UNIT V INTRODUCTION TO COMPUTER AIDED DRAWING **9**

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

Total: 45 hours

U19AETL101L **Engineering Drawing Laboratory** **L T P C**

0 0 2 1

LAB COMPONENT CONTENTS

1. Acquaintance of drawing instruments, lettering, curves etc.
2. Projection – orthographic projection views, plane of projection, first and third angle Projection
3. Orthographic projections –points
4. Orthographic projections- lines, parallel to and contained by one or both planes, perpendicular to a plane, inclined to one plane and parallel to other
5. Projection of lines – Projection of lines inclined to both plane, True length and inclination of lines, traces of lines
6. Projection of plane- perpendicular to both plane, perpendicular to one and parallel to other, perpendicular to one and inclined to the other, Traces of planes
7. Projection of solid-axis inclined to one plane and parallel to other, axis inclined to both Planes
8. Section of solids- concept of sectioning, section plane parallel to one plane, section plane perpendicular to one plane and inclined to other
9. Preparation of working drawing from models and isometric views. Drawing of missing views.
10. Final Practical Examination

Total: 15 hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Recognize the conventions and apply dimensioning concepts while drafting simple objects.

CO2 : Draw the orthographic projection of points, line, and solids

CO3 : Draw the section of solid drawings and development of surfaces of the given objects.

CO4 : Draw the isometric and perspective projection of the given objects.

CO5 : Draw the simple two dimensional drawings using computer aided drawing tool

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2	1			3		1	1	1	2		2	
CO2	1			2			2	3		1				2	
CO3	2		2		3		3		2	1		2		2	
CO4	1			1				3	3		1	3		3	
CO5	1		2	1	3		3	3	1	1	1	3		3	

TEXT BOOKS

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.

2.Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

REFERENCE BOOKS

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

U19AEPC101 **Crop Production Laboratory-I** **L T P C**

0 0 4 2

COURSE OBJECTIVES

• To introduce the students to principles of field crops production and to introduce the production practices of crops.

• To delineate the role of agricultural and irrigation engineers in relation to various crop production practices.

• To equip the students with necessary theoretical and practical knowhow on basic principles of cropping and acquaint them with the cultivation practice of few important crops of Tamil Nadu.

PRE-REQUISITES

NIL

CONTENTS

UNIT I AGRICULTURE AND CROP PRODUCTION 9

Introduction to agriculture and its crop production sub-sectors - field crop production and horticulture; Factors affecting crop growth and production: genetic (internal) and environmental (external) factors; Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices

UNIT II CROP SELECTION AND ESTABLISHMENT 9

Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants; Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing.

UNIT III CROP MANAGEMENT 9

Crop water Management; Crop nutrition management - need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling; Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and methods of harvest.

UNIT IV PRODUCTION PRACTICES OF AGRICULTURAL CROPS 9

Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: cereal crops, grain legumes, oil seed crops, sugarcane, and fiber crops, and special purpose crops such as those grown for green manure and fodder.

UNIT V PRODUCTION PRACTICES OF HORTICULTURAL CROPS 9

Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops; Cultivation practices of representatives of each group; Special features of production of horticultural crops - green house cultivation

Total: 45 hours

U19AEPC101 **Crop Production -I Laboratory** **L T P C**

0 0 4 2

LAB COMPONENT:

To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.

1. Identification of different crops in local region
2. Visit to meteorological observatory
3. Visit to wetlands and irrigate dry lands to learn important cropping systems and Hi Tec nursery
4. Seed selection and seed treatment procedures
5. Seed bed and nursery preparation
6. Sowing / Transplanting
7. Biometric observation for crops
8. Nutrient management studies
9. Water management and irrigation scheduling
10. Weed management studies
11. Integrated Pest Management studies
12. Harvesting
13. Post harvesting

Total: 45 hours

COURSE OUTCOMES :

At the end of the course students should be able to

CO1 : Students completing this course would have acquired knowledge on crop selection, crop production crop management.

CO2 : The students will have the required knowledge in the area of production of agricultural crop

CO3: The students will have the required knowledge in Crop water Management, Crop nutrition management

CO4: Students completing this course would have acquired knowledge on Generalized management and cultivation practices for important groups of field crops in Tamil Nadu

CO5: Students completing this course would have acquired knowledge on Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops;

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1	1		2		2		3	2		2	2	
CO2	3	3			2	3		1		1			2	2	
CO3			1	2			1		3	2	3	3	2	2	
CO4	3	3			2		2	3		1			2	2	
CO5		3	1	1		2			3		1		2	2	

TEXT BOOKS

T1. Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2015.

T2. Hand Book of Agriculture. 2009 (6th revised edition), Indian Council of Agricultural Resarch (ICAR), New Delhi

T3. Balasubramanian P and Palaniappan SP. 2001. Principles and practices of Agronomy. Agrobios Publishers, Ludhiana

REFERENCE BOOKS

R1. Ramasamy S and Siddeswran K 2018. Agriculture and crop production.Sri Shakthi Institute of Engineering and Technology, Coimbatore

R2. Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2005

R3 Reddy T. Sankara G.H. Yellamanda Reddi, Principles of Agronomy, Kalyani Publishers, New Delhi, 2005.

U19AETH101T **Introduction to Agriculture Engineering** **L T P C**

2 0 0 2

COURSE OBJECTIVES

• To present the basic theory and practice for various areas of Agricultural Engineering.

• To make students to understand application of engineering to the problems of agricultural production.

• To delineate the role of agricultural and irrigation engineers in relation to various engineering practices in crop production.

• To equip the students with necessary theoretical and practical knowhow on soil and water conservation, farm power and machinery, energy and processing.

PRE-REQUISITES

NIL

THEORY COMPONENT CONTENTS

UNIT I FARM POWER **6**

Agricultural Engineering – Introduction – Branches - Importance in national and global scenario – Institutes & Organizations – Farm Power sources – Power available in farms - Tractor and Powertiller – Role of farm power in increasing crop production.

UNIT II FARM MACHINERY & EQUIPMENT **9**

Tillage equipment – Sowing, Planting, Fertilizer application - Sprayers, Weeding and interculture equipment – Harvesting machinery - Combines.

UNIT III SOIL & WATER CONSERVATION ENGINEERING, IRRIGATION & DRAINAGE ENGINEERING **9**

Soil & water - Land development, Land use classification - Soil erosion and control - Soil conservation methods - Watershed management - Agro meteorology – Sources of water – Tanks – Wells & Reservoirs – Irrigation methods – Micro irrigation – Drainage.

UNIT IV AGRICULTURAL PROCESS ENGINEERING **9**

Post harvest of crops, Unit operations in agricultural processing, Ripening chamber and Cold Storage - Packing of agricultural produces – Material handling equipment – Milk processing and dairy products.

UNIT V AGRO ENERGY **9**

Solar energy – Application of Photovoltaic in agriculture - Bio-gas and its utilization in agriculture – Gasification of biomass for IC Engines - Energy efficient cooking stoves and alternative cooking fuels – agricultural wastes and their utilization.

Total: 30 hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Students completing this course would have acquired knowledge on various disciplines of Agricultural Engineering.

CO2 : The students will have the required knowledge in the area of farm machinery & equipment

CO3: Students completing this course would have acquired knowledge on soil & water conservation engineering, irrigation & drainageengineering

CO4: The students will have the required knowledge in the area agricultural process engineering

CO5: Students completing this course would have acquired knowledge on Solar energy, Application of Photovoltaic in agriculture - Bio-gas and its utilization in agriculture

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		1			2		2	1	2	2	2	
CO2		1		2	3		2		1		2	2	2	2	
CO3	2		2	3		2		1	3	3			2	2	
CO4		1			1	2	3		2		2	1	2	2	
CO5	3	2		3		1		2		2		1	2	2	

TEXT BOOKS

T1. Michael, A.M. & Ojha, T.P. “Principles of Agricultural Engineering Vol. I & II”, Seventh Edition, Jain Brothers, New Delhi, 2011.

T2. Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology – A problem solving approach, Springer Science, NY, USA, 2007.

REFERENCE BOOKS

R1. Jagdishwar Sahay. “Elements of Agricultural Engineering”, Standard Publishers Distributors, 2010.

U19CCEX101 **Engineering Exploration I** **L T P C**

1 0 2 2

COURSE OBJECTIVES

• To understand the role of an Engineer as a problem solver.

• To learn engineering design aspects, and multi-disciplinary approach.

• To find solutions to complex problems through engineering design utilizing multi-disciplinary systems approach.

• To Examine the given problem using process of engineering problem analysis.

• To collect data in different forms and to have visual analysis.

PRE-REQUISITES

Nil

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO ENGINEERING AND ENGINEERING STUDY 3+6

Difference between science and engineering, Problem space of an engineer (needs), various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.

UNIT II ENGINEERING DESIGN 3+6

Engineering Design Process, Importance of analysis in engineering design, general analysis procedure, Multidisciplinary facet of design, Mechatronics system design,12V DC power supply design, Conversion of Electrical to Mechanical Energy.

UNIT III MECHANISMS 3+6

Mechanisms and Machines, Different types of Mechanisms (focus on linkages), Degrees of freedom or mobility of a mechanism, 4-Bar Mechanisms: Crank Rocker Mechanism, Slider Crank Mechanism.

UNIT IV PLATFORM BASED DEVELOPMENT 3+6

Introduction to systems and Platform Based Development, Arduino as a development board, Sensors, actuators and control, Interfacing of I/O devices, Pulse Width Modulation, Analog and Digital data.

UNIT V DATA ACQUISITION AND ANALYSIS 3+6

Types of Data, Descriptive Statistics techniques as applicable to different types of data, Types of graphs as applicable to different types of data, Usage of Microsoft Excel tool for descriptive statistics, Data Acquisition (Temperature and humidity) using Sensors interfaced with Arduino, Exporting acquired data to Microsoft Excel and analysis using visual representation.

Total: 45 hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understand the role of an Engineer as a problem solver.

CO2 : Able to learn design engineering solutions to complex problems utilizing multidisciplinary systems approach.

CO3: Examine a given problem using process of engineering problem analysis.

CO4: Identification of variables involved in problem analysis and conducting experiments.

CO5: Recording data and analyze

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2			2			2		2		1		2	3
CO2			2		1		1		2			2	1	2	3
CO3		2	1		1	1			1		2	1		2	2
CO4	1			1			2		1		2		2	2	2
CO5	1		1		2		2	2		2		2		2	2

SEMESTER II

U19ENTL202T **English For Engineers** **L T P C**

2 0 0 2

COURSE OBJECTIVES

• To develop learners' ability to listen and comprehend talks for the application of language in various context.

• To develop the students' ability to use English accurately, appropriately and fluently in different social and professional situations.

• To comprehend advanced technical passages and to identify the author's purpose and tone. • To enhance advanced level of writing by organizing ideas and achieving consistency in academic as well as workplace contexts.

• To enhance the technical components of English language for formulating effective and appropriate sentences.

PRE-REQUISITES

Nil

THEORY COMPONENT CONTENTS

UNIT I **6**

Listening to talks and presentation - Describing person, place and things - Reading comprehension (IELTS/TOEFL) – Instructions - Subject-verb Agreement - Collocation

UNIT II **6**

Academic Listening and making notes - Process Description - Checklist – Recommendations - Impersonal voice - Compound words.

UNIT III **6**

Impromptu speech - Cloze reading - Email Writing - Direct and Indirect speech – Guessing meaning based on the context - Accent

UNIT IV **6**

BBC Hard Talks & NDTV Big Fights - Data Interpretation - Conditional Clauses - Question tags. Stress – Misspelled Words

UNIT V **6**

BEC listening - Group Discussion - Reading Charts, Tables and Graphs - Minutes of Meeting - Fixed and semi fixed expressions– Embedded Clauses - Technical Vocabulary – Adverbs - Intonation

Total: 30 hours

SELF STUDY

• Swami and Friends by R.K.Narayan

• The Hound of the Baskerville – Sherlock Holmes by Arthur Canon Doyle

• The Alchemist by Paulo Coelho

• The Old Man and the Sea by Earnest Hemingway

• The Invisible Man by Ralph Ellison

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Able to listen to advanced level of language and make note on it.

CO2 : Give an oral presentation in class using effective delivery strategies.

CO3 : Make inferences and predictions based on information in the text.

CO4 : Produce coherent and unified paragraph with adequate support and detail.

CO5 : Apply pragmatic and sociolinguistic aspect of communication for professional presentations.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			2		1	2	1	1	3		2	1	2	
CO2		2	2		2	2	2	2	2	3		2		2	
CO3	1	1		1		3	3	1	2	3		3	2	2	
CO4			2		1	1	1		1	3		1		3	
CO5	1	2		2		3	3	3	3	3		3	3	3	

TEXT BOOKS

T1. Rizvi M Ashraf, Effective Technical Communications, Mc Graw Hill, 2e, 2018

T2. Whitby Norman. Business Benchmark Pre-Intermediate to Intermediate Student's Book. Cambridge University Press, London 2008

REFERENCE BOOKS

R1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016

R2. Gupta S.M. Current English Grammar and English, Delhi,2013.

R3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007

R4. The Oxford Guide to Writing and Speaking, John Seely, Oxford, 2005 5 Chaturvedi PD, Mukesh, The art and sciences of Business Communication, 4e. Pearson 2018

WEB RESOURCES

W1. www.oxfordonlineenglish.com/free-english-pronunciation-lessons

W2. https://www.bbc.co.uk/programmes/n13xtmdc

W3. http://www.cambridge.org/elt/blog/

U19ENTL202L	**English for engineers Laboratory**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

LAB COMPONENT CONTENTS

1. Netiquette
2. Para Jumbles
3. Verbs from News Stories
4. Narrative writing and Speaking
5. Movie Review
6. One minute Talk
7. Impromptu Talks
8. Technical Presentation
9. Reading Comprehension
10. Articulation of reading a text

Total: 30 hours

U19MATH210 **Laplace Transforms And Advanced Calculus For Agriculture Engineering L T P C**

3 1 0 4

COURSE OBJECTIVES:

Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of Laplace transforms, Vector Differentiation, Vector Integration, Complex Differentiation and Complex Integration which are being widely used in Agricultural Engineering studies.

PRE-REQUISITES:

• Basic concepts of Differentiation

• Basic concepts of Integration

• Basic concepts of Vectors and Trigonometry functions

UNIT I – LAPLACE TRANSFORMS **9+4**

Definition – Transforms of Elementary functions – Properties of Laplace transforms (Statement only) – Transforms of Periodic functions – Transforms of derivatives and integrals (Statement only) – Inverse transforms – Convolution theorem (Problems only) – Application to linear ODE of second order with constant coefficients – Applications of Laplace transforms in Agricultural Engineering.

UNIT II – VECTOR DIFFERENTIATION **9+3**

Scalar and Vector Point functions – Gradient – Directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Del applied twice to Point functions (Problems only) – Applications of Vector Differentiation in Agricultural Engineering.

UNIT III – VECTOR INTEGRATION **9+4**

Line Integral – Green's theorem in the plane (excluding proof) – Stoke's theorem (excluding proof) – Gauss divergence theorem (excluding proof) – Simple applications involving cubes and rectangular parallelepipeds – Applications of Vector Integration in Agricultural Engineering.

UNIT IV – COMPLEX DIFFERENTIATION **8+3**

Limit and derivative of a complex function – Analytic functions – Cauchy-Riemann equations – Harmonic functions – Orthogonal properties of analytic functions (excluding proof) – Construction of analytic functions by Milne – Thomson's Method – Conformal transformation : $w = z + c$, cz, $1/z$ and Bilinear transformation – Applications of complex differentiation in Agricultural Engineering.

UNIT V – COMPLEX INTEGRATION **8+3**

Complex integration – Statements of Cauchy's theorem and Cauchy's integral formula – Laurent's series – Singular points – Residues – Calculation of Residues – Cauchy's Residue theorem (excluding proof) – Applications of complex integration in Agricultural Engineering.

Total: 60 hours

COURSE OUTCOMES:

At the end of the course, a student will be able to

CO1. Apply the knowledge of Laplace transforms to solve the differential and integral equations.

CO2. Perform vector calculus operations such as gradient, divergence and curl in vector and scalar fields.

CO3. Apply the techniques of line, surface and volume integrals to solve application problems.

CO4. Gain knowledge to construct the analytic function and to find the image of given region under conformal mapping.

CO5. Gain knowledge to solve the problems by using complex integration.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2	1		1	2		1	2	2	2	
CO2	3	3		1			1	1		2		2	2	2	
CO3		3	1	2	2	1		2			1	2	2	2	
CO4	3	3		1	1		1		2	2		2	2	2	
CO5	3	3	2		2		1		2		1	2	2	2	

TEXT BOOKS:

T1. Grewal. B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.

REFERENCE BOOKS:

R1. Bali. N. P and Manish Goyal., "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt., Ltd., 2010.

R2.Glyn James, "Advanced Modern Engineering Mathematics", 4 th Edition, Pearson Education - 2011.

R3. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2011.

R4. Peter V. O 'Neil, "Advanced Engineering Mathematics", 7 th Edition, Cengage learning India Pvt ., Ltd, New Delhi,2011. .

R5. Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

U19CHTL204T **Engineering Chemistry** **L T P C**

3 0 0 3

COURSE OBJECTIVES

• To make students acquainted with water quality parameters along with the principles and methods of treating water for potable and industrial purposes.

• To understand the nature of soils and its properties.

• To understand the principles and generation of energy through fuels cells and storage devices.

• To learn about various types of fuels, its calorific values and the combustion analysis.

• To know the properties and applications of important nanomaterials.

PRE-REQUISITES

• Students should know about the fundamentals of chemistry and their applications to water treatment, polymers and batteries which they already gained knowledge from school.

THEORY COMPONENT CONTENTS

UNIT I AQUATIC CHEMISTRY **10**

Introduction to water and its treatments - Quality parameters (physical, chemical & biological) – Hardness – Expression of hardness – Estimation of hardness by EDTA method –Domestic water: Requirements (WHO and Indian Standards) – Municipal water treatment – Disinfection methods; Boiler Feed Water: Boiler troubles (scale and sludge formation only) – Requirements; Conditioning methods: External conditioning (Demineralization and Zeolite process) - Internal conditioning; Desalination: Desalination of brackish water – Reverse osmosis.

UNIT II SOIL CHEMISTRY **10**

Chemical (elemental) composition of the earth's crust and soils. Geochemistry of major and micronutrients and trace elements. Chemistry of acid soils; active and potential acidity; lime potential, sub-soil acidity. Chemistry of salt-affected soils and amendments; soil pH, EC, ESP, SAR and important relations; Chemistry and electrochemistry of water logged soils.

UNIT III BATTERIES & FUEL CELLS **8**

Batteries - Types – characteristics - fabrication and working of batteries (alkaline battery, lead – acid battery, Ni-Cd battery and lithium ion batteries) - super capacitors; Fuel cells - principle, working and applications of hydrogen - oxygen, solid oxide, direct methanol and proton exchange membrane fuel cells.

UNIT IV FUELS AND COMBUSTION **8**

Fuels: Classification of fuels – Calorific value - Higher and lower calorific values; Coal:Analysis of coal (proximate only) - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method);Petroleum: Manufacture of synthetic petrol (Bergius process only) - Knocking - Octane number - Diesel oil - Cetane number – Gaseous fuels; Natural gas: Compressed natural gas (CNG) - Liquefied petroleum gases (LPG) - Ignition temperature - Spontaneous ignition temperature – Explosive range - Flue gas analysis (ORSAT Method).

UNIT V NANOMATERIALS **9**

Nanomaterials - Types (Nanoparticles, Nanoclusters, Nanowires, Nanrods and Nanotubes) – Properties – Synthesis & Applications; Role of bottom up and top down approaches in nano technology – solgel process, CVD and Laser ablation – Nano dynamics - Carbon Nanotubes & Graphene – Applications.

Total: 45 hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the water and its parameters influencing treatment process.

CO2 : Understand the chemistry and analysis of soil.

CO3 : Learn about various types of batteries, fuel cells and its applications.

CO4 : Gain knowledge on the properties of polymers, composites and manufacturing methods.

CO5: Understand the importance of nanomaterials and their applications.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1		1			1			2	1	1	2	2	
CO2		3		2		2	1		2	1		1	2	2	
CO3	2		1	2	2		1	1			1		2	2	
CO4						1	2		2	3		2	2	2	
CO5	2	1		1		2		3		2	2		2	2	

TEXT BOOKS

T1. P. C. Jain and Monica Jain, “Engineering Chemistry”, DhanpatRai Publications Pvt. Ltd, New Delhi, 16th Edition, 2017.

T2. S. S. Dara and S.S. Umare, “Textbook of Engineering Chemistry”, S. Chand & Company Ltd, New Delhi, 2017.

REFERENCE BOOKS

R1. PrasantaRath, “Engineering Chemistry”, Cengage Learning India Pvt. Ltd, 2013.

R2. O.G. Palanna, “Engineering Chemistry”, Tata McGraw-Hill Education Pvt. Ltd, New Delhi, 2017.

R3. Sunita Rattan, “A Textbook of Engineering Chemistry”, S.K. Kataria& Sons, New Delhi, 2013.

R4. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry’, Wiley India Pvt. Ltd, New Delhi, 2nd Edition 2014.

WEB RESOURCES

W1. https://extension.psu.edu/how-to-interpret-a-water-analysis-report

W2. http://www.themetalcasting.com/metal-finishing.html

W3. https://batteryuniversity.com/learn/article/fuel_cell_technology

W4. https://www.slideshare.net/RichardPradeep/polymers-and-polymer-composites

W5. https://www.nanowerk.com/spotlight/spotid=16047.php

U19CHTL204L **Engineering Chemistry Laboratory** **L T P C**

0 0 2 1

LAB COMPONENT CONTENTS

1. Determination of pH, EC, tubidity and TDS of water sample.
2. Estimation of Ca, Mg, total, permanent and temporary hardness of water by EDTA method.
3. Estimation of chloride in water sample by Argentometric method.
4. Determination of alkalinity of water sample.
5. Estimation of iron content of the water sample by potentiometric titration.
6. Estimation of Nitrate in waste water.
7. Estimation of the amount of phosphate and sulphate in waste water.
8. Determination of DO content of water sample by Winkler’s method.

Total: 45 hours

TEXT BOOKS

T1 Laboratory Manual, prepared by chemistry Department

REFERENCE BOOKS

R1. Vogel’s textbook of quantitative chemical analysis (8th edition, 2014)

U19CSTL203T **C Programming** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

The course aims to provide the students

• Write modular programs consisting of structure, functions and pointer concepts.

• Define the files, file manipulations

• Use structure variables for data storage and manipulation.

• Knowledge about linear data structure

UNIT I POINTERS **9**

Pointers introduction- Address in C- Pointer variables-Reference operator (&) and Dereference operator (*)-Relation between Arrays and Pointers- Passing address to a Function- Pointer Arithmetic-pointers and functions Generic pointer, array of pointers, Example: Sorting a list of Names using pointers, pointer to pointer

UNIT II STRUCTURES AND UNIONS **9**

Introduction to Structures- How to define a structure- Create structure variable-Access members of a structure-Nested structures- Structures and pointers introduction-Passing structure to a function-Returning structure from a function-Passing structure by reference– array of structures- C unions- How to define a union - Create union variables -Access union members-Unions vs Structures

UNIT III FILE MANAGEMENT AND DYNAMIC MEMORY ALLOCATION **9**

Why files- Types of files- File Operations: Opening a file, Closing a file, Read and write filescommand line arguments- Dynamic memory Allocation- malloc()-calloc()-free()-realloc()- allocating memory to pointers- C enumeration- Enumeration declaration-Enums for flags- C Macros- Including Header Files-Macros using #define, #undef, #if, #ifelse- Conditional Compilation- Predefined Macros

UNIT VI INTRODUCTION TO DATA STRUCTURES **9**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT V STACK AND QUEUE **9**

Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.

U19CSTL203L **C Programming Laboratory** **L T P C**

0 0 2 1

LAB COMPONENT:

1. Programs on pointer operators, call by reference, pointers with arrays
2. Programs using structures and unions.
3. Implementation of linked list
4. Applications of linked list
5. Implementation of stack
6. Applications of stack
7. Implementation of Queue
8. Applications of queue

Total: 45 hours

COURSE OUTCOME:

After the course the students are expected to be able to:

CO1:Inscribe C programs that use Pointers to access arrays, strings and functions.

CO2:Exercise user defined data types including structures and unions to solve problems

CO3:Exercise files concept to show input and output of files in

CO4: Inscribe C programs using pointers and to allocate memory using dynamic memory management functions.

CO5:Understand the concepts of Linear data structures.

CO/PO MAPPING													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2			1		1			2			3	2	
CO2		2		1		1		2	2		2	1	2	1	
CO3	1		3	1		2		3		1	1		1	2	
CO4		1				1	2	2		1			2	2	
CO5	2		2	1		2		1			2		2	3	

TEXT BOOK:

T1. Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill

T2. M.A.Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education Asia, 2007.

REFERENCE BOOKS:

R1. Programming With C, Schaum Series

R2. The ‘C’ programming language by Kernighan and Ritchie, Prentice Hall

R3. Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, “Data Structures using C and C++”, Second Edition, Prentice-Hall of India, 2009.

R4. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, “Data Structures & Algorithms”, Pearson Education, New Delhi, 2009.

U19AETL202T **CROP PRODUCTION - II** **L T P C**

1 0 2 2

COURSE OBJECTIVES

- To study the different agronomic practices for various crops
- To do the different practices in horticultural crops
- To study the fundamental cultivation practices of different fruit and plantation crops
- To study the fundamental cultivation practices of different vegetable and spices crops
- To study the fundamental cultivation practices of different medicinal and ornamental crops

PRE-REQUISITES

U19AETL102

UNIT I INTRODUCTION TO AGRONOMY 9

Definition of Agriculture and Agronomy – Factors affecting crop growth – climate and weather parameters – Soil fertility and productivity – tillage and tilth - objective and principles – different kinds of tillage, Seeds and seed treatment – sowing and planting – different methods – crop geometry – manures and fertilizers – source, nutrient contents and methods of application – bio fertilizers – irrigation techniques for different soils and crops – Weeds – classification of weeds- principles and methods of weed management – cropping systems – monoculture and multiple cropping – inter, mixed, relay, strip and multitier cropping

UNIT II FUNDAMENTALS OF HORTICULTURE 9

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

UNIT III FUNDAMENTALS OF FRUIT AND PLANTATION CROPS 9

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

UNIT IV FUNDAMENTALS OF VEGETABLE AND SPICES 9

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables).

UNIT V PRODUCTION PRACTICES OF HORTICULTURAL CROPS 9

Importance and scope of fruits, vegetables, spices and condiments and beverages. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions.

UNIT VI PRODUCTION PRACTICES OF MEDICINAL PLANTS 9

Importance and scope of medicinal and aromatic plants. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, COtus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Important phytochemicals present in different medicinal plants and their properties with uses. Commercially available products made out from different medicinal plants

Total: 45 hours

U19AETL202L	**CROP PRODUCTION – II LABORATORY**	**L T P C**
		0 0 2 1

LAB COMPONENT:

14. Acquiring skill on the organizational set up of the agricultural farm
15. Identification of different crops in the crop cafeteria
16. Identification of seeds, manures and fertilizers
17. Visit to irrigated dryland to learn irrigated dryland cropping systems and irrigation methods
18. Visit to dryland farm to learn dryland cropping systems
19. Visit to NPRC, Vamban to learn about pulses and pulses based cropping systems
20. Visit to SWMRI, Thanjavur to learn about important Rice based cropping systems
21. Working out seed rate for different field crops
22. Working out fertilizer schedule for major crops of wet, garden and dry land
23. Identification of meteorological instruments
24. Identification of farm tools and implements
25. Identification of implements for primary and secondary tillage
26. Practicing different methods of seed treatment, sowing and planting

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the different agronomic practices for various crop and deliver different practices for commercially important crops

CO2 : Understand the fundamental cultivation practices of different fruit and plantation crops and involve in the fundamental cultivation practices of different vegetable and spices crops

CO3 : Understand the fundamental cultivation practices of different ornamental crops

CO4: Importance of vegetables & spices in human nutrition and national economy
CO5:Importance and scope of fruits, vegetables, spices and condiments and beverages

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2			1		2		3		2	1	2	
CO2		3	1		1				3	2		1	2	2	
CO3	2		3	2		2	3	1			1		1	1	
CO4		2			3	1			3			3	3	2	
CO5			2	1			1			2	1		2	3	

TEXT BOOKS

T1. Ramasamy S and Siddeswran K 2018. Agriculture and crop production. Sri Shakthi Institute of Engineering and Technology, Coimbatore

T2. Sankaran, s. and V.T Subbaiah Mudaliar, 1993. “Principles of Agronomy". The Bangalore printing and pub co. Bangalaore.

T3. Hand Book of Agriculture. 2009 (6th revised edition), Indian Council of Agricultural Resarch (ICAR), New Delhi T4. Balasubramanian P and Palaniappan SP. 2001. Principles and practices of Agronomy. Agrobios Publishers, Ludhiana

REFERENCE BOOKS

R1. S. Prasad and U. Kumar. 2010. Principles of Horticulture. Agrobios, New Delhi.

R2. S.S. Singh. 1985. Principles and Practices of Agronomy. Kalyani Publishers, Ludhiana

R3 T. R. Gopalakrishnan. 2007. Vegetable Crops. New India Publishing Agency, Pitampura, Delhi.

R4 T. Radha and L. Mathew. 2007.Fruit Crops. New India Publishing Agency, Pitampura, Delhi.

U19AEPC202 **Practices and Certification in 2D Drawings** **L T P C**

0 0 3 2

COURSE OBJECTIVES

- To meet both academic and industry requirements towards design and drawing
- To develop the skills necessary to continue design careers when students enter the workforce, or work toward additional levels of industry certification.

UNIT I USER INTERFACE & OBJECTS MANIPULATION 12

UI Navigation-Interaction -Creating Drawings Coordinate Entry -Draw Tools and Settings - Manipulating Objects Grips -Object Selection-Move Objects-Drawing Organization- and Inquiry Commands-Layers-Object properties- Line types Inquiry -Altering Objects -Modify Tools-Working with Layouts Layouts and Viewports -Annotating the Drawing

UNIT II ADDING TO A DRAWING 12

Dimensioning-Adding Dimensions to a Drawing-Hatching Objects- Hatching Objects Fills and Gradients-Edit Hatch Patterns and Fills

UNIT III WORKING WITH REUSABLE CONTENT AND ALTERING OBJECTS. 12

Blocks Design Center-Tool Palettes-Creating Additional Drawing Objects- Shapes Plotting -Drawing Output Stretch objects-Offset objects-Create a radius between objects-Trim and extend objects-Break and join objects-Annotations

UNIT IV WORKING WITH TEXT & DIMENSIONING 12

Text styles,text justification multi-line text- Set the Annotative property for objects-Create and use Multileaders-Create Template Content- Create and use templates-Creating Additional Drawing Objects - Hide and isolate objects-Create polyline-Edit polylines- Create Dimensions-Edit Dimensions-Work with dimension styles.

UNIT V DRAWING ORGANIZATION AND INQUIRY COMMANDS 12

Calculate the area of objects-Change object properties-Use layers Hatching Objects -Use hatching Insert and Manage External References -Apply External -References Isolate or Hide Displayed Objects- Isolate and hide objects -Manipulating Objects Use grips Copy, Move, Mirror, and Rotate objects Use selection set methods Describe and use arrays-Using rotation reference angles- Layouts and Visibility -Create and use Viewports -Create and use layouts -Create and Manage Layers-Printing and Plotting Use page setup for plotting-Reusable Content Creation and insertion. Application Projects.

Total: 60 hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Use user interface and object manipulation

CO2 : Create objects and dimensions to objects.

CO3 : Annotate text for plotting

CO4 : Create virtual objects

CO5 : Get international certification with permission to use Autodesk logo in portfolios

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1		3		1	2		3	2	2	1	3	
CO2		2	2		1	2	2		1		1	3	2	2	
CO3	3		1	2			1		2	1		2	2	3	
CO4	1	1		1	3		1	2	1			3	1	1	
CO5	3		2	2		1		3		3	1	2	1	3	

TEXT BOOKS

T1. Mastering In Autocad And Autocad Lt - Wiley Publications.

T2. AutoCAD 2018 Training Guide Sagar Linkan

REFERENCE BOOKS

R1. Digital Drawing for Designers: A Visual Guide to AutoCAD2017 , Fairchild Books; 2017 edition

R2. Autocad 2019, Y Vishnu P. Singh Asian (2018)

WEB RESOURCES

W1. Safari Books, Lynda,

W2. Cadlearning, Solidprofesso

U19CCEX202	**Engineering Exploration II**	**L T P C**
		1 0 2 2

COURSE OBJECTIVES

• To learn about the project management and the importance of team work.

• To Analyze engineering solutions from ethical and sustainability perspectives.

• To Apply basics of engineering project management skills in product development

• To Build a simple systems/prototypes using engineering development process.

• To test the working and improvements required if any.

PRE-REQUISITES

U19CCEX01

THEORY COMPONENT CONTENTS

UNIT I PROJECT MANAGEMENT 6+0

Importance of Teamwork, Importance of Project Life Cycle, Project Management Tools, Various Tools used in Electronics Documentation, Importance of communication, Usage of Communication Media.

UNIT II ENGINEERING ETHICS 6+0

Engineering Ethics: Introduction to ethics, moral values, Significance of Professional Ethics, Code of Conduct for Engineers, Identifying Ethical Dilemmas in different tasks of engineering, Applying Moral Theories and codes of conduct for resolution of Ethical Dilemmas.

UNIT III SUSTAINABILITY 3+0

Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment, carbon foot print.

Total: 30 hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Analyze engineering solutions from ethical and sustainability perspectives.

CO2: Apply basics of engineering project management skills in project development

CO3: Develop design principles in project development.

CO4 : Build simple systems/prototypes using engineering design and development process.

CO5 : Test the working of the product developed and modification required

CO/PO MAPPING													**CO/PSO**	
CO s	**PSOs**												**Mapping**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3		2	3		1	3		2			1	
CO2	1	3	1	2		3		1		3	1		2	1
CO3		1	3		2		2		2	1			1	2
CO4	3			2			1			1	2		1	2
CO5		3	1		2	1	2	1	3			1	2	3

SEMESTER III

U19MATH319 TRANSFORMS AND NUMERICAL METHODS FOR AGRICULTURE ENGINEERING

L T P C

3 1 0 4

COURSE OBJECTIVES

Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of Fourier series, Fourier transform, Boundary value problem, interpolation and Approximation, Numerical differentiation and Integration which are being widely used in Agriculture Engineering studies

PRE-REQUISITES

- Differentiation
- Integration
- Trigonometric Identities

THEORY

UNIT I FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and COine series –Harmonic Analysis – Applications of Fourier series in Agriculture Engineering

UNIT II FOURIER TRANSFORM 9+3

Fourier integral theorem (statement only) – Fourier transform pair – Fourier Sine and COine transforms – Transform of elementary functions – Properties (Problems only)– Applications of Fourier transform in Agriculture Engineering.

UNIT III BOUNDARY VALUE PROBLEM 9+3

Fourier series solution in Cartesian Coordinates–Solutions of one-dimensional heat equation –Steady state solution of two-dimensional heat equation – Applications of Boundary value problem in Agriculture Engineering.

UNIT IV INTERPOLATION AND APPROXIMATION 9+3

Interpolation with equal intervals – Newton's forward and backward difference formulae - Interpolation with unequal intervals - Lagrange's interpolation – Inverse interpolation – Divided differences – Newton's divided difference formula – Applications of Interpolation and approximation in Agriculture Engineering

UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Newton's forward and backward difference formulae - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Evaluation of double integrals by Trapezoidal–Applications of Numerical Differentiation and Integration in Agriculture Engineering.

Total: 60 periods

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Determine the behaviour of the Fourier series at points of discontinuity.

CO2 Determine the behaviour of the Fourier transform at all intervals.

CO3 Solve one dimensional heat equation by separation of variables.

CO4 Apply Numerical techniques for solving the problems involving the interpolation concept.

CO5 Apply Numerical techniques for solving the problems involving the differentiation and Integration concepts.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	2		1	2	3		2		1	1		1	1	
CO2			2	2		1	1		3	2		1		2	
CO3	1	3	1		3		3		1		1		2		
CO4		1	3	1	2		1	3		1		2		3	
CO5	3		3	2		3		1		3	2		1		

TEXT BOOKS

T1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition, 2017.

T2. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 43rd Edition, New Delhi, 2015.

REFERENCE BOOKS

R1. Bali, N.P. and Manish Goyal, “A Text Book of Engineering Mathematics”, Lakshmi Publications Pvt. Ltd., New Delhi, 2016.

R2. Erwin Kreyszig, " Advanced Engineering Mathematics ", John Wiley and Sons,10th Edition, New Delhi, 2016.

R3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fifth Edition, 2018.

R4.Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2017.

R5.Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.

R6.Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 7th Edition, New Delhi, 2015.

U19AETL303T STRENGTH OF MATERIALS FOR AGRICULTURE ENGINEERING L T P C

3 0 0 3

COURSE OBJECTIVES

- To study the basics of engineering mechanics
- To do the different fundamental laws governing motion
- To study the fundamental ideas involved in statics and dynamics of particles
- To study the fundamental ideas of links, mechanisms and machine elements
- To study the importance of balancing

PRE-REQUISITES

UNIT I Stresses and Strains 9

Simple stresses and strains – elasticity and plasticity - force deformation curve for biological materials - Hooke's Law – Principle of superposition – Stresses in bars of different sections – stresses in bars of uniformly tapering sections and in composite bars.

UNIT II Thermal stress and Elastic Constants 9

Thermal stresses and strains in simple bars and composite bars – lateral and linear strain –Poisson's ratio – volumetric strain of a rectangular body subjected to an axial force - relation between elastic constants and their derivation

UNIT III Centre of gravity and Moment of Inertia 9

Centroid – plane figures, symmetrical, unsymmetrical sections, solid bodies and cut out holes -moment of inertia – rectangular section, perpendicular axis theorem –circular section, parallel axis theorem – unsymmetrical section

UNIT IV Shear Force and Bending moment 9

Types of loads acting on the beams – different types of beams – shear force –bending moment –sign conventions – relation between shear force and bending moment. Analysis of perfect frame –bending stresses in beams – shearing stresses in beams

UNIT V Deflection of beams, Cylindrical Shells and Columns 9

Deflection of beams – double order differential equation method – Macaulay's method. Thin cylindrical and spherical shell – combined bending and direct thrust –columns and struts – torsion of circular shafts – Shaft coupling – Design of keys and bolts

Total:45 Periods

U19AETL303L **STRENGTH OF MATERIALS FOR AGRICULTURE ENGINEERING LABORATORY L T P C**

0 0 2 1

LAB COMPONENT CONTENTS

1. Introduction to workshop tool and machines

2.Measurement of mass moment of inertia.

3.Dynamic force analysis of 4-bar mechanism and slider crank mechanism (Analytical Methods)

4.Identification of different mechanisms in agri machineries

5.Workout of velocity acceleration diagram

6.Problems on force analysis

7.Force Analysis of farm tools and implements

8.Visit to machine manufactures company

9.Problems on Balancing

10.Model design of simple mechanisms

COURSE OUTCOMES

CO1 :Understand the different aspects of engineering mechanics

CO2 :Deliver different fundamental laws governing motion

CO3 :Understand the fundamental links, mechanisms and machine elements

CO4 :Understand the fundamentals involved in involved in statics and dynamics of particles

CO5 :Understand the fundamental of balancing

CO/PO MAPPING													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	
CO1	3			2		2		1		2	2	1	1		
CO2	3	2	1		1	1	3		1	1			2	2	
CO3		3		1	3		1	3	3		1	1	2		
CO4	1		1	2		1	2			1	3			2	
CO5	3	2	2		1		2	1	2		2	2	1		

TEXT BOOKS

• Khurmi, R.S. 2009, A text book of Engineering mechanics, S. Chand and Company Ltd. Ram Nagar, New Delhi - 110 055

REFERENCE BOOKS

• Khurmi.R.S and Gupta.J.K. 2014.A Text Book of Machine Design. S. Chand & Company Ltd., New Delhi.

• David H. 2012. Machines and Mechanisms- Applied Kinematic Analysis-4th Edition. Myszka University of Dayton. Pearson Education, Inc., New Jersey. Link: https://mechzoneblog.files.wordpress.com/2017/08/machines-and-mechanisms.pdf

• Bansal, R.K. 1992, Engineering mechanics and Strength of Materials, Laxmi Publication, 7/21, Ansari Road, Daryaganj, New Delhi - 110 002.

Web link

• http://www.cs.cmu.edu/

• http://www.civil.port.ac.uk

• www.ebookee.com/Mechanics-and-Strength-of Materials_67103.html

U19AETL304T **DESIGN OF FARM STRUCTURES** **L T P C**

1 0 0 1

COURSE OBJECTIVES

- To conceive and design various farm structures related to agricultural engineering.
- To study about the various types of loadings acting on the farm structure
- To study about the various factors involved in selection of place for farm structures
- To study the case studies of existing farm structures

THEORY

UNIT I INTRODUCTION TO FARM STRUCTURES **9**

Farm Structures-Categories of farm buildings-Farm Stead planning-Site Selection of farm structures-Farm Building Arrangement-Load consideration for farm building-Classification of loads

UNIT II DESIGN OF FARM STRUCTURES **9**

Building foundation and floors-Foundation footings-Types of foundation-Design of beams and columns-Deflection in members-Maximum Bending Moment-RC columns, floors and masonry blocks

UNIT III DESIGN OF ROOF TRUSSES **9**

Roof framing,-Types of roofs-Roof members-Rafters-Design of various types of trusses.

UNIT IV DESIGN OF POULTRY AND CATTLE FARMS **9**

Poultry housing requirements-Site selection and building design for poultry farm Housing for breeding flock, Laying hens, pullets rearing and broiler production Housing for cattle and buffaloes.

UNIT V ENVIRONMENTAL IMPACTS **9**

Agricultural building environment- Physiology Consideration-Case studies of existing Poultry and Cattle farms.

U19AETL304L **DESIGN OF FARM STRUCTURES LABORATORY** **L T P C**

0 0 4 2

LAB

1. Planning and Layout of farmstead
2. Design of stall bam
3. Design of loose housing and milk parlors
4. Design of poultry house

5. Design of a sheep / goat house

6. Design of ventilation system for dairy and poultry house.

7.Design of silos – over ground and underground and hay storages

8. Design of farm fencing system

9. Design of machinery and equipment shed and workshops

10. Design of septic tank and sanitary structures

11 Design of rural /farm roads and culverts.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	2		1		3		2	1	3			1		
CO2		1	2		3	2	1	3	2		1			2	
CO3	3		1	1		3	1	2		1	3		1	2	
CO4	1	2		2	1	3		3		1			1		
CO5		3	2	1	3	2		1		3	1			1	

TEXT BOOKS

1. Barre, H.J. and Sammet, L.L. "Farm Structures". John Wiley and Sons Inc. 1950."

2. Neubaur, L. W. and Walker, H.B. "Farm Buildings Design". Prentice Hall Inc., 1961.

REFERENCE BOOKS

1. Khanna, S.K. and Justo, C.E.G. "Highway Engineering". Nemchand and Bros., Roorkee, India. 4. Dutta, B.N. "Estimating and COting in Civil Engineering Theory and Practice". S. Dutta and Co. 5. Bazirani, V.N. and Ratwani, M.M. "Steel Structures". Khanna Publishers, Delhi, 1981.

2. Justo, C.E.G. and Khanna, S.K. "Highway Engineering". Nemchand and Bros., Roorkee, India (Revised).

U19AETL305T **WORKING PRINCIPLES OF MACHINES** **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To study the basics of engineering mechanics
- To do the different fundamental laws governing motion
- To study the fundamental ideas involved in statics and dynamics of particles
- To study the fundamental ideas of links, mechanisms and machine elements
- To study the importance of balancing

THEORY

UNIT I BASICS OF ENGINEERING MECHANICS **9**

Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces vector and scalar quantity. Composition and resolution of forces, Couples – analytical and graphical method. Principle of moments and their applications – Varignon's theorem. –Simple stresses and strains Types of Beams – Support reactions of beams – trusses – elasticity and plasticity -Hooke's Law

UNIT II FUNDAMENTAL MACHINE LAWS **9**

Law of machine, velocity ratio, mechanical advantage and efficiency of simple lifting machines. Laws of motion, Newton's Laws of motion relative velocity, rotational and translation motion. power and energy. Laws of conservation of energy and momentum. Centrifugal and centripetal forces, Theories of failure – Rankine's and Guest theory

UNIT III BASICS OF LINKS, MECHANISMS AND MACHINES **9**

Types of Motion, Links, Kinematic Pair, Types of Joints, Degree of Freedom, Classification of Kinematic Pairs, Kinematic Chain, Linkage, Mechanism and Structure, Inversions of Four-bar and Slider Crank Mechanism, Mobility of Mechanisms, Transmission Angle. Dead Point, Slider-Crank Mechanism, Inversion of the Slider-Crank Mechanism, Cams

UNIT IV STATIC AND DYNAMIC OF PARTICLES **9**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies. free body diagram -Velocity and acceleration in simple mechanisms -. Coriolis component of acceleration.

UNIT V BALANCING **9**

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes. Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine.

Total: 45 hours

U19AETL305L **WORKING PRINCIPLES OF MACHINES LABORATORY** **L T P C**

0 0 2 1

LAB COMPONENTS

1. Introduction to workshop tool and machines

2.Measurement of mass moment of inertia.

3.Dynamic force analysis of 4-bar mechanism and slider crank mechanism (Analytical Methods)

4.Identification of different mechanisms in agri machineries

5.Workout of velocity acceleration diagram

6.Problems on force analysis

7.Force Analysis of farm tools and implements

8.Visit to machine manufactures company

9.Problems on Balancing

10.Model design of simple mechanisms

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the different aspects of engineering mechanics

CO2 : Deliver different fundamental laws governing motion

CO3 : Understand the fundamental links, mechanisms and machine elements

CO4 : Understand the fundamentals involved in involved in statics and dynamics of particles

CO5 : Understand the fundamental of balancing

CO/PO MAPPING													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	
CO1	2		1		3		1	3		1	1	1	1	1	
CO2		1		1		3		1	3	2				2	
CO3	3		3	1	2	1	3		1		1	2	1		
CO4	2	3	2		3		1	3	2	1	2			3	
CO5		2		1	3	1	3		1	2	3	1	1		

TEXT BOOKS

• Khurmi, R.S. 2009, A text book of Engineering mechanics, S. Chand and Company Ltd. Ram Nagar, New Delhi - 110 055.

REFERENCE BOOKS

• Khurmi.R.S and Gupta.J.K. 2014.A Text Book of Machine Design. S. Chand & Company Ltd., New Delhi.

• David H. 2012. Machines and Mechanisms- Applied Kinematic Analysis-4th Edition. Myszka University of Dayton. Pearson Education, Inc., New Jersey. Link: https://mechzoneblog.files.wordpress.com/2017/08/machines-and-mechanisms.pdf

• Bansal, R.K. 1992, Engineering mechanics and Strength of Materials, Laxmi Publication, 7/21, Ansari Road, Daryaganj, New Delhi - 110 002

U19AETL306T Emerging Trends of Unit Operations in Agriculture Processing

L T P C

2 0 0 2

COURSE OBJECTIVES

- To introduce the basic concepts of evaporation and working of evaporators
- To educate the various emerging methods of mechanical separation
- To introduce the principles of comminution and modern technology in working of size reduction equipments
- To teach the basic concepts of contact equilibrium separation and recent trends in processing industries
- To impart knowledge on new developments in crystallisation and distillation

UNIT I EVAPORATION AND CONCENTRATION 9

Unit operations in food processing –conservation of mass and energy – overall view of an engineering process-dimensions and units – dimensional and unit consistency –dimensionless ratios-evaporation – definition – liquid characteristics – single and multiple effect evaporation- performance of evaporators and boiling point elevation – capacity –economy and heat balance- types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator

UNIT II MECHANICAL SEPARATION 9

Filtration – definition –filter media – types and requirements-constant rate filtration –constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press- sedimentation – gravitational sedimentation of particles in a fluid – Stoke‟ s law, sedimentation of particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment-Microwave Sensors for process control.

UNIT III SIZE REDUCTION 9

Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger‟ s, Bond‟ s and Kick‟ s laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation.

UNIT IV CONTACT EQUILIBRIUM SEPARATION 9

Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium – equilibrium concentration relationships – operating conditions-calculation of separation in contact – equilibrium processes-gas absorption – rate of gas absorption –stage – equilibrium gas absorption equipment-properties of tower packing – types –construction – flow through packed towers-extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers-washing – Recent trends in equipments

UNIT IV CONTACT EQUILIBRIUM SEPARATION 9

Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium – equilibrium concentration relationships – operating conditions-calculation of separation in contact – equilibrium processes-gas absorption – rate of gas absorption –stage – equilibrium gas absorption equipment-properties of tower packing – types –construction – flow through packed towers-extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers-washing – Recent trends in equipments

Total:45 Periods

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : demonstrate the working of various evaporators

CO2 :explain the importance of mechanical separation

CO3 :identify different kinds of equipment used for size reduction

CO4 :To explain the concepts of contact equilibrium separation

CO5 :To demonstrate the working of various crystallisers and distillation equipments

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1		1		2	1		1	3	2	1	2		
CO2	1	2	1		1		2	3		1	1		2	1	
CO3	3		3	2	1	2	1		3		2	2	1		
CO4	2	3	1		1	3		1	2	1	1			3	
CO5	3	2		1	3	1	3		1		3	1	1		

TEXT BOOKS

1.Earle, R.L., “Unit operations in Food Processing”, Pergamon Press, Oxford, U.K, 1985.
2.Rao, D.G., “Fundamentals of Food Engineering”, PHI Learning Pvt.Ltd., 2009.
3. Sahay.K.M and Singh K.K., “Unit Operations of Agricultural Processing”, Vikas Publising House Pvt Ltd.,2001.

REFERENCE BOOKS

• 1. McCabe, W.L., and Smith, J.C., “Unit Operations of Chemical Engineering”, Mc-Graw-HillInc., Kosaido Printing Ltd., Tokyo, 1990.

2. Coulson, J.M and J.F. Richardson,“Chemical Engineering”. Volume I to V. The Pergamon Press. New York, 1999

3. Geankoplis, C.J. “Transport Processes and Separation Process Principles”, 4th Edition,Prentice Hall, 2003

U19AEPC303L	Design Analysis and Simulation of machine elements-1 Lab	L	T	P	C
		0	0	4	2

UNIT 1: INTRODUCTION TO SOLID WORKS

Introduction to Solid Works: Command Manager, Toolbar, Dimensioning Standard and Units, Important Terms and Their Definitions, 2D Command Line Emulator, SimulationXpress, Physical Dynamics, Physical Simulation, Seed Feature, Feature Manager Design tree, Absorbed Features

UNIT2: DRAWING SKETCHES FOR SOLID MODELS

Drawing Lines, Orientation Rollout, Options Rollout, Drawing Continuous Lines, Drawing Individual Line, Drawing Circles, Drawing Arcs, Drawing Rectangles, Drawing Polygons, Drawing Splines, Drawing Slots, Placing Sketched Points, Drawing Ellipses, Drawing Elliptical Arcs, Drawing Parabolic Curves, Drawing Display Tools, Deleting Sketched Entities.

UNIT 3: EDITING AND MODIFYING SKETCHES

Editing Sketched Entities, Creating Patterns, Editing Patterns, Writing Text in the Sketching Environment, Modifying Sketched Entities, Modifying a Sketched Line Modifying a Sketched Circle, Modifying a Sketched Arc, Modifying a Sketched Polygon Modifying a Spline, Modifying the Coordinates of a Point, Modifying an Ellipse or an Elliptical Arc Modifying a Parabola, Dynamically Modifying and Copying Sketched Entities, Splitting Sketched Entities

UNIT4: ADVANCED MODELING TOOLS

Advanced Modeling Tools, Creating Simple Holes, Creating Standard Holes Using the Hole Wizard, Adding External COmetic Threads, Creating Fillets, Selection Methods, Creating Fillets Using the FilletXpert, Creating Chamfers, Creating Shell Features, Creating Wrap Features, Creating Sweep Features, Creating Cut-Sweep Features, Creating Loft Features,Adding a Section to a Loft Feature, Creating Lofted Cuts, Creating 3D Sketches, Creating Grid Systems Editing 3D Sketches, Creating Curves Extruding a 3D Sketch, Creating Draft Features

UNIT5:WORKING WITH BLOCKS

Introduction to Blocks, Blocks Toolbar, Saving a Sketch as a Block in the design Library, Creating Mechanisms by using Blocks, Creating the Rack and Pinion Mechanism, Creating the Cam and Follower Mechanism, Applying Motion to Blocks, Creating Parts from Blocks,Selected Blocks, Block to Part Constraint

U19AEPC303L Design Analysis and Simulation of machine elements-1 Lab **L T P C**

0 0 4 2

LAB COMPONENTS

A) EXTRUSION

B) EXTRUDE CUT

C) REVOLVE

D) FILLET

E) Seed Sowing Machine

F) Mini Harvester

G) Maize Thresher

H) Drone

I) Alloy Wheel

J) Shock Absorber

K) Knuckle Joint

L) Closed coil Spring

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : know the Command Manager, Toolbar, Dimensioning Standard and Units, ImportantTerms and Their Definitions

CO2 : know the drawing sketches for solid models

CO3 : do editing and modifying sketches

CO4 : Creating Simple Holes, Creating Standard Holes Using the Hole Wizard, Adding External COmetic Threads,

CO5 : Creating Mechanisms by using Blocks, Creating the Rack and Pinion Mechanism

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1		1		2	1		1	3	2	1	2		
CO2	1	2	1		1		2	3		1	1		2	1	
CO3	3		3	2	1	2	1		3		2	2	1		
CO4	2	3	1		1	3		1	2	1	1			3	
CO5	3	2		1	3	1	3		1		3	1	1		

References:

1. Narayan, K. Lalit (2008). Computer Aided Design and Manufacturing. New Delhi: Prentice Hall of India. p. 3. ISBN 978-8120333420.

2. Farin, Gerald; Hoschek, Josef; Kim, Myung-Soo (2002). Handbook of computer aided geometric design [electronic resource]. Elsevier. ISBN 978-0-444-51104-1.

3. Duggal, Vijay (2000). Cadd Primer: A General Guide to Computer Aided Design and Drafting Cadd, CAD. Mailmax Pub. ISBN 978-0962916595.

U19CCLC301 Career Enhancement Programme -I L T P C

0 0 2 1

COURSE OBJECTIVES

- To enable students to gain strong foundation by expanding theirlogical, numerical and reasoning skills.
- To help them master mathematical concepts to understand and solve problems.
- To ensure students develop ability to comprehend, work with, and apply general mathematical techniques and models to different situations.

UNIT I CLOCKS AND CALENDAR 3

Minute Spaces - Hour Hand and Minute Hand - Odd Days - Leap Year –Ordinary Year- Counting of Odd Days

UNIT II ANALOGY PATTERN RECOGNITION 3

Relating two objects - Problems on Number Analogy

UNIT III NUMBER SERIES PATTERN RECOGNITION 3

Find the next Image- Mirror Image- Water Image- Embedded Image

UNIT IV CODING AND DECODING PATTERN RECOGNITION 3

Coding and decoding by letter shifting- Coding Letters of a Word-Coding and decoding in

fictitious language

UNIT V ANALYTICAL REASONING 3

Problems related to Triangles – To find the missing numbers

COURSE OUTCOMES

At the end of the course students should be able to

CO1:To help students understand with quantitative ideas and at ease in

applying quantitative methods. Individuals who are quantitatively confident routinely use mental estimates to quantify, interpret, and check other information.

CO2 : To help students understand with analogies to comprehend change and find similarities in the unfamiliar.

CO3: To test a candidate's ability to determine the descriptions of the objects and how the objects are related and to find the next picture or missing pictures.

CO4: To enable students to solve the problems by an indirect and creative approach

CO5:To judge the ability of the candidates to Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3		2	1		3		3	2	3	1	1	2		
CO2		3	1		2		3	1	1		2		2	1	
CO3	1	3		2		3	2		2	1		2	1		
CO4		1	1	3		3		3	1	2	1			2	
CO5	3	1	2		2	1	3	2	3		2	1	1	1	

TEXT BOOKS

T1.Aggarwal, R.S. “Quantitative Aptitude”, Revised Edition 2016, Reprint 2018, S.Chand& Co

Ltd., New Delhi.

T2. Pearson Publication, “A Complete Manual for the CAT”, 2018

T3. Analytical Reasoning by M.K Pandey

REFERENCE BOOKS

R1 Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014

R2Arun Sharma “How to Prepare for Quantitative Aptitude for the CAT ” , McGraw HillEducation; Eighth edition 2018

R3Dr. R.S.Aggarwal “A Modern Approach to Logical Reasoning “ , S.Chand& Co Ltd., NewDelhi.- 2018

R4Arun Sharma “How to Prepare for Logical Reasoning for the CAT ” , McGraw Hill Education; Eighth edition 2018

WEB RESOURCES

W1. https://www.indiabix.com/aptitude/questions-and-answers/

W2. https://testbook.com/aptitude-practice

U19CCEX303 ENGINEERING EXPLORATION -III L T P C

0 0 2 1

COURSE OBJECTIVES

- To identify the community problem and its stakeholder.
- To examine required specifications and gap in existing and required product.
- To build sustaining interactions among people that create social value by transforming ideas into tangible products, services, or initiatives.
- To develop skills to work collaboratively, reports and progress updates throughout the lifecycle of project.

THEORY COMPONENT CONTENTS

UNIT I Engineering Exploration 6+0

Engineering projects in community service, design thinking process-empathize, define, ideate,prototype, test.

UNIT II Problem Identification and Product Development 6+0

Authentic need in the community or society, identify a real user or stake holder, interaction withstakeholders, viewpoints, interviewing, scenario, clear and measurable requirements, criteria for success, identifying relevant benchmarks, identifyingthe gap between the available and required products, requirements documentation

UNIT III Conceptual Design 3+0

Ideation-generated multiple ideas, evaluation of ideas, systems model, architectural design,prototype development, testing real/simulated users, feedback

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Understand the Engineering attributes and Ethics.

CO2:Identify the community problem and its stakeholder.

CO3: Examine required specifications and gap in existing and required product.

CO5 : Develop skills to work collaboratively, reports and progress updates throughout the lifecycle ofthe project.

CO6 : Analyse the design and compare the real-time situations

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	
CO1	3	2	1	3		2	3	2	1		2	1	1		
CO 2	3	3		1	2	1	3	1		1	3		1	2	
CO 3	1	1	2		3		2		1	2		1	2		
CO 4	3		1	2	3	1	1	2	1	3	2			2	
CO 5	1	3	1		2	3	2		3	2	3	2	1	1	

SEMESTER IV

U19MATH426 PROBABILITY AND STATISTICS FOR AGRICULTURE ENGINEERING **L T P C**

3 0 0 3

COURSE OBJECTIVES

Engineering Mathematics is an essential tool for describing and analyzing engineering process and systems. It enables precise representation and communication of knowledge. The objective of the course is to expose students to understand the basics and importance of Probability and Random variables, Two dimensional random variables, Testing of Hypothesis, Design of experiments, Statistical quality control which are being widely used in Agriculture Engineering studies.

PRE-REQUISTITES

- Probability
- Differentiation
- Integration
- Statistics

THEORY

UNIT I RANDOM VARIABLES 9

Probability (Concepts only) – Discrete and Continuous random variables –Moment generating functions – Binomial, Poisson, Exponential and Normal distributions– Problems – Properties (statement only) – Applications of Probability and Random variables in Agriculture Engineering.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance - Correlation and linear regression –Applications of Two-Dimensional random variables in Agriculture Engineering.

UNIT III TESTING OF HYPOTHESIS 9

Sampling distributions – Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means – Small sample tests based on t for single mean, and difference of means and F distributions for difference of variances - Applications of Testing of Hypothesis in Agriculture Engineering

UNIT IV DESIGN OF EXPERIMENTS 9

Analysis of variance – One-way classification – Completely Randomized Design (CRD) –Two-way classification – Randomized Block Design (RBD) – Latin square Design – Applications of Design of Experiments in Agriculture Engineering.

UNIT V STATISTICAL QUALITY CONTROL 9

Control Charts for measurements (X& R Charts) - Control Charts for Attributes (p, c and np charts) – Applications of Statistical Quality Control in Agriculture Engineering.

COURSE OUTCOMES

At the end of the course students should be able to,

CO1 Apply the concepts of probability for solving the Engineering problems.

CO2 Understand the basic concepts of two-dimensional random variables and apply in engineering applications.

CO3 Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO4 Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.

CO5 Analyze the charts and statistical techniques, which are used in engineering and management problems.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	3	2		2	3		1		3		1		
CO2		3	1		3	2	1	2		1			1	2	
CO3	1	1		3	2	1	2	3	3		3		2	1	
CO4		3	1		2		1			2	1		1	1	
CO5	1	2	3	1		3		1	3	1	1			1	

TEXT BOOKS

T1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund ‘s Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2017.

T2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCE BOOKS

R1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 9th Edition, 2016.

R2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.

R3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 4rd Edition, Elsevier, 2009.

U19AETL407T THERMODYNAMICS **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the basic laws of thermodynamics and heat transfer.
- To understand the principle of operation of thermal equipments like IC engine, boilers, turbine and refrigerator etc.

THEORY

UNIT I BASIC CONCEPTS OF THERMODYNAMICS **9+3**

Thermodynamics and Energy – Systems – Types and properties - State and Equilibrium -Processes and Cycles – Forms of Energy – Temperature and Zeroth law of Thermodynamics –Pure substances – Phase change processes of pure substances – Property diagrams – Internal energy – Enthalpy – Energy transfer by Heat, Work and Mass – Applications.

UNIT II FIRST AND SECOND LAW OF THERMODYNAMICS 9+3

First law of thermodynamics – Energy balance for closed systems and steady flow systems –Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility - Applications.

UNIT III HEAT ENGINES **9+3**

Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines –Gas Turbines - Boilers – Fire Tube Boiler & Water Tube Boilers , Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine , Turbine Components -Refrigeration Cycle – Vapour Compression & Vapour Absorption System ,Gas Refrigeration System – Environmental friendly Refrigerants – Air Conditioning.

UNIT IV GASES AND VAPOUR MIXTURES **9+3**

Ideal and Real gases – Vander waals equations – Reduced property – Compressibility chart -Properties of mixture of gases – Dalton’s law and Gibbs – Dalton law – Internal energy, Enthalpy and specific heats of gas mixtures.

UNIT V HEAT TRANSFER **9+3**

Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thickness –Simple, fins convection – Free convection and forced convection – Flow over Flat plates and Flow through Pipes – Radiation – Black Body, Grey Body Radiation.

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the basic concepts of Thermodynamics

CO2 : Interpret laws of Thermodynamics

CO3 : Understand the working Mechanisms of Heat engines

CO4 : Analyze the problems on gases and vapour mixtures

CO5 : Understand the fundamentals of Heat Transfer

CO6: Gain the knowledge in internal combustion engines and refrigeration systems.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3		2		1		1	2	2	1			1		
CO2	3		3	2	2	2		3	2	1	1	1	1	1	
CO3		2		2	1	1	1	2	1		3		2	1	
CO4	2	1	2		3		1		3	2		1		2	
CO5	2	3	1	3	1	2		1	2	3	2		1		
CO6	1		2	1		1	2	3		1	3	2		2	

TEXT BOOKS

T1. Yunus A. Cengel and Michael A.Boles, “Thermodynamics: An Engineering Approach”, Fourth Edition, Tata McGraw-hill, 2004.

T2. Nag.P.K., “Engineering Thermodynamics”, Third Edition, Tata McGraw hill, 2005.

T3 R.K.Rajput, “A Text book of Engineering Thermodynamics”, Third Edition, Laxmi publication (P) Ltd., 2007.

REFERENCE BOOKS

R1. Domkundwar.S., C.P.Kothandaraman “A course in Thermal engineering”, Fifth Edition, Dhanpat rai & co (p) Ltd, 2000.

R2. Michael J.Moran, Howard N.Shapiro, “Fundamentals of Engineering Thermodynamics”, Fourth Editon, John wiley & Sons, 2000.

U19AET407L THERMODYNAMICS LABORATORY L T P C

0 0 2 1

OBJECTIVES:

• To study the value timing-V diagram and performance of IC Engines

• To Study the characteristics of fuels/Lubricates used in IC Engines

• To study the Performance of steam generator/ turbine

LIST OF EXPERIMENTS

1. Determination of Flash Point and Fire Point of various fuels using open cup apparatus.

2. Determination of Flash Point and Fire Point of various fuels using closed cup apparatus.

3. Valve Timing and Port Timing diagrams.

4. Actual p-v diagrams of IC engines.

5. Determination of COP of a refrigeration system

6. Experiments on Psychrometric processes

7. Performance test on a reciprocating air compressor

8. Study on Steam Generators and Turbines.

9. Study on IC engines.

10. Study on steam boilers.

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the basic concepts Thermodynamics

CO2 : Interpret laws of Thermodynamics

CO3 : Understand the working Mechanisms of Heat engines

CO4 : Analyze the problems on gases and vapour mixtures

CO5 : Understand the fundamentals of Heat Transfer

CO6: Gain the knowledge in internal combustion engines and refrigeration systems

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3		2		1		1	2	2	1			1		
CO2	3		3	2	2	2		3	2	1	1	1	1	1	
CO3		2		2	1	1	1	2	1		3		2	1	
CO4	2	1	2		3		1		3	2		1		2	
CO5	2	3	1	3	1	2		1	2	3	2		1		
CO6	1		2	1		1	2	3		1	3	2		2	

U19METL306T FLUID MECHANICS AND HYDRAULICS **L T P C**

2 0 0 2

COURSE OBJECTIVES

- To introduce the students to the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes.
- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic pumps. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

THEORY

UNIT I PROPERTIES OF FLUIDS 9+3

Properties of fluids – definition – units of measurement - Mass density – specific weight, specific volume – specific gravity - equation of state – perfect gas - VisCOity –vapour pressure – compressibility and elasticity - surface tension – capillarity. Fluid pressure and measurement – simple, differential and micro manometers - Mechanical gauges – calibration. Hydrostatic forces on surfaces – total pressure and centre of pressure - Horizontal- vertical and inclined plane surface - Pressure diagram – total pressure on curved surface. Archimedes principles – buoyancy – meta centre – metacentric height.

UNIT II FLUID FLOW ANALYSIS 9+3

Types of fluid flow – velocity and acceleration of a fluid particle - Rotational – irrotational circulation and vorticity - Flow pattern – stream line – equipotential line – stream tube path line – streak line –flow net – velocity potential – stream function. Principles of conservation of mass – energy –momentum – continuity equation in Cartesian co-ordinates - Euler's equation of motion.

UNIT III FLOW MEASUREMENT 9+3

Bernoulli's equation – applications - Venturimeter – orifice meter – nozzle meter - rotameter – elbow meter - pitot tube – Orifice – sharp edged orifice discharging free – submerged orifice – mouth piece - Flow through orifice under variable head – time of emptying a tank with and without inflow. Flow through pipes – laminar and turbulent flow in pipes - Reynold's experiment - Darcy – Weisbach equation for friction head loss – Chezy's formula – Manning's formula – Hazen-William‟s formula -Major and minor losses in pipes – hydraulic gradient line – energy gradient line. Siphon – water hammer in pipes – gradual and sudden closure of valves

UNIT IV OPEN CHANNEL FLOW 9+3

Types of flow in channel – uniform flow – most economical section of channel – rectangular –trapezoidal. Specific energy and critical depth - momentum in open channel flow – specific force –critical flow – computation. Flow measurement in channels – notches – rectangular, Cipolletti and triangular – float method - Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.

UNIT V DIMENSIONAL ANALYSIS & PUMPS 9+3

Dimensional analysis – Fundamental dimensions – dimensional homogeneity – Rayleigh's method and Buckingham Pi-Theorem - concept of geometric, kinematic and dynamic similarity. Important non dimensional numbers – Reynolds, Froude, Euler, Mach and Weber - Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers - Priming – cavitation – specific speed – characteristic curves. Turbine and submersible pumps - Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump-Hydraulic ram.

Total:60 Periods

TEXT BOOKS

T1.Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002.

T2. Modi, P.N. and Seth S.M.,Hydraulics and Fluid Mechanics. Standard Publishers Distributors, New Delhi, 2010.

T3 Jagdish Lal,. Hydraulic Machines. Metropolitan Book House, New Delhi, 2000.

REFERENCE BOOKS

R1. Michael A.M. and S.D. Khepar, Water Well and Pump Engineering. Tata McGraw Hill Co. New Delhi, 2005.

R2. Garde, R.J., Fluid Mechanics through problems. New Age International Publishers (P) Ltd., New Delhi, 2002. bnb

U19METL306L FLUID MECHANICS AND HYDRAULICS LABORATORY **L T P C**

0 0 2 1

LAB COMPONENTS

1. Calibration of Rotatometer
2. Flow through Venturimeter
3. Flow through circular orifice
4. Determination of friction co-efficients in pipes
5. Determination of losses duet to bends fitting and elbows
6. Charaterisitic of centrifugal pump
7. Characteristics of Reciprocating pumps
8. Characterics of submersible pumps
9. Determination of mean velocity of pitot tube
10. Flow through a rectangular notch

COURSE OUTCOMES

CO. 1. Explain the principles of kinematic pairs of planar mechanisms

CO2. Compute velocity and acceleration in planar mechanisms.

CO3. Apply various motion principles to draw cam profiles

C04. Compute the gear terminology suitable for given application

C05. Discuss the effect of various types of friction in power transmission

C06. Apply the concepts of kinematics in predicting motion mechanism for given application

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2			2	1		2		3	1			1		
CO2	2	2	1		2	1	3	1	2		1	1		1	
CO3	3	3		2		3		2	1	3		2	2		
CO4	1	2	1	1	3	1	1		3	1	1	2		1	
CO5	2		2	3	2		2	1		3		1			
CO6	3	2		1	3	1	3		1		3		1		

TEXT BOOKS

T1.Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002.

T2. Modi, P.N. and Seth S.M.,Hydraulics and Fluid Mechanics. Standard Publishers Distributors, New Delhi, 2010.

T3 Jagdish Lal,. Hydraulic Machines. Metropolitan Book House, New Delhi, 2000.

REFERENCE BOOKS

R1. Michael A.M. and S.D. Khepar, Water Well and Pump Engineering. Tata McGraw Hill Co. New Delhi, 2005.

R2. Garde, R.J., Fluid Mechanics through problems. New Age International Publishers (P) Ltd., New Delhi, 2002. bnb

U19AETL408T SURVEYING AND LEVELLING L T P C

2 0 0 2

COURSE OBJECTIVES

To introduce the principle of surveying, various methods and applications to Agricultural & Irrigation Engineering projects.

THEORY

UNIT I FUNDAMENTALS AND CHAIN SURVEYING 9

Definition- Classifications - Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting – applications- enlarging and reducing figures- Areas enclosed by straight lines - Irregular figures- digital Planimeter

UNIT II COMPASS AND PLANE TABLE SURVEYING 9

Compass – Basic principles - Types - Bearing – Systems and conversions – Sources of errors - Local attraction - Magnetic declination-Dip-Traversing - Plotting - Adjustment of closing error – applications - Plane table and its accessories - Merits and demerits - Radiation - Intersection - Resection – Traversing-sources of errors – applications.

UNIT III THEODOLITE AND MODERN SURVEYING 9

Theodolite - Types - Description - Horizontal and vertical angles - Temporary and Permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense methods - Stadia constants - Anallactic lens - Traversing - Gale‟s table - Total Station Global Positioning System (GPS).

UNIT IV LEVELLING 9

Level line - Horizontal line - Datum - Bench marks -Levels and staves - temporary and permanent adjustments – Methods of leveling - Fly levelling - Check levelling - Procedure in levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling - sources of errors in leveling- Precise levelling - Types of instruments - Adjustments - Field procedure.

UNIT V LEVELLING APPLICATIONS 9

Longitudinal and Cross-section-Plotting - Contouring - Methods – Characteristics and uses of contours-Plotting – Methods of interpolating contours – computation of cross sectional area and volumes - Earthwork calculations - Capacity of reservoirs - Mass haul diagrams

Total: 45 Periods

U19AETL408L SURVEYING AND LEVELLING LABORATORY L T P C

0 0 2 1

LAB COMPONENTS

1. CHAIN SURVEYING a) Ranging, Chaining and Pacing b) Chain traversing

2. COMPASS SURVEYING a) Triangulation Problem b) Compass traversing

3. PLANE TABLE SURVEYING a) Radiation b) Intersection - Triangulation problem c) Plane table traversing

4. THEODOLITE SURVEYING a) Measurement of horizontal & vertical angles b) Tangential & Stadia Tacheometry

5. LEVELLING a) Fly levelling using Dumpy level b) Fly levelling using Tilting level c) Check levelling d) Block Levelling e) Radial Contouring

6. Demonstration of TOTAL STATION AND GPS

COURSE OUTCOMES

CO1 : Gain knowledge in basic use of all surveying equipments
CO2 : Understand the errors and possible correction in Compass and plane table surveying
CO3 : Apply the knowledge of theodolite instrument in practical aspect.
CO4 : Apply the levelling concept in the field with its adjustments
CO5 : Understand and prepare the LS and CS coutour maps and carryout surveying works related to land and civil engineering projects.
CO6: Apply the knowledge of modern survey instrument in practical aspect.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	1		1			2	3			2		1	
CO2	1	3	1	2	3	1	2	3		2	1		1	1	
CO3	3	1	1	2	2		1	1		1		2			
CO4	2	2	3	2		3	2		2		2	1		2	
CO5	3	2		1	3		2	2		1	3		1		
CO6	1	3	1	2		3	3		1		1	2		1	

TEXT BOOKS

1. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.

2. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.

REFERENCE BOOKS

1. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004.

2. A.M. Chandra, Plane Surveying, New Age International Publishers 2002. 3. Alak De, Plane Surveying, S. Chand & Company Ltd., 2000.

U19FTTL401T POST HARVEST ENGINEERING OF CEREALS,PULSES AND OIL SEEDS **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To introduce post harvest techniques
- To impart knowlede on drying and is methods
- To educate the working of cleaners and graders
- To teach the working of shelling and handling equiments
- To impart knowledge on paddy and crop processing

UNIT I INTRODUCTION 9

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-moisture content –measurement –direct and indirect methods – moisture meters equilibrium moisture content.

UNIT II PSYCHROMETRY AND DRYING 9

drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction Psychrometry – importance –Psychrometric charts and its uses – Drying – principles and theory of, operation and maintenance of dryers – Design of dryers Unit

UNIT III CLEANING AND GRADING 9

Principles - air screen cleaners – adjustments - cylinder separator-spiral separator – magnetic separator-colour sorter-inclined belt separator – length separators - effectiveness of separation and performance index.

UNIT IV SHELLING AND HANDLING 9

Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator – castor sheller – material handling –belt conveyor –screw conveyor – chain conveyor – bucket elevators –pneumatic conveying.

UNIT V PADDY AND CROP PROCESSING 9

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 - wheat milling – pulse milling methods – oil seed processing

Theory:45 Tutorial:0 Practical:0 Project:0 Total:45 Periods

COURSE OUTCOMES

CO1 :To explain post harvest techniques

CO2 : To demonstrate various drying methods

CO3 : To operate cleaners and graders

CO4 : To identify various shelling and handking equipments

CO5 : To explain various paddy and crop processing

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	3	1		2		1	2	1	1		1	1	2	
CO2	2	3		3	2	1		3		3	1	1	1		
CO3	3	1	2	1	3	1		2	3	1	3			1	
CO4	1		2		1		3	1		2	3	2	1		
CO5	2	1	1	3	2	1	1		3	1	2			2	

TEXT BOOKS

1. Chakraverty, A.2000.Third Edition, Post harvest technology for Cereals, Pulses and oilseeds. Oxford &IBH publication Pvt Ltd, New Delhi

2. Sahay, K.M., and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi.

REFERENCE BOOKS

1. Pande, P.H. 1994. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana

2. Mohsenin, N.N.1970. physical properties of plant and animal materials Grodon and Breach publishers, Ludhiana

U19AEPC404L Design, Analysis and Simulation of Machine Elements - II L T P C

0 0 4 2

COURSE OBJECTIVES

UNIT1: MODELLING IN SOLID WORKS

Introduction to Solid Works: Command Manager, Toolbar, Dimensioning Standard and Units, Important Terms and Their Definitions, 2D Command Line Emulator, SimulationXpress, Physical Dynamics, Physical Simulation, Seed Feature, Feature Manager Design tree, Absorbed Features

UNIT2: TOOLS FOR SOLID MODELS

The Sketching Environment, Starting a New Session of Solid Works, Work flow customization Area, Task Panes, Starting a New Document in Solid Works, Understanding the Sketching environment, Learning Sketcher Terms, Selecting Entities,Drawing Lines Line Cursor Parameters

UNIT3: ADVANCED MODELING TOOLS

Advanced Modeling Tools Creating, Mirror Features Creating Linear Pattern Features Creating, Circular Pattern Features, Advanced Modeling Tools Creating Dome Features, Creating Indents, Creating Deform Features, Creating Flex Features, Creating Fastening Features, Creating the Mounting Boss. Creating Snap Hooks, Creating Snap Hook Grooves, Creating Vents, Creating a Lip/Groove Feature, Creating Freeform Features.

UNIT 4: ASSEMBLY MODELING

Advanced Assembly Mates, Applying the Symmetric Mate, Applying the Width Mate, Applyingthe Distance Mate, Applying the Angle Mate, Applying the Path Mate, Mechanical Mates, Applying the Cam Mate Applying the Gear Mate Applying the Rack Pinion Mate, Applying the Screw Mate, Applying the Hinge Mate, Checking Interferences in an Assembly, Checking the Hole Alignment, Creating Assemblies for Mechanism

UNIT 5: SHEET METAL DESIGN

Designing the Sheet Metal Components by Creating the Base Flange, Creating the Base Flange, Understanding the Feature Manager Design tree of a Sheet Metal Component, Creating the Edge Flange, Creating Tabs, Creating the Sketched Bend Creating the Miter, Flange Creating Closed Corners Creating Hems, Creating the Jog Bend, Breaking the Corners

LAB COMPONENTS

To model the given drawing according to the given dimensions

Exercise no.1 - Sub Soil Plough Design

Exercise no.2 - Piston Assembly

Exercise no.3 - Tractor plow in soil agriculture equipment

Exercise no.4 - Grinding Machine

Exercise no.5 - Tractor

Exercise no.6 - Heavy duty Cultivator

Exercise no.7 - Agriculture Spray Pump

Exercise no.8 - Engine Assembly

Exercise no.9 - Cam and Spring Mechanism

Exercise no.10 - Chaff Cutter

COURSE OUTCOMES

CO1 :To know the basic tools in solidworks

CO2 : Understanding the Sketching environment, Learning Sketcher Terms

CO3 : to know the Advanced Modeling Tools Creating, Mirror Features Creating Linear Pattern Features Creating

CO4 : To know the Advanced Assembly Mates, Applying the Symmetric Mate, Applying the Width Mate

CO5 : To designing the Sheet Metal Components by Creating the Base Flange

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	3	1		2		1	2	1	1		1	1	2	
CO2	2	3		3	2	1		3		3	1	1	1		
CO3	3	1	2	1	3	1		2	3	1	3			1	
CO4	1		2		1		3	1		2	3	2	1		
CO5	2	1	1	3	2	1	1		3	1	2			2	

References:

Narayan, K. Lalit (2008). Computer Aided Design and Manufacturing. New Delhi: Prentice Hall of India. p. 3. ISBN 978-8120333420.

Farin, Gerald; Hoschek, Josef; Kim, Myung-Soo (2002). Handbook of computer aided geometric design [electronic resource]. Elsevier. ISBN 978-0-444-51104-1.

Duggal, Vijay (2000). Cadd Primer: A General Guide to Computer Aided Design and Drafting Cadd,

U19CCLC402 Career Enhancement Programme - II **L T P C**

0 0 2 1

COURSE OBJECTIVES

- To enable students to learn to interpret given information correctly, determine which mathematical model best describes the data, and apply the model correctly.
- To improve students' analytical and data interpretation skills

THEORY

UNIT I VEDIC MATHEMATICS AND SUDOKU 3

Addition- Subtraction- System of Multiplication- Squaring numbers- Cube roots – Square roots - Logic-based Sudoku

UNIT II

NUMBER SYSTEM – LCM & HCF – SIMPLIFICATION – SURDS & INDICES – CYCLICITY-EQUATIONS 3

Classification on Numbers -Power cycles and remainders - Concept of highest common factor -concept of least common multiple - Divisibility Rule - Number of zeros in an expression -Problems on Surds and Indices - Concept of Unit digit - Simultaneous equations- Quadratic equations – In equation

UNIT III FUNDAMENTALS OF ALGEBRA - AVERAGES 3

Variables - Algebraic expressions - Substitution & evaluating expressions - Writing algebraic expressions- Combining like terms - Algebraic expressions Nested fractions - Introduction - average of different groups - addition or removal of items and change in average replacement of some of theitems

UNIT IV PERCENTAGES – RATIOS AND PROPORTION 3

Utility of percentage - importance of base/denominator for percentage calculations - concept of percentage values through additions - fraction to percentage conversion table- Introduction- Ratio properties- dividing a given number in the given ratio - comparison of ratios - proportions - relation among the quantities more than two – variation

UNIT V PARTNERSHIP - MIXTURES AND ALLEGATIONS - PROBLEM ON AGES 3

Definition - Alligation rule - mean value (COt price) of the mixture - Problems on ages and Problems related to ratios

Total: 15 Hour

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Problem-solving time would be reduced and also the dependence on the calculators will be cut down. Improves mental calculation and increases speed and accuracy.

CO2 : Confidently analyze and solve data interpretation questions based on graphs, tables,Venn diagram and flow charts

CO3: Helps to understand numbers better, opens up other subjects and helps to think logically

CO4: Sharpens the mind increases mental ability and intelligence, Increase visualization andconcentration.

CO5: Fine-tune their overall critical thinking skills.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3		1	2	1	1		1		2		3	1	2	
CO2	1	2	1	3	2	3	2	2	1	3	1	3	1	1	
CO3		1	1	2	1	2	1	3	2	2	2		1		
CO4	1	1	2	3	2		2		2	1	3	2	2	1	
CO5		2	1		2	2	3	2		3	2	2		1	

TEXT BOOKS

T1. Arihant Publications," Quantitative Aptitude Quantam CAT ", Sarvesh Kumar Verma

T2. Aggarwal, R.S. "Quantitative Aptitude", Revised Edition 2016, Reprint 2018, S.Chand& CoLtd., New Delhi.

T3. Pearson Publication, "A Complete Manual for the CAT", 2018

REFERENCE BOOKS

R1. Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014

R2. Arun Sharma "How to Prepare for Quantitative Aptitude for the CAT " , McGraw Hill Education; Eighth edition 2018

R3Arun Sharma "How to Prepare for Logical Reasoning for the CAT " , McGraw Hill Education; Eighth edition 2018

WEB RESOURCES

W1. https://www.indiabix.com/aptitude/questions-and-answers/

W2. https://testbook.com/aptitude-practice/

W3. http://www.allindiaexams.in/online-test/online-aptitude-test/all

W4. https://www.fresherslive.com/online-test/aptitude-test/questions-and-answer

U19CCEX404L ENGINEERING EXPLORATION -IV L T P C

0 0 2 1

COURSE OBJECTIVES

- To learn about the project management and the importance of team work
- To analyze engineering solutions from ethical and sustainability perspectives.
- To apply basics of engineering project management skills in product development.
- To build simple systems/prototypes using engineering development process.
- To analyse the COt factors involved in engineering process.

THEORY COMPONENT CONTENTS

UNIT I Engineering Management 6+0

Engineering economics, management of work, the management of engineers, the management of engineering, contemporary management issues

UNIT II Professional Ethics 6+0

Engineering ethics, engineering as social experimentation, engineer's responsibility for safety, responsibilities and rights, global issues

UNIT III Process Planning and COt Estimation 3+0

Process planning, estimating and COting, element of COt, product COt estimation, estimation of machining time, COt estimation of any agricultural equipment/ product manufacturing.

Practical

Course Project Reviews & Project Work Hours (PWH) 0+30

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Analyze engineering solutions from ethical and sustainability perspectives.

CO2: Apply basics of engineering project management skills in project development

CO3: Develop design principles in project development and manage the engineers.

CO5 : Build simple systems/prototypes using engineering design and development process.

CO6 : Evaluate the COt estimation during developing of prototype/ product/ equipment.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3		1	2	1	1		1		2		3	1	2	
CO2	1	2	1	3	2	3	2	2	1	3	1	3	1	1	
CO3		1	1	2	1	2	1	3	2	2	2		1		
CO4	1	1	2	3	2		2		2	1	3	2	2	1	
CO5		2	1		2	2	3	2		3	2	2		1	

SEMESTER V

U19AETL509T SOLAR SYSTEM DESIGN AND WIND ENERGY ENGINEERING L T P C

2 0 0 2

COURSE OBJECTIVE:

- To introduce to the students to the basic concepts involved in the solar energy radiation and solar thermal collectors.
- To get understand the solar concentrating collectors and solar pond.
- To understand procedure of solar PV technology and Hybrid systems.
- To understand the concept of wind energy ,factors influencing and site selection.
- To understand the basic design wind mill types and applications .
- To understand wind energy storage ,safety and environmental aspects.

UNIT I SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS 9

Solar radiation availability - radiation measurement – transmittance - absorptance – Basic earth sun angles -estimation of average solar radiation, radiation on tilted surface - Flat plate collectors - heat transfer correlations - collector efficiency - heat balance – absorber plate – types - selective surfaces. Solar water heaters - types their performance. Solar driers – types – heat transfer -performance of solar dryers – agro industrial applications.

UNIT II SOLAR CONCENTRATING COLLECTORS 9

Concentrating collectors – types – reflectors - solar thermal power stations – principle and applications - Solar energy storage systems – thermal - sensible and latent heat, chemical, electrical, electro-magnetic energy storage – selection of materials for energy storage - Solar distillation – application - Solar stills - types - Solar pond - performance – characteristics - applications – Solar refrigeration.

UNIT III SOLAR PV TECHNOLOGY 9

Solar photovoltaic technology –introduction – solar cell basics – Types of solar cells and modules – encapsulation – Design of solar PV system – load estimation - batteries – invertors – operation - system controls. Standalone and grid connected systems - PV powered water pumping - Hybrid system - Solar technologies in green buildings.

UNIT IV WIND ENERGY 9

Nature of the wind – power in the wind – factors influencing wind – wind energy potential and installation in India- wind speed monitoring - wind resource assessment -wind power laws - velocity and power duration curves - Betz limit - site selection.

UNIT V WIND MILL TYPES AND APPLICATIONS 9

Wind energy conversion devices - classification, characteristics, applications – Design of horizontal axis wind mill rotor diameter - Wind energy storage - wind farms - wheeling and banking - testing and certification procedures. Water pumping - Hybrid systems – Wind mill safety and environmental aspects.

TOTAL: 45 PERIOD

U19AETL509L RENEWABLE ENERGY LABORATORY L T P C

0 0 2 1

LAB COMPONENTS

1. Familiarization with different solar energy gadgets
2. To study solar photovoltaic system
3. To study about solar lighting
4. To study about solar pumping
5. To study about solar fencing
6. To study solar cooker
7. To study solar drying system
8. To study solar distillation
9. To study solar pond
10. To study wind turbine components.
11. To study on wind energy generator.
12. To study on Hybrid (Solar-Wind) Power System

COURSE OUTCOMES :

The student will be able to understand

- Understand of renewable and non-renewable sources of energy
- Understand the influence of solar energy radiation and collectors.
- Gain knowledge about working principle of various solar energy systems.
- Apply the concepts of solar PV technology and Hybrid systems.
- Apply the concepts of Wind energy and factors involved in wind energy generation.
- Apply concepts of Hybrid systems using solar and wind energy.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	3	2	3	1	3	2	1	3		1	3	2	1	1	
CO 2	2	3	1	1	2	1	2	3	1	2	2			2	
CO 3	1	2	3		2	1		1	1	3		2	2		
CO 4	3	1	3	1	2	2	2	1		1	1			2	
CO 5	3	2		3	2	2		2	3		3	1	1		

TEXTBOOKS:

1. Rai., G.D. “Solar Energy Utilization” Khanna publishers, New Delhi, 2002.

2. More, H.S and R.C. Maheshwari, “ Wind Energy Utilization in India” CIAE Publication Bhopal, 1982.

3. Solanki, C.S. “Renewable Energy Technologies: A Practical guide for beginners”. PHI learning Pvt. Ltd, New Delhi. 2008.

REFERENCES:

1. Solanki, C.S. “Solar Photovoltaic Technology and Systems”, PHI learning Pvt. Ltd., New Delhi, 2013.

2. Rai. G.D. “Non Conventional Sources of Energy”, Khanna Publishers, New Delhi, 2002.

3. Rao. S and B.B. Parulekar. “Energy Technology – Non conventional, Renewable and Conventional”. Khanna Publishers, Delhi, 2000.

4. Rajput. R.K. “Non- Conventional Energy Sources and Utilization”, S. Chand & Company Pvt. Ltd, New Delhi, 2013.

U19AEH503 FARM TRACTORS **L T P C**

3 0 0 3

COURSE OBJECTIVES:

• To equip the student with sufficient knowledge about tractor and its categories

• To provide the fundamental ideas of I.C. engine and its working

• To provides the fundamental idea about the various systems, their principles of operation and types, components of tractor

• To impart knowledge on the concept of traction and mechanics of tractor

• To introduce the ergonomic and safety considerations in tractors; and tractor testing

THEORY

Unit I –Tractors **9**

Classification of tractors - Tractor engines – construction of engine blocks, cylinder head andcrankcase - features of cylinder, piston, connecting rod and crankshaft – firing order- combustion chambers.

Unit II - Engine systems **9**

Valves-inlet and outlet valves – valve timing diagram. Air cleaner- exhaust – silencer. Cooling systems - lubricating systems - fuel system – governor- electrical system.

Unit III - Transmission systems **9**

Transmission - clutch - gear box - sliding mesh - constant mesh - synchro mesh. Differential, final drive and wheels. Steering geometry - steering systems - front axle and wheel alignment. Brake - types - system.

Unit IV- Hydraulic systems **9**

Hydraulic system - working principles, three point linkage - draft control - weight transfer, theory of traction -tractive efficiency – tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility -operators seat.

Unit V- Power tiller and Tractor Testing **9**

Power tiller - special features - clutch - gear box - steering and brake. Makes of tractors andpower tillers. Types of tests- test procedure - need for testing & evaluation of farm tractor –Test code forperformance testing of tractors and power tillers.

COURSE OUTCOMES :

The student will be able to understand

CO1: To understand about tractor and its categories
CO2: To provide a solution for the problems related I.C. engine and its working
CO3: To understand the various systems, their principles of operation and types, components of tractor
CO4: To solve the problems related to traction and mechanics of tractor
CO5: To design the tractor and power based on ergonomic and safety considerations of operator and able to test the tractor in field condition

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	3	3	1		1		3		1	2	1	2	
CO2	2	3		2	2	1	3	1		2				1	
CO3	3	1	2	3		1		1	2		2		2		
CO4		2	1		1		3		3	2	2			1	
CO5	3	2	1	3	1	2		3	3	1	2		2		

TEXT BOOKS

1. Jain, S.C. and C.R. Rai. 1999. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi.

REFERENCE BOOKS

1. Barger, E.L., J.B. Liljedahl and E.C. McKibben, 1997. Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi.

2. Domkundwar A.V. 1999. A course in internal combustion engines. Dhanpat Rai & Co. (P)Ltd., Educational and Technical Publishers, Delhi.

3. Black, P.O. 1996. Diesel engine manual. Taraporevala Sons& Co., Mumbai.

4. Grouse, W.H. and Anglin, D.L. 1993. Automative mechanics. Macmillan McGraw- Hill,Singapore.

5. Indian Standard Codes for Agril. Implements. Published by ISI, New Delhi

U19AETH502 DESIGN OF BASIC MACHINE ELEMENTS **L T P C**

3 1 0 4

COURSE OBJECTIVES:

• To introduce to the students to the basic concepts involved in the design of basic elements that are common to any agricultural machinery.

• To get through the detailed design & drawing of various components of agricultural machineries.

• To understand procedure of machine design and develop an ability to apply it for simple component design by using design data hand book.

• To understand the different theories of failure and develop an ability to apply its knowledge for design of mechanical component and determine the resisting areas against failure

• To determine forces on transmission shaft and design of transmission shaft

THEORY

UNIT I STRESSES IN MACHINE MEMBERS **09**

Introduction to design process- factor influencing the machine design, selection of material based on mechanical properties- Direct, bending and torsional stress equations- calculation of Principal stresses for combined loading. Design of curved beams- factor of safety – theories of failure-stress concentration design of variable loading- Soderberg and Goodman relations.

UNIT II DESIGN OF POWER TRANSMISSION SYSTEMS **09**

Selection of V-Belts and pulleys- selection of flat belts and pulleys- wire ropes and pulleys- selection of transmission chains and sprockets. Design of pulleys and sprockets.

UNIT III DESIGN OF SHAFTS AND COUPLINGS **09**

Design of solid and hollow shafts based on strength and rigidity- Design of keys, keyways and splines- Design of rigid and flexible couplings. Design of bolts and nuts - knuckle and cotter joints.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS **09**

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs.

UNIT V DESIGN OF GEARS AND BEARINGS **09**

Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation. - Failure of gear teeth.- Applications of different types of Gears - Types of bearings – sliding contact and rolling contact types. – Bearing selection based on application - Lubrication in journal bearings – calculation of bearing dimensions.

TOTAL :45 PERIODS

(Note: Use of PSG Design Data book is permitted in the university examination

COURSE OUTCOMES

- At the end of the course the student will have the knowledge on detailed design and drawing of basic machine components.
- Understand the influence of steady and variable stresses in machine component design.
- Apply the concepts of power transmission systems.
- Apply the concepts of design to shafts, keys and couplings.
- Apply the concepts of design to energy storing elements
- Apply the concepts of design to gears and bearings.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2		1	1		1		3		1		
CO2		1		3	1		2	2		3	2	2		2	
CO3		2	3	2		2		1		3	2		2		
CO4	1	1	2	3	3		3		2	2		2		2	
CO5	1	2		3	1	2		2	1		2		1	1	
C06	3	3	2	2	1		1	2	1		3	2		2	

TEXTBOOKS:

1. Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house, 2005.

2. Bhandari V.B, “Design of Machine Elements”, Tata McGraw-Hill Book Co, 2003.

REFERENCES:

1. Norton R.L, Machine Design – An Integrated Approach, Pearson Publications, 3rd Edition, 2006.

2. Srivastava A.K., Goering.C.E. and Rohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993.

3. Gary Krutz, Lester Thompson and Paul Clear., “Design of Agricultural Machinery”, John Wiley and Sons, New York, 1984

U19AETL510T Irrigation Automation and Drainage Engineering **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To conceive and design various aspects of irrigation techniques
- To study about the automation adopted in irrigation techniques
- To study about the various factors involved in selection of diversion and impound structures
- To design proper drainage systems

THEORY

UNIT I WATER RESOURCES AND IRRIGATION REQUIREMENT **9**

Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation –duty and delta - Rooting characteristics - Moisture use of crop, Evapotranspiration - ET plot - Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.

UNIT II METHODS OF IRRIGATION AND AUTOMATION **9**

Methods of Irrigation – Surface and Subsurface methods –Automation in Drip and Sprinkler - Hydraulics and design - Erodible and non-erodible, Kennedy's and Lacey's theories, Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system

UNIT III DIVERSION AND IMPOUNDING STRUCTURES **9**

Head works –Weirs and Barrage –Types of impounding structures - Factors affecting, location of dams - Forces on a dam -Design of Gravity dams- Earth dams, Arch dams – Spillways -Energy dissipaters.

UNIT IV CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT **9**

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlet, Escapes –Lining and maintenance of canals - Command area - Concept, Components of CADP - On Farm Development works, Farmer's committee - its role for water distribution and system operation - rotational irrigation system.

UNIT V AGRICULTURAL DRAINAGE **9**

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

U19AETL510L Irrigation Automation and Drainage Engineering Laboratory **L T P C**

0 0 2 1

LAB COMPONENTS

1. To study various instruments in the Meteorological Laboratory
2. Determination of infiltration rate using double ring and digital infiltrometer
3. Determination of soil moisture wetting pattern for irrigation scheduling
4. Design of Drip irrigation system
5. Design of sprinkler irrigation system
6. Measurement of flow properties in open irrigated channels (flumes, notches)
7. Evaluation of surface irrigation
8. Determination of uniformity coefficient for drip irrigation system
9. Determination of uniformity coefficient for sprinkler system (catch can method)
10. To conduct experiment on disc filter for micro irrigation systems

COURSE OUTCOMES

CO1 :Understand the different water sources for irrigation and its requirement

CO2 :Deliver different types of irrigation techniques for various crops

CO3 :Adopt recent automation techniques for irrigating the crops

CO4 :Apply the knowledge of selecting diversion and impound structures in the field

CO5 :Gain Knowledge in fundamentals of Command Area Development

CO6 :Gain Knowledge in the selection of agricultural drainage structures

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2		1	1		1		3		1		
CO2		1		3	1		2	2		3	2	2		2	
CO3		2	3	2		2		1		3	2		2		
CO4	1	1	2	3	3		3		2	2		2		2	
CO5	1	2		3	1	2		2	1		2		1	1	
C06	3	3	2	2	1		1	2	1		3	2		2	

TEXT BOOKS

1. Dilip Kumar Majumdar., “Irrigation Water Management”, Prentice-Hall of India, New Delhi, 2008

2. Michael, A.M., “Irrigation Engineering”, Vikas Publishers, New Delhi, 2008.

3 Garg, S.K., “Irrigation Engineering,” Laxmi Publications, New Delhi, 2008

REFERENCES

Basak, N.N., “Irrigation Engineering”, Tata McGraw-Hill Publishing Co, New Delhi, 2008. .

Murthy, V.V.N. Land and water management, Kalyani publishing, New Delhi, 1998

U19AETL511T Hydrology and Water Resources Engineering **L T P C**

2 0 0 2

COURSE OBJECTIVES

• To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources

THEORY

UNIT I PRECIPITATION AND ABSTRACTIONS **10**

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods- Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression –Infiltration

UNIT II RUNOFF **8**

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships- flow measurements.

UNIT III FLOOD AND DROUGHT **9**

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS **9**

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.

UNIT V GROUNDWATER AND MANAGEMENT **9**

Origin- Classification and types - properties of aquifers- governing equations - artificial recharge -RWH in rural and urban areas

U19AETL511L Hydrology and Water Resources Engineering Laboratory **L T P C**

0 0 2 1

LAB COMPONENTS

Measurement of Rainfall by non –recording rain gauge

Measurement of rainfall by recording rain gauge.

To determine mean rainfall of an area by Thiessen mean Polygon method.

To determine mean rainfall of an area by isohyetal method.

The determine meanings rogosity coefficient.

To determine the velocity of a running of a stream in a canal by current meter and calculate the approximate discharge of the canal.

To design a regime channel by Lacey's theory for a given .pattern of crops and area to be irrigated.

To determine the yield of an open well by recuperation test.

To determine the yield of an open well by constant level pumping test.

To visit a Multipurpose River valley, project and to prepare a report of the solid project.

COURSE OUTCOMES

CO1 : An understanding of the key drivers on water resources, hydrological processes and their integrated behavior in catchments

CO2 :Ability to construct and apply a range of hydrological models to surface water and groundwater problems.

CO3 :Understanding of hydrograph, flood and drought

CO4: Understanding the General principles of design, site selection, spillways, elevation

CO5: understanding the groundwater and management

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2	1		3	3			3		1	2	
CO2		2	3		2	1	2		2	3	1	2	1	1	
CO3	2	1	1	3		2		3	2		2			1	
CO4	1	3	2		2	3	2	1	1	2	3	2		1	
CO5		1	1	3	1		3	1		3	1	3	2		
C06	3	3	2	2	3	2	2	3	1		3			1	

TEXT BOOKS

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010

2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.

3 Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

REFERENCE BOOKS

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007

2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.

3 Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998

U19AETH504	IoT in Agriculture	L T P C
		2 1 0 3

Course objectives

- To introduce the students with various concepts of IoT
- To work on different projects making use of Internet of things
- To expose the students to various concepts of precision farming
- To enhance the knowledge on various environmental control systems
- To familiarize the students with various weather prediction models
- To expose the students to various expert and decision support systems

UNIT -1 Introduction & Concepts **9**

Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.Definition & Characteristics of IoT- Physical Design of IoT- Things in IoT- IoT Protocols- Logical Design of IoT- IoT Functional Blocks- IoT Communication Models- IoT Communication APIs- IoT Enabling Technologies- M2M towards IoT- IoT- Interfacing Esp8266

UNIT – II IoT Cloud & Network Layers **9**

Wireless Communication Protocols- IoT Application Layer Protocols: HTTP- MQTT - XMPP- CoAP- AMQP- Web Sockets -IoT Gateway: Node Red – Thing Speak - Ubidots - AWS IoT – IBM Watson IoT.

UNIT – III Domain Specific IOTs **9**

Home Automation, Agriculture, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health& Life Style - What is an IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, and Programming &IOT Devices.

UNIT – IV Precision farming **9**

Precision agriculture – Sensors – Remote sensing – GPS – GIS and various mapping software – Yield mapping systems – Crop production modelling – Expert systems in agriculture - Controlled environment agriculture – Control systems – Artificial lighting systems – Management of crop growth in green houses – online measurement of plant growth in green houses- Simulation of crop growth- Estimating system reliabilities

UNIT – V Weather Prediction **9**

Weather and climate - Seasonal forecasting – Understanding the world climate system – Global climate models – Importance of climate variability – Importance of agricultural meteorology for crop production

COURSE OUTCOMES

CO1: Students can explain the basic concepts of IoT

CO2: Students shall understand about the IoT cloud layers and various types of associated network

CO3: Students can explain about the various concepts of precision farming techniques

CO4: Students can explain the concepts of controlled environment agriculture and various controlled growing environments

CO5: Students can analyse about weather and climate and its predictability

CO6: Students can apply various concepts of IoT in precision farming, Controlled agricultural practices

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2	2	1	1		1	2	3	2	1	1	
CO2		2	1		1	1		2	1		2	1		1	
CO3	1		2	3		1	3		1	2	3	3	2	2	
CO4	1	3	2	1	3	2		3		1	1		1	1	
CO5	3		1		2	3	1	2	3	2	1	3	1	2	
C06	3	3	2	2			3			3			1	2	

SEMESTER-VI

U19AETL612T **Farm Machinery and Equipment** **L T P C**

3 0 0 3

OBJECTIVES:

• To study the working principles of farm Power and Farm Mechanization
• To study to the working principles Tillage equipment and its types
• To understand the working principles of sowing and fertilizing equipment
• To study the working principles of weeding and plant protection equipment
• To understand the working concept of Harvesting Machinery.
• To expose the students to farm mechanization benefits and constraints, identification of Components of primary and secondary tillage implements

UNIT I FARM POWER AND FARM MECHANIZATION **9**

Farm Power-sources of Farm power- merits and demerits of different forms power -status of farm power in India- Farm mechanisation - objectives. Status of Farm Mechanization in India- Mechanization in farming operations. Types of farm implements - trailed, mounted. Field capacity - forces acting on tillage tool.

UNIT II PRIMARY AND SECONDARY TILLAGE IMPLEMENTS **9**

Tillage - objectives - methods - primary tillage implements -Secondary tillage implements - animal drawn ploughs - construction- Mould board plough- attachments - mould board shapes and types. Disc plough - force representation on disc - Types of disc ploughs - Subsoiler plough - Rotary plough. Cultivators - types - construction. Dise harrows - Bund former – ridger - leveler. Basin lister- Wetland preparation implements.

UNIT III SOWING AND FERTILIZING EQUIPMENT **9**

Crop planting - methods - row crop planting systems - Devices for metering seeds - furrow openers - furrow closers- types - Types of seed drills and planters - calibration-fertilizer metering devices - seed cum fertilizer drills - paddy transplanters - nursery tray machines.

UNIT IV WEEDING AND PLANT PROTECTION EQUIPMENT **9**

Weeding equipment - hand hoe - long handled weeding tools - dryland star weeder – wetland Cono weeder and rotary weeder - Engine operated and tractor weeders Sprayers -types-classification - methods of tomization, spray application rate, droplet size determination - volume median diameter, numerical median diameter - drift control

UNIT V HARVESTING MACHINERY **9**

Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder combine harvesters, balers, threshers, tractor on top combine harvester, combine losses

TOTAL: 45 PERIODS

OUTCOME:

CO1. To understand the concept of farm power and farm mechanization

CO2. To understand the concept of primary and secondary tillage equipment.

CO3. To design the sowing and fertilizing equipment

CO4. To solve the problems related to weeding

CO5. To understand the fundamental concept of Harvesting Machinery and its applications.

CO6 To acquire the knowledge of farm machinery and equipment used in the farm for different field operations.

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2	2	1	1		1	2	3	2	1	1	
CO2		2	1		1	1		2	1		2	1		1	
CO3	1		2	3		1	3		1	2	3	3	2	2	
CO4	1	3	2	1	3	2		3		1	1		1	1	
CO5	3		1		2	3	1	2	3	2	1	3	1	2	
C06	3	3	2	2			3			3			1	2	

TEXTBOOKS:

1. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.,2010.

2. Michael and Ohja, Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005

REFERENCES:

1. Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.

2. Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi., 1996.

3. Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.

U19AETL613T REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM **L T P C**
2 0 0 2

OBJECTIVES:

- To introduce the principles and basic concepts of Remote Sensing and GIS
- To introduce the remote sensing systems, data products and analysis
- To introduce the spatial data models, analysis and presentation techniques
- To study the applications of Remote Sensing and GIS in agriculture, soil and waterresources

UNIT I CONCEPTS OF REMOTE SENSING AND SATELLITES 9

Definition- Historical background - Components of remote sensing – Energy source, electromagnetic spectrum, radiation principle, platforms and sensors - Active and passive remote sensing interference - Atmospheric effects on remote sensing – Energy interaction with earth surface feature - Data acquisition - Reflectance, spectral signatures for water, soil and vegetation.- Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT,SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution - Recent satellites with its applications

UNIT II DATA PRODUCTS AND IMAGE ANALYSIS 9

Data products –based on level of processing- o/p – scale – area/coverage – data availability – data ordering- data price - Image interpretation – Visual interpretation elements – interpretation key. Digital image processing – Image enhancement – image classification – Supervised and unsupervised – Vegetation Indices.

UNIT III CONCEPTS OF GIS 9

Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data – History and development of GIS – Definition – Components – Hardware and Software.

UNIT IV DATA INPUT AND ANALYSIS 9

Data – Spatial, Non-Spatial – Database models – Hierarchical network, Relational and Object Oriented Data Models – Raster and Vector – Methods of Data input – Data Editing – Files and formats – Data structure – Data compression. Introduction to analysis – Measurements – Queries

– Reclassification – Simple spatial analysis – Buffering – Neighboring functions – Map overlay – Vector and raster – Spatial interpolation – Modelling in GIS – Digital Elevation Modelling – Expertsystems

UNIT V APPLICATION OF RS AND GIS 9

Crop Acreage estimation - Estimation of Crop Water Requirement – Crop condition - Soil mapping - classification of soil with digital numbers – soil erosion mapping- reservoir sedimentation usingimage processing - Inventory of water resources – water quality assessment - Application of Remote Sensing and GIS in Precision Agriculture - Monitor Crop Health - Management Decision Support Systems

TOTAL: 45 PERIODS

OUTCOMES:

CO1: The students will understand the remote sensing principles,

CO2: The students will understand remote sensing systemssatellite data processing and available data products.

CO3: The students will understand decision making process using DBMS

CO4: The students will understand utilization of advanced techniques in addressing the real world problems

CO5: The students will understand the application of remote sensing and GIS

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2	1		3	3			3		1	2	
CO2		2	3		2	1	2		2	3	1	2	1	1	
CO3	2	1	1	3		2		3	2		2			1	
CO4	1	3	2		2	3	2	1	1	2	3	2		1	
CO5		1	1	3	1		3	1		3	1	3	2		
C06	3	3	2	2	3	2	2	3	1		3			1	

TEXTBOOKS:

1. Anji Reddy. M, Remote Sensing and Geographical Information Systems, BS Publications, Hyderbad, 2001
2. Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wileyand Sons, New York, 2000.

REFERENCES:

1. Bettinger, P., and Michael, G.W., "Geographical Information System: Applications in Forestry and Natural Resources Management," Tata McGraw–Hill Higher Education, New Delhi, 2003
2. Ian Heywood., "An Introduction to GIS", Pearson Education, New Delhi, 2001.
3. Jeffery Star and John Estes, "Geographical Information System — An Introduction," Prentice Hall India Pvt. Ltd., New Delhi, 1998.
4. Patel A.N & Surendra Singh, "Remote sensing principles & applications", Scientific Publishers , Jodhpur 1992

U19AETL614T	BIOENERGY- PRINCIPLES AND APPLICATIONS	L T P C 2 0 0 2

OBJECTIVES:

C604.1 To introduce to the students the concepts of bio energy resources

C604.2 To expose the students to types of energy resources

C604.3 To enhance knowledge on estimation of bio energy plants.

C604.4 To expose the students to bio fuel production.

C604.5 To enhance knowledge in alcohol production and gasifiers

C604.6 To familiarize with principles and concepts to solve issues related to energy and environment.

UNIT I BIO RESOURCE - AN INTRODUCTION` 9

Bio resource – origin – biomass types and characteristics- biomass conversion technology- Biodegradation - steps in biogas production- parameters affecting gas production- Types of biogas plants- Construction details- operation and maintenance.

UNIT II BIO ENERGY 9

Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics –Biocatalysis –Kinetics of product formation.

UNIT III BIO REACTORS AND FERMENTORS 9

Bio reactors/ fermentors – Batch type – continuous stirred tank reactors- Biological waste water treatment- Activated sludge process- Down stream processing-Recovery and purification of products.

UNIT IV ALCOHOL PRODUCTION 9

Alcohol ethanol production - Acid hydrolysis - enzyme hydrolysis-Methanol synthesis - Antibiotics- enzymes- principles of thermochemical conversion – combustion - pyrolysis- Gasification – types of gasifiers.

UNIT V ENERGY AND ENVIRONMENT 9

Principles of operation- chemical reaction- cleaning and cooling - Utilization- Improved wood burning stove - Energy plantations- Biomass briquetting - co generation- Impact on Environment –

– Bioenergy policy.

TOTAL: 45 PERIODS

OUTCOMES:

CO1 Understanding the importance of bio resources .

CO2 Ability to classify the bio energy and characteristics of bio energy.

CO3 Knowledge in bio reactors and fermentors.

CO4 Ability to gain knowledge in Alcohol production process.

CO5 Understanding the importance of Energy and Environment

CO6 Knowledge in capturing and applying bioenergy on replacement of fossil fuels.

TEXTBOOKS:

1. Rai G.D,Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.
2. Bouley James .E & David Follis - Biochemical Engineering Fundamentals Mc Graw-Hill publishing company, Tokyo.1986

REFERENCES:

1. Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986

2. Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.
3. Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. Technology and application of biogas. Jain Brothers, New Delhi.
4. Mathur,A.N.and Rathore,N.S.1993.,Biogas production Management and Utilisation. Himanshu Publication. New Delhi.

Mapping of Course outcomes (CO) to Program outcomes (POs)

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2	1		3	3			3		1	2	
CO2		2	3		2	1	2		2	3	1	2	1	1	
CO3	2	1	1	3		2		3	2		2			1	
CO4	1	3	2		2	3	2	1	1	2	3	2		1	
CO5		1	1	3	1		3	1		3	1	3	2		
C06	3	3	2	2	3	2	2	3	1		3			1	

U19AETH605 SOIL AND WATER CONSERVATION ENGINEERING L T P C

3 1 0 4

OBJECTIVES:

- To present the concepts of erosion so that students get a sound knowledge about theproblems associated with it.
- To enable the students to make use of the principles and concepts to solve issues relatedto soil and water management.

UNIT I SOIL EROSION PRINCIPLES 9

Approaches to soil conservation – Soil conservation in India - Erosion – Agents - Causes - Mechanics of water erosion – Soil erosion problems - Types of water erosion: Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion, Stream bank erosion – Classification of Gully – Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways - Prerequisites for soil and waterconservation measures.

UNIT II ESTIMATION OF SOIL EROSION 9

Runoff computation for soil conservation: SCS-CN method – Evolution of Universal Soil Loss Equation: Applications and Limitations – Modified Universal Soil Loss Equation – Revised Universal Soil Loss Equation- Permissible erosion – Land use capability classification - Classification of eroded soils.

UNIT III EROSION CONTROL MEASURES 10

Agronomic practices: contour cultivation - strip cropping – tillage practices – Soil management practices – Bunding: Types and design specifications - Mechanical measures for hill slopes – Terracing: Classification and design specification of bench terrace – Grassed waterways: Location, construction and maintenance – Types of temporary and permanent gully control structures.

UNIT IV WATER CONSERVATION MEASURES 9

In-situ soil moisture conservation – Water harvesting principles and techniques: Micro catchments, catchment yield using morphometric analysis - Farm ponds: Components, Design, Construction and Protection – Check dams - Earthen dam – Retaining wall.

UNIT V SEDIMENTATION 8

Sediment: Sources – Types of sediment load – Mechanics of sediment transport – Estimation of bed load – Sediment Graph - Reservoir sedimentation: Basics - Factors affecting sediment distribution pattern, Rates of reservoir sedimentation - Silt Detention Tanks – sediment control methods.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: The students will be able to gain fundamental knowledge on the concepts of soil erosion principles

CO2: The students will be able to gain fundamental knowledge on estimation of soil erosion

CO3: They will have sufficient knowledge on erosion control measures

CO4: They will have sufficient knowledge on soil and water conservation measures.

CO5: The students will be able to gain fundamental knowledge on the concepts of sedimentation

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1	2	2	2	1	1		1	2	3	2	1	1	
CO2		2	1		1	1		2	1		2	1		1	
CO3	1		2	3		1	3		1	2	3	3	2	2	
CO4	1	3	2	1	3	2		3		1	1		1	1	
CO5	3		1		2	3	1	2	3	2	1	3	1	2	
C06	3	3	2	2			3			3			1	2	

TEXTBOOKS:

1. Suresh, R., "Soil and Water Conservation Engineering", Standard Publication, New Delhi,2007.
2. Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of IndiaPrivate Limited, New Delhi, 2000.
3. "Sedimentation Engineering", 2006, ASCE manual and Report on Engineering Practice No.54, Edited by Vito A. Vanoni. ASCE publishing.

REFERENCES:

1. Murthy, V.V.N., "Land and Water Management Engineering", Kalyani Publishers, Ludhiana,1998.
2. Gurmail Singh, "A Manual on Soil and Water Conservation", ICAR Publication, New Delhi,1982.

U19AETL613L Remote Sensing and Geographical Information Systems Laboratory **L T P C**
0 0 1 1

OBJECTIVES:

- To introduce the principles and basic concepts of Remote Sensing and GIS through hands ontraining

1. Measurement of relief displacement using parallax bar
2. Stereoscopic vision test
3. Aerial photo interpretation - visual
4. Satellite images interpretation – visual
5. Introduction to QGIS
6. Geo-referencing of images
7. Image enhancement practice
8. Supervised classification practice
9. Unsupervised classification practice
10. Database Management Systems
11. Spatial data input and editing - Digitising
12. Raster analysis problems – Database query
13. GIS applications in DEM and its analysis

TOTAL: 60 PERIODS

OUTCOME:

- On completion of the lab course, the students will have adequate knowledge in applicationof RS and GIS in various fields of agricultural engineering.

TEXTBOOKS:

1. Lillesand, T.M. and Kiefer, R.W. 2005. "Remote Sensing and Image Interpretation ",II edition. John Wiley & sons.
2. Heywood, I., Cornelius. S., Carver. S 2002. An Introduction to Geographical InformationSystems. Addison Wesley Longman, New York.

REFERENCES:

1. Floyd F.Sabins. 2005. "Remote Sensing: Principles and Interpretation", III edition. Freemanand Company New York.
2. Jensen, J.R., 2004. "Introductory Digital Image Processing: A Remote SensingPerspective". Prentice – Hall. New Jersey.

U19AETL614L	Bio Energy Laboratory	L T P C 0 0 1 1

OBJECTIVE:

- To gain the practical knowledge on various renewable energy gadgets.

EXPERIMENTS:

1. Characterization of biomass – proximate analysis
2. Determination of caloric value of fuels – solids and gases
3. Design of KVIC / Deenbandhu model biogas plant
4. Study of UASB biomethanation plant
5. Purification of biogas – CO_2 and H_2S removal
6. Performance evaluation of agro based gasifier
7. Study on pyrolysis unit – Biochar, Charcoal and Tar making process
8. Testing of biogas/producer gas engines
9. Study on briquetting and Stoichiometric calculations
10. Automatic weather station – Analysis of wind data and prediction
11. Testing of solar water heater
12. Testing of natural convection solar dryer
13. Study on Solar power and I-V Characteristics
14. Testing of solar photovoltaic water pumping system The lab includes visit to biomass power plant and wind farms.

OUTCOME:

On completion of the lab course, the students will

- Be exposed to renewable energy sources and their applications.

REFERENCES:

1. Khandelwal, K.C. and Mahdi, S.S. “Biogas Technology”. Tata Mc Graw Hill Pub. Co. Ltd.,New Delhi, 1986.
2. Nijaguna, B. T. “Biogas Technology” New Age International Pvt. Ltd., New Delhi, 2006.
3. Rao. S and B.B. Parulekar. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi, 2000.
4. Solanki, C.S. “Solar Photovotaics – Fundamentals, Technologies and Applications”, PHI Learning Pvt. Ltd., New Delhi, 2011.

LIST OF EQUIPMENTS REQUIRED

1. Hot air oven- 1 no.
2. Muffle furnace - 1 no.
3. Junkers gas calorimeter- 1 no.
4. Bomb calorimeter- 1 no.
5. Model of Biogas and Deenabandhu biogas plant- 1 no.
6. Biogas scrubbing unit - 1 no.
7. Gasifier - Lab Scale -1 no.
8. Pyrolysis unit -1 no.
9. Biogas/ Producer gas dual fuel Engine -1 no.
10. Briquetting Machine - Lab Scale -1 no.
11. Automatic weather station -1 no.
12. Solar water heater-1 no.
13. Solar dryer-1 no.

14. Solar PV training kit- 1 no.
15. Solar PV water pumping system -1 no.

*The equipments includes the basic requirements like petri plates, silica crucible with lid,weighing balance, tongs, gloves, solarimeter, hand held anemometer, temperature and humidity sensor.

TOTAL: 60 PERIODS

SEMESTER VII

U19AETH706 AGRICULTURAL ECONOMICS, EXTENSION AND FARM MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart the fundamental knowledge and basic concepts of Economics and Farm Management
- To understand the types of resources and Investment analysis in agriculture sector
- To understand the Farm financial analysis, Investment and Budgeting for farms.
- To expose the students to different extension methods for communication to take the work from lab to field
- To plan the financial aspects, economics related to farm management in a COt effective manner.

UNIT I FARM MANAGEMENT & PLANNING **9**

Farm Management – definition – scope- Classification of farms – Basic concepts in farm management - Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts – Farm appraisal techniques – Valuation - Farm management- need and analysis –Elements of farm planning – Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit - examples of farm planning and budgeting

UNIT II LAWS OF ECONOMICS **9**

Agricultural Economics – definition and scope – Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns – Equi-marginal returns - Product relationship – Production function – definition and types – Production function curves – Optimum level of input use – Economies of scale external and internal economies and diseconomies - COt concepts – types - Opportunity COt – comparison of COts – Factor relationship – concepts.

UNIT III COT CURVES **9**

Principle of substitution – isoquant, isocline, expansion path, ridge line and least COt combination of inputs-Product-product relationship – Production possibility curve, isorevenue line and optimum combination of outputs – COt curves –Optimum input and output levels – Factor &relationship – Least COt combination of inputs – Estimation of COt of cultivation and COt of production of crops - annual and perennial crops

UNITIV MANAGEMENT OF RESOURCESAND FINANCIAL ANALYSIS **9**

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- COt of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques- Farm financial analysis – Balance sheet – Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles - Preparation of interview schedule and farm visit for data collection.

UNIT V AGRICULTURAL EXTENSION **9**

Communication – models – elements and their characteristics – types and barriers - Programme planning – monitoring and evaluation - Extension teaching methods - Audio-Visual aids – classification – purpose, planning and selection – individual, group and mass contact methods –Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone – Diffusion - Adoption –Capacity building of extension personnel and farmers –types of training, training to farmers, farm women and rural youth, FTC & KVK.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: To impart knowledge on econometric tools to the students of agricultural economics.

CO2: To acquire knowledge and analytical skills in addressing the various extension methods, communication gadgets. Be trained in capacity building techniques related issues of agricultural marketing.

CO3: To acquire the basic knowledge on various appraisal techniques in Budgeting and Investment analysis in agriculture sector of agricultural projects.

CO4: To understand firm and farm level decision rules for the efficient operation of enterprises and the institutional structure and use of agricultural marketing systems.

CO5: To have a solid understanding of how markets operate and the effects of extensive government policies on those markets.

Mapping of course outcomes to Program outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1		1			1				
CO2		2	1	2	1		1		3	1	2	1
CO3	1				3						2	1
CO4	3		2	3			1	2		2	1	2
CO5	1				2			1		2		1

Mapping of Course outcomes (CO) to Program Specific outcomes (PSOs)

	PSO1	PSO2
CO1	1	
CO2		3
CO3	1	2
CO4	2	1
CO5	2	

TEXTBOOKS:

1. Johl, S.S., and Kapur, T.R.,Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007.
2. Subba Reddy, S., Raghu Ram, P., NeelakantaSastry T.V and Bhavani 3. Devi, I., "Agricultural Economics"Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.
3. Ray, G.L., 1999. Extension Communication and Management, NayaProkash, 206, BidhanSarani, Calcutta.
4. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. pvt. Ltd, New Delhi

REFERENCES:

1. Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
2. Subba Reddy, S., and Raghu Ram, P. „ "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
3. Sankhayan, P.L. „"Introduction to Farm Management", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001
4. Muniraj, R., "Farm Finance for Development", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.
5. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork.

U19AEPR702 **PROJECT WORK PHASE – I** **L T P C**
0 0 4 2

Course Objectives

- To inculcate the habit of reading and writing leading to effective and efficient communication.
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.

Course Outcomes

At the end of the course, learners will be able to

CO1 identify technically and economically feasible problems of social relevance

CO2 plan and build the project team with assigned responsibilities

CO3 identify and survey the relevant literature for getting exposed to related solutions

CO4 analyse, design and develop adaptable and reusable solutions of minimal complexity by using modern tools

CO5 implement and test solutions to trace against the user requirements

CO6 deploy and support the solutions for better manageability and provide scope of improvability

Course Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1		2	2	2	2	2	2	1	1	1	1
2	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
3	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
4	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
5	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
6	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2

SEMESTER VIII

U19AEPR802	PROJECT WORK PHASE – II	L T P C 0 0 6 6

Course Objectives

- To inculcate the habit of reading and writing leading to effective and efficient communication.
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.

Course Outcomes

At the end of the course, learners will be able to

CO1 identify technically and economically feasible problems of social relevance

CO2 plan and build the project team with assigned responsibilities

CO3 identify and survey the relevant literature for getting exposed to related solutions

CO4 analyse, design and develop adaptable and reusable solutions of minimal complexity by using modern tools

CO5 implement and test solutions to trace against the user requirements

CO6 deploy and support the solutions for better manageability and provide scope of improvability

Course Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1		2	2	2	2	2	2	1	1	1	1
2	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
3	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
4	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
5	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2
6	3	3	3	3	2	2	2	2	2	2	2	1	2	2	2

PROFESSIONAL ELECTIVES

U19AEPE001 - HEAT AND MASS TRANSFER FOR AGRICULTURAL

L T P C
3 0 0 3

OBJECTIVE:

- The course is intended to build up necessary background for the understanding of the physical behavior of the various modes of heat transfer, like, conduction, convection and radiation.
- To understand the application of various experimental heat transfer correlations in engineering calculations.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

UNIT I CONDUCTION **9**

Mechanism of heat transfer – Conduction, convection and radiation – General differential equation of heat conduction – Fourier law of conduction – Cartesian and cylindrical coordinates – one dimensional steady state heat conduction – Conduction through plane walls, cylinders and spherical systems – Composite systems – Conduction with internal heat generation – Extended surfaces – Unsteady heat conduction – Lumped analysis – Use of Heislers chart.

UNIT II CONVECTION **9**

Convective heat transfer coefficients – Boundary Layer concept – Types of convection – Forced convection – Dimensional analysis – External flow – Flow over plates, Cylinders and spheres – Internal flow – Laminar and turbulent flow – Combined Laminar and turbulent flow – Flow over bank of tubes – Free convection - Dimensional analysis – Flow over vertical plates, horizontal plate, inclined plate, cylinders and spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS **9**

Nusselts theory of condensation – Pool boiling, flow boiling, correlations in boiling and condensation, types of heat exchangers – LMTD method of heat exchanger analysis – Overall heat transfer coefficient – Fouling Factors.

UNIT IV RADIATION **9**

Basic concepts, law of radiation – Stefan Boltsmann law, Kirchoff law – Block body radiation – Grey body radiation shape factor algebra – Electrical analogy – Radiation shields – introduction to gas radiation

UNIT V MASS TRANSFER **9**

Diffusion mass transfer – Fick‟ s Law of diffusion – Steady state molecular diffusion – Convective mass transfer – Momentum, heat and mass transfer analogy – Convective mass transfer correlations.

TOTAL :45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Mechanism of heat transfer, Conduction, convection and radiation and General differential equation of heat conduction

CO2: Convective heat transfer coefficients, Boundary Layer concept, Laminar and turbulent flow and Combined Laminar and turbulent flow

CO3: Nusselts theory of condensation, Pool boiling, flow boiling and types of heat exchangers

CO4: law of radiation, Stefan Boltsmann law and Kirchoff law

CO5: Fick‟ s Law of diffusion and Steady state molecular diffusion

CO/PO MAPPING												**CO/PSO Mapping**		
PROGRAMME OUTCOMES (POs)												**PSOs**		
PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1			2			2	2	2			2		1	
	2			1			1	2	3	1	2	2	2	
		2	2		2		2		3		2		2	
2		1		1		3		1		2	3	1	3	
	1				3	3	3	3	3		3		3	

TEXT BOOKS:

1. Sachdeva, R.C., “Fundamentals of Engineering Heat and Mass Transfer”, New Age International, New Delhi, 1995.

2. Yadav, R., “Heat and Mass Transfer”, Central Publishing House, New Delhi, 1995.

REFERENCES:

1. Ozisik, M.H., “Heat Transfer”, McGraw Hill Book Co., New York, 1994.

2. Nag, P.K., “Heat Transfer”, Tata McGraw Hill Book Co., New Delhi, 2002.

3. Holman, J.P., Heat and Mass transfer, Tata McGraw Hill Book Co., New York, 2002.

4. Kothandaraman, C.P., “Fundamentals of Engineering Heat and Mass Transfer”, New Age International, New Delhi, 1998.

5. Incropera, F. P., and Dewitt, D. P., “Fundamentals of Engineering Heat and Mass Transfer”, John Wiley and Sons, New York, 1998.

U19AEPE002 - DAIRY AND FOOD ENGINEERING - PRINCIPLES & PRODUCTS

L T P C
3 0 0 3

OBJECTIVES :

- To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products , sanitation and effluent treatment in dairy industry
- To expose the students to the fundamental knowledge of food, its properties and different methods of food processing

UNIT I PROPERTIES AND PROCESSING OF MILK **9**

Dairy Industry – importance and status – Milk Types – Composition and properties of milk - Production of high quality milk - Method of raw milk procurement and preservation - Processing – Staining - Filtering and Clarification - cream separation – Pasteurization – Homogenization - sterilization, UHT processing and aseptic packaging – emulsification - Fortification.

UNIT II DAIRY PRODUCTS **9**

Manufacture of Milk Powder - Processing of Milk Products - Condensed Milk - Skim milk - Butter milk - Flavoured Milk, whey, casein, yoghurt and paneer - Manufacture of Butter - Cheese Ghee, ice creams and frozen desserts - standards for milk and milk products - Packaging of Milk and Milk Products - Cleaning and Sanitation - Dairy effluent treatment and disposal .

UNIT III FOOD AND ITS PROPERTIES, REACTION AND KINETICS **9**

Constituents of food - thermal processing of foods - cooking, blanching, sterilization, pasteurization, canning - Interaction of heat energy on food components, reaction kinetics, Arrhenius equation, TDT curves - water activity, sorption behaviour of foods – isotherm models - monolayer value, BET isotherms, Raoult‟ s law, Norrish, Ross, Salwin - Slawson equations.

UNIT IV PROCESSING AND PRESERVATION OF FOODS **9**

Coffee, Tea processing - Concentration of foods, freeze concentration - osmotic and reverse osmotic concentration - drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers - rehydration of dehydrated foods - Fat and oil processing, sources, extraction, methods and equipment, refining of oils, hydrogenation, manufacture of margarine - Food preservation methods - preservation by irradiation, microwave and dielectric heating of food.

UNIT V PACKAGING AND QUALITY CONTROL **9**

Food packaging, importance, flexible pouches - retort pouches - aseptic packaging, granules, powder and liquid packaging machines - nanotechnology – principles - applications in food processing – food plant location - Quality control of processed food products - Factors affecting quality.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: importance and status for Milk Types, Filtering and Clarification for cream separation & Pasteurization and Homogenization

CO2: Processing of Milk Products, standards for milk and milk products, Cleaning and Sanitation

CO3: thermal processing of foods, reaction kinetics, Raoult‟ s law, Norrish, Ross, Salwin - Slawson equations.

CO4: drying and dehydration of food, rehydration of dehydrated foods & Food preservation methods

CO5: powder and liquid packaging machines, applications in food processing & applications in food processing

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1		3		1	2		3	2	2	1	3	
CO2		2	2		1	2	2		1		1	3	2	2	
CO3	3		1	2			1		2	1		2	2	3	
CO4	1	1		1	3		1	2	1			3	1	1	
CO5	3		2	2		1		3		3	1	2	1	3	

.

TEXTBOOKS:

1.Chandra Gopala Rao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad, 2006.

2.Walstra. P., Jan T. M. Wouters., Tom J. Geurts “Dairy Science and Technology”, CRC press, 2005.

3.Ananthakrishnan, C.P., and Sinha, N.N., “Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi, 1999. 63

REFERENCES:

1. Subbulakshmi.G., and Shobha A. Udipi, Food Processing and Preservation, New Age International Publications, New Delhi, 2007.
2. Toledo, R.T., “Fundamentals of Food Process Engineering”, CBS Publishers and Distribution, New Delhi, 1997.
3.

U19AEPE003 - REFRIGEATION AND COLD CHAIN MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

- To understand the underlying principles of operation in different refrigeration & Air conditioning systems and components.
- To provide knowledge on basic design aspects of Refrigeration & Air conditioning systems.

UNIT I REFRIGERATION CYCLE **9**

Review of thermodynamic principles of refrigeration. Concept of Air refrigeration system. Vapour compression refrigeration cycle – use of P.H charts – multistage and multiple evaporator systems – cascade system – COP comparison.

UNIT II REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING **9**

Compressors – reciprocating & rotary (elementary treatment) – condensers – evaporators cooling towers. Refrigerants – Properties – selection of refrigerants, Alternative refrigerants, cycle controls.

UNIT III PSYCHROMETRY **9**

Psychrometric processes use of psychrometric charts – grand and room sensible heat factors – bypass factors – air washers, requirements of comfort air conditioning, summer and winter air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS **9**

Cooling load calculation working principles of – centralized Air conditioning systems, split, ductable split, packaged air conditioning, VAV & VRV systems. Duct design by equal friction method, indoor air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES **9**

Vapor absorption systems – Ejector jet, steam jet refrigeration, thermo electric refrigeration. Applications: ice – plant – food storage plants – milk chilling plants.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Review of thermodynamic principles of refrigeration and use of P.H charts ,multistage and multiple evaporator systems

CO2: Compressors, reciprocating & rotary and Properties and selection of refrigerants

CO3: use of psychrometric charts and summer and winter air conditioning.

CO4: working principles of centralized Air conditioning systems, VAV & VRV systems

CO5: Ejector jet, steam jet refrigeration, thermo electric refrigeration and its applications

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2	1			3		1	1	1	2		2	
CO2	1			2			2	3		1				2	
CO3	2		2		3		3		2	1		2		2	
CO4	1			1				3	3		1	3		3	
CO5	1		2	1	3		3	3	1	1	1	3		3	

TEXTBOOKS:

1. Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd., New Delhi, 1983.

2. Arora, C.P., “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1988.

REFERENCES:

1. Dossat, R.J., “Principles of Refrigeration and Air Conditioning”, Pearson Education Pvt. Ltd., New Delhi, 1997.

2. Jordon and Priester, “Refrigeration and Air Conditioning”, Prentice Hall of India Pvt. Ltd., New Delhi, 1985.

3. Stoecker, N.F., and Jones, “Refrigeration and Air Conditioning”, Tata McGraw Hill, New Delhi, 1981.

U19AEPE004 DRYING AND SEPARATION METHODS

L T P C
3 0 0 3

Course Objectives

To study the different methods of processing and preservation of fruits and vegetables including drying and separation.

UNIT I PSYCHROMETRY AND DRYING **9**

Psychrometry – importance – Psychrometric charts and its uses – 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 II DRYING AND DEHYDRATION **9**

Dehydration of fruits and vegetables – types of dryers, construction and working - methods – fluidized bed dryer, freeze drying, osmotic dehydration and foam mat drying – principles, construction, operation and applications - quality parameters and advantages.

UNIT III CLEANING AND GRADING **9**

Principles - air screen cleaners – adjustments - cylinder separator - spiral separator – magnetic separator - colour sorter - inclined belt separator – length separators - effectiveness of separation and performance index.

UNIT IV PROCESSING AND PRESERVATION OF FOODS **10**

Coffee, Tea processing - Concentration of foods, freeze concentration - osmotic and reverse osmotic concentration - drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers - rehydration of dehydrated foods - Fat and oil processing, sources, extraction, methods and equipment, refining of oils, hydrogenation, manufacture of margarine - Food preservation methods - preservation by irradiation, microwave and dielectric heating of food.

UNIT V SEED PROCESSING AND TESTING **9**

Components of seed processing in a broader sense; Steps in seed processing in its narrower sense: preliminary cleaning, basic cleaning and grading, and equipment used in each of the steps; Seed treatment; Seed drying; Seed sampling; Seed testing: details of specific tests conducted for different purposes (service, certification and seed law enforcement); Standards prescribed for different crops.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Drying principles and theory of drying, thin layer and deep bed drying

CO2: Dehydration of fruits and vegetables – types of dryers, construction and working

CO3: Principles of air screen cleaners and itsadjustments, cylinder separator, spiral separator

CO4: Coffee, Tea processing, Concentration of foods, freeze concentration

CO5: Components of seed processing in a broader sense, Steps in seed processing in its narrower sense

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	3	1		2		1	2	1	1		1	1	2	
CO2	2	3		3	2	1		3		3	1	1	1		
CO3	3	1	2	1	3	1		2	3	1	3			1	
CO4	1		2		1		3	1		2	3	2	1		
CO5	2	1	1	3	2	1	1		3	1	2			2	

TEXTBOOKS:

1. Hall,C.W and T.J.Hedrick. 1971. Drying of milk and milk products. AVI Publishing Co., West Port, Connecticut.

2. Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.

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1. Chandra Gopala Rao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad, 2006.

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U19AEPE005 FOOD PROCESSING AND PRESERVATION

L	T	P	C
3	0	0	3

Course Objectives

To introduce the students to the area of Food Processing and preservation.
To have an effective understanding of food processing and technology subjects.
To enable students to appreciate the importance of food processing with respect to the large-scale production.
To import knowledge on processing of food waste

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE 12

Source of food - significance for processing and preservation of foods – Different food groups-, food pyramids, classification and functions, cooking of foods – methods and cooking media, advantages of processing of foods, changes of nutritional components in cooking, effects of processing of foods on antinutritional components.

UNIT II FOOD COMPONENTS 12

Classification, Structure, nutritive value, processing outlines of major Cereals and millets-Pulses-fruits and vegetables, fats, oilseeds and nuts. Major and minor nutrients, sugar and related products, spices and aromatics, beverages and appetizers, organic foods

UNIT III PROCESSING OF ANIMAL FOODS 12

Meat, Poultry and Fish-Structure, composition, nutritive value and processing outline. Processing of milk and milk products, egg processing and storage, need and nutritional benefits of animal products, value added products

UNIT IV INTRODUCTION TO FOOD PROCESSING AND PRESERVATION 12

Food spoilage, fermentation, methods of preservation - High temperature and Low temperature Preservation, traditional methods of food processing and preservation, radiation processing, microwave, non-thermal techniques. Role of enzymes and additives in food preservation

UNIT V FOOD PACKAGING AND QUALITY 12

Food packaging – importance, types and functions, packaging materials – synthetic and natural, Impact of packaging materials on food quality, shelf-life of foods, bottling and canning, nutritional labelling, labelling of vegan and animal based products

TOTAL: 45 PERIODS

Course Outcomes

At the end of the course, learners will be able to:
C01: Describe the fundamentals of food processing and preservation
C02: Familiar with the functional properties of Carbohydrates, fats, lipids, proteins in food
C03: Knowledge about the importance of food additives and their function and will develop strategies that will promote food safety and prevent food borne illness
C04: Analyze the uses of enzymes, modified proteins and develop novel products, explain, analyze and evaluate scenarios related to various unit operations in food processing and preservation
C05: Identify spoilage and deterioration mechanism in food and methods to control deterioration and spoilage
C06: Demonstrate packing methods, materials and factors affecting food packing

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	
CO 1	3	1		1		2	1		1	3	2	1	2		
CO 2	1	2	1		1		2	3		1	1		2	1	
CO 3	3		3	2	1	2	1		3		2	2	1		
CO 4	2	3	1		1	3		1	2	1	1			3	
CO 5	3	2		1	3	1	3		1		3	1	1		

3 - High, 2 - Medium, 1 – Low

TEXT BOOKS

1. Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.
2. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.

REFERENCES

1. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005

WEBSITES:

1. https://www.heartfoundation.org.nz/educators/edu-resources/food-tech
2. https://www.stemcrew.org/guides/subjects/food-technology-teaching-resources

U19AEPE006 - PROCESS ENGINEERING OF FRUITS AND VEGETABLES

L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of Post Harvest Technology of fruits and vegetables through their structure and composition
- To study the different methods of processing and preservation of fruits and vegetables including drying and dehydration
- To learn the latest methods of storage of fruits and vegetables

UNIT I STRUCTURE, COMPOSITION, RIPENING AND SPOILAGE 9

Importance of post harvest technology of horticultural crops – post harvest losses – factors causing losses - structure, cellular components, composition and nutritive value of horticultural crops – fruit ripening – mechanism and equipment - spoilage of perishable commodities – mechanism and factors causing spoilage.

UNIT II CLEANING, GRADING AND ON-FARM PROCESSING 9

Harvesting and washing of fruits and vegetables – cleaning and grading – fruits and vegetables - peeling - equipment – construction and working – pre-cooling – importance, methods, pre-treatments and advantages.

UNIT III PRESERVATION OF FRUITS AND VEGETABLES 9

Thermal and non-thermal techniques of preservation of fruits and vegetables and their products - methods - minimal processing of horticultural commodities – fruits and vegetables, advantages - quick freezing preservation - commercial canning of fruits, vegetables and other perishable commodities – processing and concentration of juice - membrane separation process and application - hurdle technology of preservation and techniques.

UNIT IV DRYING AND DEHYDRATION 9

Dehydration of fruits and vegetables – types of dryers, construction and working - methods – fluidized bed dryer, freeze drying, osmotic dehydration and foam mat drying – principles, construction, operation and applications - quality parameters and advantages.

UNIT V STORAGE 9

Storage of fruits and vegetables – storage under ambient conditions, low temperature storage, evaporative cooling – cold storage of horticultural commodities – estimation of cooling load - controlled atmosphere storage – concept and methods –modified atmosphere packaging – gas composition, quality of storage – waxing of fruits – types of wax, equipment and advantages.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: technology of horticultural crops, losses in post harvest and mechanism and equipment

CO2: Harvesting and washing of fruits and vegetables, construction and working of pre-cooling and pre-treatments and advantages

CO3: techniques of preservation of fruits and vegetables and their products, processing and concentration of juice

CO4: types of dryers, construction and working, operation and applications for quality parameters and advantages

CO5: cold storage of horticultural commodities, gas composition, quality of storage – waxing of fruits, equipment and advantages.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2	1			3		1	1	1	2		2	
CO2	1			2			2	3		1				2	
CO3	2		2		3		3		2	1		2		2	
CO4	1			1				3	3		1	3		3	
CO5	1		2	1	3		3	3	1	1	1	3		3	

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TEXT BOOKS:

1. Fellows. P. 2000. Food Processing Technology – Principles and Practice, second edition, CRC Press, Woodland Publishing Limited, Cambridge, England.

2. Sudheer K. P. and V. Indra.2007. Post harvest Technology of Horticultural Crops. New India Publishing Company, New Delhi. 3. L.R.Verma and V.K.Joshi. 2000. Post Harvest Technology of Fruits and Vegetables – handling, Processing, Fermentation and waste management. Indus Publishing company, New Delhi.

REFERENCES:

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2. Potter, N.N.1976. Food science. AVI Publishing Co. Inc.Westport, Connecticut, 2nd edition.

3. Sivetz Michael and N.W.Desrosier. 1979. Coffee Technology. AVI Publishing Co. Inc, Westport, Connecticut.

4. Frank.H.Slade. 1967. Food Processing Plant. Volume 1. Leonard Hill Books. London.

U19AEPE007 - STORAGE AND PACKAGING TECHNOLOGY

L T P C
3 0 0 3

OBJECTIVES:

- To understand the underlying principles of spoilage and storage
- To provide knowledge on different storage methods and packaging techniques.

UNIT I SPOILAGE AND STORAGE **9**

Direct damages, Indirect damages of perishable and durable commodities – control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses.

UNIT II STORAGE METHODS **9**

Improved storage methods for grain-modern storage structures-infestation-temperature and moisture changes in storage structures-CAP storage-CA storage of grains and perishables construction operation and maintenance of CA storage facilities

UNIT III FUNCTIONS OF PACKAGING MATERIALS **9**

Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.

UNIT IV FOOD PACKAGING MATERIALS AND TESTING **9**

Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength.

UNIT V SPECIAL PACKAGING TECHNIQUES **9**

Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Direct damages, Indirect damages of perishable and durable commodities, and factors affecting storage

CO2: temperature and moisture changes in storage structures, operation and maintenance of CA storage facilities

CO3: functions of package, packaging materials and functions of package and packaging materials

CO4: paper and paper boards, package material testing for tensile, bursting and tear strength

CO5: antimicrobial packaging & shrink and stretch packaging.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2	1		1	2		1	2	2	2	
CO2	3	3		1			1	1		2		2	2	2	
CO3		3	1	2	2	1		2			1	2	2	2	
CO4	3	3		1	1		1		2	2		2	2	2	
CO5	3	3	2		2		1		2		1	2	2	2	

TEXTBOOKS:

1. Sahay, K.M. and K.K.Singh. 1996. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd., New Delhi.

REFERENCES:

1. Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.

2. Chakaraverty, A. 2000. 3rd edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.

U19AEPE008 Food Quality and Safety

L T P C
3 0 0 3

OBJECTIVES:

- To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.
- Importance of science, food security and ecological balance

UNIT I LAND RESOURCE AND ITS SUSTAINABILITY **9**

Land Resources of India, Population and land, Land utilization, Net Area Sown, changes in cropping pattern, land degradation.

UNIT II WATER RESOURCE AND ITS SUSTAINABILITY **9**

Rainfall forecasting - Adequacy of Rainfall for crop growth – Rainfall, Drought and production instability – Irrigation potential – Available, created and utilized – River basins; Watersheds and Utilizable surface water – Utilizable water in future (Ground water & Surface water)

UNIT III SUSTAINABLE AGRICULTURE & ORGANIC FARMING **9**

Agro-ecosystems - Impact of climate change on Agriculture, Effect on crop yield, effect on Soil fertility – Food grain production at State Level – Indicators of Sustainable food availability – Indicators of food production sustenance – Natural farming principles – Sustainability in rainfed farming – organic farming – principles and practices.

UNIT IV FOOD PRODUCTION AND FOOD SECURITY **9**

Performance of Major Food Crops over the past decades – trends in food production – Decline in total factor productivity growth – Demand and supply projections – Impact of market force – Rural Land Market – Emerging Water market – Vertical farming - Sustainable food security indicators and index – Indicator of sustainability of food Security – Path to sustainable development.

UNIT V POLICES AND PROGRAMMES FOR SUSTAINABLE AGRICULTURE AND FOOD SECURITY **9**

Food and Crop Production polices – Agricultural credit Policy – Crop insurance –Policies of Natural Resources Use – Policies for sustainable Livelihoods – Virtual water and trade - Sustainable food Security Action Plan.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Upon completion of this course, the students will gain knowledge on the need for sustainable agriculture

CO2:They will be able to comprehend the need for food security on global level and the Nutritional Security.

CO3:The students will be able to demonstrate how ecological balance is required for sustainability of agriculture

CO4:Food production and food security

CO5:Polices and programmes for sustainable agriculture and food security

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2	1		1	2		1	2	2	2	
CO2	3	3		1			1	1		2		2	2	2	
CO3		3	1	2	2	1		2			1	2	2	2	
CO4	3	3		1	1		1		2	2		2	2	2	
CO5	3	3	2		2		1		2		1	2	2	2	

TEXTBOOKS:

1. B.K.Desai and Pujari, B.T. Sustainable Agriculture : A vision for future, New India Publishing Agency, New Delhi, 2007.
2. Saroja Raman, Agricultural Sustainability – Principles, Processes and Prospects, CRC Press, 2013

REFERENCES:

1. Swarna S.Vepa etal., Atlas of the sustainability of food security. MSSRF, Chennai, 2004.
2. Sithamparanathan, J., Rengasamy, A., Arunachalam, N. Ecosystem principles and sustainable agriculture, Scitech Publications, Chennai, 1999.
3. Gangadhar Banerjee and Srijeet Banerji, Economics of sustainable agriculture and alternate production systems, Ane Books Pvt Ltd., 2017
4. M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.

U19AEPE009 PRECISION FARMING

L T P C
3 0 0 3

Objectives:

- To expose the students to applications in precision farming techniques, precision farming of horticultural crops environmental control systems..
- To expose the students to applications in precision farming, environmental control systems, agricultural systems management and weather prediction models.

UNIT I PRECISION FARMING **9**

Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

UNIT II PRECISION FARMING TECHNIQUES **9**

Concept and introduction of precision farming – Importance, definition, principles and concepts – Role of GIS and GPS - Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation – georeferencing and photometric correction – Sensors for information gathering – UAV - geostatistics – robotics in horticulture - postharvest process management (PPM) – remote sensing

UNIT III PRECISION FARMING OF HORTICULTURAL CROPS **9**

Precision farming techniques for horticultural crops - Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

UNIT IV ENVIRONMENT CONTROL SYSTEMS **9**

Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

UNIT V AGRICULTURAL SYSTEMS MANAGEMENT **9**

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: **P**recision agriculture and agricultural management

CO2: Concept and introduction of precision farming

CO3: Precision farming techniques for horticultural crops

CO4: Environment Control Systems

CO5: Agricultural systems - managerial overview, Reliability of agricultural systems

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1		1		2	1		1	3	2	1	2		
CO2	1	2	1		1		2	3		1	1		2	1	
CO3	3		3	2	1	2	1		3		2	2	1		
CO4	2	3	1		1	3		1	2	1	1			3	
CO5	3	2		1	3	1	3		1		3	1	1		

TEXTBOOKS:

1. National Research Council, “Precision Agriculture in the 21st Century”, National Academies Press, Canada, 1997.
2. H. Krug, Liebig, H.P. “International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation”, 1989

REFERENCES:

1. Peart, R.M., and Shoup, W. D., “Agricultural Systems Management”, Marcel Dekker, New York, 2004.
2. Hammer, G.L., Nicholls, N., and Mitchell, C., “Applications of Seasonal Climate”, Springer, Germany, 2000.

U19AEPE010 - PROTECTED CULTIVATION

L T P C
3 0 0 3

OBJECTIVES:

- To impact knowledge on the protected cultivation of vegetables, fruits and flower crops.
- To sensitize the students on hi-tech production technology of fruits, vegetables and flower crops.

UNIT I PROTECTED CULTIVATION AND ITS TYPES 9

Importance and methods of protected culture in horticultural crops - Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, poly house, net house, poly tunnels, screen house, protected nursery house - study of environmental factors influencing green house production – cladding / glazing / covering material – ventilation systems – cultivation systems including nutrient film technique / hydroponics / aeroponic culture – growing media and nutrients – canopy management – micro irrigation and fertigation systems.

UNIT II PROTECTED CULTIVATION OF VEGETABLE CROPS 9

Protected cultivation technology for vegetable crops - Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – post harvest handling.

UNIT III PROTECTED CULTIVATION OF FLOWER CROPS 9

Protected cultivation technology for flower crops - Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliages and fillers – integrated pest and disease management – postharvest handling.

UNIT IV PRECISION FARMING TECHNIQUES 9

Concept and introduction of precision farming – Importance, definition, principles and concepts – Role of GIS and GPS - Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation – georeferencing and photometric correction – Sensors for information gathering – UAV - geostatistics – robotics in horticulture - postharvest process management (PPM) – remote sensing

UNIT V PRECISION FARMING OF HORTICULTURAL CROPS 9

Precision farming techniques for horticultural crops - Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Importance and scope of protected cultivation, study of environmental factors influencing green house production& micro irrigation and fertigation systems

CO2: Hi-tech protected cultivation techniques & integrated pest and disease management

CO3: Hi-tech protected cultivation of cut roses & postharvest handling

CO4: Role of GIS and GPS, Sensors for information gathering & remote sensing

CO5: Precision farming techniques for horticultural crops

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3			2		2		1		2	2	1	1		
CO2	3	2	1		1	1	3		1	1			2	2	
CO3		3		1	3		1	3	3		1	1	2		
CO4	1		1	2		1	2			1	3			2	
CO5	3	2	2		1		2	1	2		2	2	1		

TEXTBOOKS:

1. Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.

2. Paul V. Nelson. 1991. Green house operation and management. Ball publishing USA.

REFERENCES:

1. Lyn. Malone, Anita M. Palmer, Christine L. VIoghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.

2. David Reed. 1996. Water, media and nutrition for green house crops. Ball publishing USA. 3. Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.

U19AEPE011 GROUND WATER WELLS AND PUMPS

L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of groundwater, its availability, assessment and utilization
- To understand the theory behind well design, construction and management of wells

UNIT I HYDROGEOLOGIC PARAMETERS **9**

Water Balance – Distribution of subsurface water – Water bearing properties of Rocks – Types of Aquifers – Aquifer properties Estimation – Pumping test :– Permeability, Specific yield, transmissivity and Storage coefficient – Methods of Estimation – Ground water table fluctuation method – GEC Norms – Ground water development and potential in India - Groundwater prospectives - Geophysical techniques – Electrical resistivity survey

UNIT II WELL HYDRAULICS **9**

Darcy's law – Groundwater Flow Equation – Steady state flow – Dupuit Forcheimer Assumption – Theim's Equation - unsteady flow – Theis method and Jacob method – Image well theory – Partial penetration of wells.

UNIT III WELL DESIGN **9**

Design characteristics – Design of wells - Well diameter, depth and Well screen design – Materials for well screens – Well casing – Design of collector wells and Infiltration gallery – Dug wells versus tube wells

UNIT IV WELL CONSTRUCTION AND MAINTENANCE **9**

Types of wells – Well drilling - Boring, Jetting – Rotary drilling, Hammer drilling - Construction – Installation of pipes and screens - Well development, Completion and disinfection – Well maintenance – Well performance test – Well effectiveness – Well loss – Pumping equipment – Rehabilitation of wells and borewells.

UNIT V SPECIAL TOPICS **9**

Artificial Recharge Techniques – Sea water Intrusion – Introduction to Ground water modeling Techniques – Ground water pollution and legislation - Groundwater quality –Dose response assessment – Risk analysis

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Technical aspects of groundwater, its availability, assessment and utilization
CO2: Darcy's law – Groundwater Flow Equation – Steady state flow
CO3: Design characteristics – Design of wells - Well diameter
CO4: Theory behind well design, construction and management of wells
CO5: Artificial Recharge Techniques – Sea water Intrusion

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CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1		3		1	2		3	2	2	1	3	
CO2		2	2		1	2	2		1		1	3	2	2	
CO3	3		1	2			1		2	1		2	2	3	
CO4	1	1		1	3		1	2	1			3	1	1	
CO5	3		2	2		1		3		3	1	2	1	3	

TEXTBOOKS:

1. Karanth, K.R. Groundwater Assessment, Development and Management. Tata Mc-Graw Hill, 2008.

2. Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2000.

REFERENCES:

1. Rastogi,A.K. Numerical Groundwater Hydrology, Penram International Publishing. Pvt. Ltd., Bombay, 2008.

2. David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007

3. Fletcher.G.Driscoll, “Groundwater and Wells”, Johnson Revision, New York, 1987.

U19AEPE012 - MINOR IRRIGATION COMMAND AREA DEVELOPMENT

L T P C
3 0 0 3

OBJECTIVES:

- To understand the fundamentals of minor irrigation, its types, operation and maintenance and people's participation
- Command Area Development, On farm structures, policy, operation and maintenance

UNIT I DESIGN OF IRRIGATION CHANNELS **9**

Design of Erodible and Non-Erodible, Alluvial channels- Kennedy‟ s and Lacey‟ s Theories - Materials for Lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land Leveling methods

UNIT II COMMAND AREA **9**

Command area - Concept – CADA Programmes in Tamil Nadu - Duty of water - expression - relationship between duty and delta - Warabandhi - water distribution and Rotational Irrigation System – case studies.

UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER **9**

Availability of water - Rainfall, canal supply and groundwater – Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water – Dependable rainfall – Rainfall analysis by Markov chain method – Probability matrix

UNIT IV WATER BALANCE **9**

Groundwater balance model – Weekly water balance - Performance indicators – Adequacy, Dependability, Equity and efficiency – conjunctive use plan by optimization – Agricultural productivity indicators – Water use efficiency

UNIT V SPECIAL TOPICS **9**

National water policy - Institutional aspects - Socio-economic perspective- Reclamation of salt affected soils- Seepage loss in command area- Irrigation conflicts- Water productivity – Water pricing.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Kennedy‟ s and Lacey‟ s Theories & Water control and Diversion structure, Land grading - Land Leveling methods

CO2: CADA Programmes in Tamil Nadu & water distribution and Rotational Irrigation System

CO3: water requirement and utilization, Rainfall analysis by Markov chain method & Probability matrix

CO4: Adequacy, Dependability, Equity and efficiency, Water use efficiency

CO5: Reclamation of salt affected soils,Water productivity & Water pricing.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	1	2		1		3		2	1	3			1		
CO2		1	2		3	2	1	3	2		1			2	
CO3	3		1	1		3	1	2		1	3		1	2	
CO4	1	2		2	1	3		3		1			1		
CO5		3	2	1	3	2		1		3	1			1	

TEXTBOOK:

1. Michael, A.M. Irrigation Theory and practice, Vikas publishing house, New Delhi, 2006.

REFERENCES:

1. Keller, .J. and Bliesner D.Ron, 2001 Sprinkler and Trickle irrigation, An ari book, Published by Van No strand Rein hold New York
2. Israelson, 2002, Irrigation principles and practices, John Wiley & sons, New York.
3. Modi, P.N., 2002. Irrigation and water resources and water power engineering, Standard Book House, New Delhi
4. Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.
5. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi

U19AEPE013 - SPECIAL FARM EQUIPMENT

L T P C
3 0 0 3

OBJECTIVE:

- To study the special machineries used for agricultural applications

UNIT I MOWERS AND WEEDING EQUIPMENT **9**

Weeding and intercultural equipment, Junior hoe - guntaka - blade harrow - rotary weeders for upland and low land - selection, constructional features and adjustments - Spading machine – coir pith applicators - Mower mechanism - lawn mowers.

UNIT II SPRAYERS AND DUSTERS **9**

Sprayers - Sprayer operation - boom sprayer - precaution - coverage - factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) - Electrostatic sprayers - Areal spraying - Air assist sprayers - orchard sprayers - Dusters - types - mist blower cum duster - other plant protection devices, care and maintenance.

UNIT III THRESHERS AND HARVESTERS **9**

Construction and adjustments - registration and alignment. Windrowers, reapers, reaper binders and forage harvesters - Diggers for potato, groundnut and other tubers. Sugarcane harvesters - cotton pickers - corn harvesters - fruit crop harvesters – vegetable harvesters.

UNIT IV THRESHERS AND OTHER MACHINERIES **9**

Thresher – construction and working of multi crop thresher. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter- flail mowers - lawn mowers – tree pruners

UNIT V SPECIALIZED FARM EQUIPMENT **9**

Pneumatic planters – air seeders – improved ploughs – reversible ploughs – suction traps – seed and fertilizer broadcasting devices, manure spreaders, sweep weeders – direct paddy seeders, direct paddy cum daincha seeder, coconut tree climbing devices, tractor operated hoist, tractor operated rhizome planter - Transplanters and Balers.

TOTAL:45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: selection and constructional features and adjustments &- Mower mechanism

CO2: Controlled Droplet Application (CDA), other plant protection devices, care and maintenance.

CO3: Windrowers, reapers, reaper binders and forage harvesters

CO4: construction and working of multi crop thresher.

CO5: seed and fertilizer broadcasting devices, manure spreaders, sweep weeders, Transplanters and Balers

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1		1		2	1		1	3	2	1	2		
CO2	1	2	1		1		2	3		1	1		2	1	
CO3	3		3	2	1	2	1		3		2	2	1		
CO4	2	3	1		1	3		1	2	1	1			3	
CO5	3	2		1	3	1	3		1		3	1	1		

TEXTBOOKS:

1. Jagdishwar Sahay. 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi
2. Michael and Ojha. 2005. Principles of Agricultural Engineering. Jain brothers, New Delhi.

REFERENCES:

1. Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributers, Delhi.

2. Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.

3. Srivastava, A.C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi

U19AEPE014 - MECHANICS OF TILLAGE AND TRACTION

L T P C
3 0 0 3

OBJECTIVES:

- To impart the fundamental knowledge of mechanics and dynamics in various tillage implements
- To study the tyres, traction and its applications

UNIT I MECHANICS OF TILLAGE **9**

Introduction to mechanics of tillage tools - engineering properties of soil - principles and concepts -stress strain relationship

UNIT II DYNAMICSOF TILLAGE **9**

Design of tillage tools principles of soil cutting - design equation - force analysis - application of dimensional analysis in soil dynamics performance of tillage tools.

UNIT III TRACTION **9**

Introduction to traction and mechanics - off road traction and mobility - traction model - traction improvement - traction prediction

UNIT IV TYRES **9**

Tyre size - tyre lug geometry and their effects - tyre testing

UNIT V APPLICATIONS **9**

Soil compaction and plant growth - variability and geo statistics - application of GIS in soil dynamics.

TOTAL:45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: engineering properties of soil & stress strain relationship

CO2: application of dimensional analysis in soil dynamics performance of tillage tools.

CO3: off road traction and mobility, traction improvement and traction prediction

CO4: tyre lug geometry and their effects

CO5: variability and geo statistics, application of GIS in soil dynamics

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	3	3	1		1		3		1	2	1	2	
CO2	2	3		2	2	1	3	1		2				1	
CO3	3	1	2	3		1		1	2		2		2		
CO4		2	1		1		3		3	2	2			1	
CO5	3	2	1	3	1	2		3	3	1	2		2		

TEXTBOOKS:

1. Klenin, N.L.; Popov, I.F. and V.A. Sakum, (1985). Agricultural machines. Amerind Pub. Co. NewYork 2. J. B. Liljedahl, P. K. Turnquist, D. W. Smith, & M. Hoki , 1996. Tractors and their power units. Fourth ed. American Society of Agricultural Engineers, ASAE

3. Kepner, R. A., Roy Bainer and E. L. Barger. 1978. Principles of farm machinery. Third edition; AVI Publishing Company Inc: Westport, Connecticut.

REFERENCES:

1. Ralph Alcock.1986. Tractor Implements System. AVI Publ.

2. S. C. Jain, Farm Machinery- An Approach

U19AEPE015 - FARM POWER AND MACHINERY MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

- To understand the productivity of farm machines, their maintenance processes and evaluation for right selection and management
- To provide sufficient knowledge of mechanization status in the country and management techniques for future requirements.

UNIT I INTRODUCTION TO FARM POWER AND DESIGN CRITERIA 9

Modern trends, principles – procedures - fundamentals and economic considerations for design and development of farm power and machinery systems - Reliability criteria in design and its application.

UNIT II MACHINERY MANAGEMENT 9

Maintenance and scheduling of operations - Replacement of old machines - repair and maintenance of agricultural machinery - inventory control of spare parts - work study, productivity - method study - First order Markov chains and their applications in sales forecasting and in problems of inventory control and modeling of workshop processes and quality control.

UNIT III SYSTEM APPROACH 9

System approach in farm machinery management - application of programming techniques to the problems of farm power - machinery selection.

UNIT IV PLANNING OF MACHINERY 9

Time and motion study - Man-machine task system in farm operations - planning of work system in agriculture - Computer application in selection of power units and to optimize mechanization system.

UNIT V ECONOMIC ANALYSIS 9

Energy conservation - performance and power analysis - cost analysis of machinery - fixed cost and variable costs, effect of inflation on cost selection of optimum machinery and replacement criteria – Break - even analysis - reliability and cash flow problems - mechanization planning

TOTAL:45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: procedures fundamentals and economic considerations for design and development of farm power and machinery systems

CO2: repair and maintenance of agricultural machinery, First order Markov chains, applications in sales forecasting

CO3: application of programming techniques to the problems of farm power & machinery selection

CO4: Man-machine task system in farm operations

CO5: reliability and cash flow problems & mechanization planning

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	3	1		2		1	2	1	1		1	1	2	
CO2	2	3		3	2	1		3		3	1	1	1		
CO3	3	1	2	1	3	1		2	3	1	3			1	
CO4	1		2		1		3	1		2	3	2	1		
CO5	2	1	1	3	2	1	1		3	1	2			2	

TEXTBOOKS:

1. Bainer, R. Kepner, R.A. and Barger, E.L. 1978. Principles of farm machinery. John Wiley and Sons. New York.

2. Liljedahl, B: Tumquist, PK: Smith, DW; and Hoki, M. 1989. Tractor and its Power Units. Van Nostrand Reinhold

3. Culpin, C. 1978. Farm Machinery. Granada Publishing Ltd., London.

4. Kepner, R.A., Bainer, R. and Barger, E.L. 1987. Principles of Farm Machinery. C.S.B. Publishers and distributors, New Delhi.

5. Smith, H.P. and Wilkes, L.H. 1979. Farm Machinery and Equipment. Tata McGraw-Hill Publishing Co. Ltd., New Delhi

U19AEPE016 – ERGONOMICS IN FARM MACHINERY

L T P C
3 0 0 3

OBJECTIVE:

- To study the physical work load, equipment/work place design, safety and occupational health hazards in farm operations.

UNIT I ERGONOMICS 9

Ergonomics- introduction- Role of ergonomics in Agriculture - Human metabolism- energy liberation in human body- Types of human metaboism- energy requirements at work - acceptable work load.

UNIT II PHYSIOLOGICAL FUNCTIONS 9

Human Skeletal system – muscle, structure and function - Physiological stress - Efficiency of work - Physical functions - Age and individual differences in physical functions- Physiological and operational criteria of physical activity.

UNIT III ENERGY EXPENDITURE 9

Energy expenditure of activities-keeping energy expenditure within bounds- Energy expenditure of Spraying-Weeding operations - Movements of body members- Strength and endurance of movements - Movement of body members related to Agricultural activities - Speed and accuracy of movements - Time and distance of movements - Reaction time.

UNIT IV ANTHROPOMETRY 9

Anthropometry - introduction- Types of data- Principles of applied anthrophometry - concept of percentile - Normal distribution – Estimating the range - Minimum and Maximum dimensionsCost benefit analysis - applications of anthropometric data - Anthropometric consideration in tool / equipment design.

UNIT V HUMAN ENGINEERING IN TRACTOR DESIGN 9

The operator - Machine Interface - Operator exposure to environmental factors – Thermal comport for tractor operator – Spatial, Visual and Control requirement of the operator – Occupational health hazards - Noise – Dust- Vibration in Tractor.

TOTAL:45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Role of ergonomics in Agriculture, energy requirements at work

CO2: Age and individual differences in physical functions & Physiological and operational criteria of physical activity.

CO3: Strength and endurance of movements & Movement of body members related to Agricultural activities

CO4: Types of data Principles of applied anthrophometry & applications of anthropometric data

CO5: Operator exposure to environmental factors, Spatial, Visual and Control requirement of the operator

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2			1		2		3		2	1	2	
CO2		3	1		1				3	2		1	2	2	
CO3	2		3	2		2	3	1			1		1	1	
CO4		2			3	1			3			3	3	2	
CO5			2	1			1			2	1		2	3	

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TEXT BOOKS:

1. Bridger, R.S. Introduction to ergonomics, McGraw Hill, INC, New York. 1995.

2. Sharma, D.N and Mukesh, S. Design of Agricultural Tractor- Principles and Problems, Jain Brothers, New Delhi. 2012.

3. Hand Book of Agricultural Engineering, Indian Council of Agricultural Research, New Delhi. 2013.

REFERENCE:

1. Wesley E.Woodson. Human Factors design Hand Book. McGraw Hill Book Co., New York. 1981.

U19AEPE017 - ON FARM WATER MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

- To understand the fundamentals of minor irrigation, its types, operation and maintenance and people's participation
- Command Area Development, On farm structures, policy, operation and maintenance

UNIT I DESIGN OF IRRIGATION CHANNELS 9

Design of Erodible and Non-Erodible, Alluvial channels - Kennedy‟ s and Lacey‟ s Theories - Materials for Lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land Leveling methods

UNIT II COMMAND AREA 9

Command area - Concept - CADA Programmes in Tamil Nadu - Duty of water - expression - relationship between duty and delta - Warabandhi - water distribution and Rotational Irrigation System - case studies.

UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER 9

Availability of water - Rainfall, canal supply and groundwater - Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water - Dependable rainfall - Rainfall analysis by Markov chain method - Probability matrix

UNIT IV WATER BALANCE 9

Groundwater balance model - Weekly water balance - Performance indicators – Adequacy, Dependability, Equity and efficiency - conjunctive use plan by optimization - Agricultural productivity indicators - Water use efficiency

UNIT V SPECIAL TOPICS 9

National water policy - Institutional aspects - Socio-economic perspective- Reclamation of salt affected soils- Seepage loss in command area- Irrigation conflicts - Water productivity - Water pricing.

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Kennedy‟ s and Lacey‟ s Theories & Water control and Diversion structure

CO2: CADA Programmes in Tamil Nadu & water distribution and Rotational Irrigation System

CO3: water requirement and utilization, Rainfall analysis by Markov chain method

CO4: conjunctive use plan by optimization & Water use efficiency

CO5: Seepage loss in command area- Irrigation conflicts, Water pricing.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	1		1		2	1		1	3	2	1	2		
CO2	1	2	1		1		2	3		1	1		2	1	
CO3	3		3	2	1	2	1		3		2	2	1		
CO4	2	3	1		1	3		1	2	1	1			3	
CO5	3	2		1	3	1	3		1		3	1	1		

TEXTBOOK:

1. Michael, A.M. Irrigation Theory and practice, Vikas publishing house, New Delhi, 2006.

REFERENCES:

1. Keller, .J. and Bliesner D.Ron, 2001 Sprinkler and Trickle irrigation, An ari book, Published by Van No strand Rein hold New York.

2. Israelson, 2002, Irrigation principles and practices, John Wiley & sons, New York.

3. Modi, P.N., 2002. Irrigation and water resources and water power engineering, Standard Book House, New Delhi.

4. Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi. 5. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi

U19AEPE018 - WATERSHED MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

- To provide the technical know-how of analyzing the degradation of soil and water resources and implementation of the measures for soil and water conservation.
- To provide a comprehensive treatise on the engineering practices of watershed management for realizing the higher benefits of watershed management.

UNIT I INTRODUCTION 9

Watershed - Definition - concept - Objectives - Land capability classification - priority watersheds - land resource regions in India

UNIT II WATERSHED PLANNING 9

Planning principles - collection of data - present land use - Preparation of watershed development plan - Estimation of costs and benefits - Financial plan - selection of implementation agency - Monitoring and evaluation system

UNIT III WATERSHED MANAGEMENT 9

Participatory watershed Management - run off management - Factors affecting runoff - Temporary & Permanent gully control measures - Water conservation practices in irrigated lands - Soil and moisture conservation practices in dry lands

UNIT IV WATER CONSERVATION PRACTICES 9

In-situ & Ex-situ moisture conservation principle and practices - Afforestation principle - Micro catchment water harvesting - Ground water recharge - percolation ponds -Water harvesting - Farm pond - Supplemental irrigation - Evaporation suppression - Seepage reduction

UNIT V WATERSHED DEVELOPMENT PROGRAMME 9

River Valley Project (RVP) - Hill Area Development Programme (HADP) - National Watershed Development Programme for Rainfed Agriculture (NWDPRA) - Other similar projects operated in India – Govt. of India guidelines on watershed development programme - Watershed based rural development – infrastructure development - Use of Aerial photography and Remote sensing in watershed management - Role of NGOs in watershed development

TOTAL: 45 PERIODS

OUTCOME:

Students can able to know about the:

CO1: Land capability classification & land resource regions in India

CO2: Preparation of watershed development plan, selection of implementation agency

CO3: Temporary & Permanent gully control measures, Soil and moisture conservation practices in dry lands

CO4: Micro catchment water harvesting, Evaporation suppression and Seepage reduction

CO5: National Watershed Development Programme for Rainfed Agriculture (NWDPRA), River Valley Project (RVP), Hill Area Development Programme (HADP)

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	
CO1	3	2	1	3		2	3	2	1		2	1	1		
CO 2	3	3		1	2	1	3	1		1	3		1	2	
CO 3	1	1	2		3		2		1	2		1	2		
CO 4	3		1	2	3	1	1	2	1	3	2			2	
CO 5	1	3	1		2	3	2		3	2	3	2	1	1	

TEXT BOOKS:

1. Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.

2. Ghanashyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.

REFERENCES:

1. Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.

2. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.

3. Tripathi R.P. and H.P.Singh 2002, Soil erosion and conservation, Willey Eastern Ltd., New Delhi

4. Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi.

5. Tideman, E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.

U19AEPE019 GROUND WATER MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

UNIT I GROUNDWATER AND MANAGEMENT **10**

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

UNIT II PRECIPITATION AND ABSTRACTIONS **10**

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges- Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton's equation - double ring infiltrometer, infiltration indices.

UNIT III RUNOFF **8**

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange's table and SCS methods – Stage discharge relationships- flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT IV FLOOD AND DROUGHT **9**

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts-Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT V RESERVOIRS **8**

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have :

CO1: an understanding of the key drivers on water resources, hydrological processes and their integrated behaviour in catchments,

CO2: ability to construct and apply a range of hydrological models to surface water and groundwater problems including Hydrograph, Flood/Drought management, artificial recharge

CO3: ability to conduct Spatial analysis of rainfall data and design water storage reservoirs

CO4: Understand the concept and methods of ground water management.

CO5: able to know the classification of reservoirs, General principles of design

CO/PO MAPPING													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2	1			3		1	1	1	2		2	
CO2	1			2			2	3		1				2	
CO3	2		2		3		3		2	1		2		2	
CO4	1			1				3	3		1	3		3	
CO5	1		2	1	3		3	3	1	1	1	3		3	

TEXTBOOKS:

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

REFERENCES:

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.

Approved by BoS Chairman

U19AEPE020 WATER HARVESTING AND SOIL CONSERVATION STRUCTURES

L T P C
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OBJECTIVES:

- To present the concepts of erosion so that students get a sound knowledge about the problems associated with it.
- To enable the students to make use of the principles and concepts to solve issues related to soil and water management.

UNIT I SOIL EROSION PRINCIPLES **9**

Approaches to soil conservation – Soil conservation in India - Erosion – Agents - Causes - Mechanics of water erosion – Soil erosion problems - Types of water erosion: Raindrop erosion, Sheet erosion, Rill erosion, Gully erosion, Stream bank erosion – Classification of Gully – Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways - Prerequisites for soil and water conservation measures.

UNIT II ESTIMATION OF SOIL EROSION **9**

Runoff computation for soil conservation: SCS-CN method – Evolution of Universal Soil Loss Equation: Applications and Limitations – Modified Universal Soil Loss Equation – Revised Universal Soil Loss Equation- Permissible erosion – Land use capability classification - Classification of eroded soils.

UNIT III EROSION CONTROL MEASURES **10**

Agronomic practices: contour cultivation - strip cropping – tillage practices – Soil management practices – Bunding: Types and design specifications - Mechanical measures for hill slopes – Terracing: Classification and design specification of bench terrace – Grassed waterways: Location, construction and maintenance – Types of temporary and permanent gully control structures.

UNIT IV WATER CONSERVATION MEASURES **9**

In-situ soil moisture conservation – Water harvesting principles and techniques: Micro catchments, catchment yield using morphometric analysis - Farm ponds: Components, Design, Construction and Protection – Check dams - Earthen dam – Retaining wall.

UNIT V SEDIMENTATION **8**

Sediment: Sources – Types of sediment load – Mechanics of sediment transport – Estimation of bed load – Sediment Graph - Reservoir sedimentation: Basics - Factors affecting sediment distribution pattern, Rates of reservoir sedimentation - Silt Detention Tanks – sediment control methods.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have :

CO1: Approaches to soil conservation – Soil conservation in India

CO2: Runoff computation for soil conservation

CO3: Agronomic practices: contour cultivation - strip cropping – tillage practices

CO4: In-situ soil moisture conservation – Water harvesting principles and techniques

CO5: Sediment: Sources – Types of sediment load – Mechanics of sediment transport

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2			1		2		3		2	1	2	
CO2		3	1		1				3	2		1	2	2	
CO3	2		3	2		2	3	1			1		1	1	
CO4		2			3	1			3			3	3	2	
CO5			2	1			1			2	1		2	3	

TEXTBOOKS:

1. Suresh, R., "Soil and Water Conservation Engineering", Standard Publication, New Delhi, 2007.
2. Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.
3. "Sedimentation Engineering", 2006, ASCE manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing.

REFERENCES:

1. Murthy, V.V.N., "Land and Water Management Engineering", Kalyani Publishers, Ludhiana, 1998.
2. Gurmail Singh, "A Manual on Soil and Water Conservation", ICAR Publication, New Delhi, 1982.
3. Mal, B.C., "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, New Delhi, 2002

U19AEPE021 PRINCIPLES OF SOIL ENGINEERING

L T P C
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OBJECTIVES:

To expose the students to the fundamental knowledge on Soil physical parameters, Permeability – Compaction, Bearing Capacity and types and methods of soil survey and interpretative groupings

UNIT I INTRODUCTION AND SOIL PHYSICS **9**

Soil - definition - major components –Soil forming minerals and processes- soil profile -Physical properties - texture –density-porosity-consistence-colour- -specific gravity - capillary and non-capillary -plasticity. Soil air - soil temperature - soil water - classification of soil water- Movement soil water. Soil colloids – organic and inorganic matter-Ion exchange- pH – Plant nutrient availability

UNIT II SOIL CLASSIFICATION AND SURVEY **9**

Soil taxonomy – Soils of Tamil Nadu and India. Soil survey - types and methods of soil survey – Field mapping-mapping units - base maps -preparation of survey reports - concepts and uses - land capability classes and subclasses - soil suitability -Problem soils – Reclamation.

UNIT III PHASE RELATIONSHIP AND SOIL COMPACTION **9**

Phase relations- Gradation analysis- Atterberg Limits and Indices- Engineering Classification of soil – Soil compaction- factors affecting compaction- field and laboratory methods.

UNIT IV ENGINEERING PROPERTIES OF SOIL **9**

Shear strength of cohesive and cohesionless - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Triaxial and vane shear test- -Permeability- Coefficient of Permeability-Darcy's law-field and lab methods - Assessment of seepage – Compressibility

UNIT V BEARING CAPACITY AND SLOPE STABILITY **9**

Bearing capacity of soils - Factors affecting Bearing Capacity- Shallow foundations-Terzaghi"s formula- BIS standards - Slope stability-Analysis of infinite and finite slopes- friction circle method-slope protection measures.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to understand
CO1: Fundamental knowledge of soil physical parameters.
CO2: The procedures involved in soil survey, soil classification.
CO3: The phase relationship and soil compaction.
CO4: Shear strength of cohesive and cohesionless - Mohr-Coulomb failure
CO5: theory Concepts of bearing capacity and slope stability.

CO/PO MAPPING													CO/PSO Mapping		
CO	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2	1		1	2		1	2	2	2	
CO2	3	3		1			1	1		2		2	2	2	
CO3		3	1	2	2	1		2			1	2	2	2	
CO4	3	3		1	1		1		2	2		2	2	2	
CO5	3	3	2		2		1		2		1	2	2	2	

TEXTBOOKS:

1. Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10th Edition, New York, 2008.
2. Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 2007.

REFERENCES:

1. Edward J. Plaster., "Soil Science", Cengage Learning India Ltd, New Delhi, 2009.
2. Arora, K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2007.
3. Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2007.
4. Sehgal, S.B., "Text Book of Soil Mechanics", CBS Publishers and Distributors New Delhi, 2007.

OPEN ELECTIVES

OPEN ELECTIVE I

B.TECH AGRICULTURAL ENGINEERING

		L	T	P	C
U19AEOE001	**AGRICULTURAL WASTE MANAGEMENT**	3	0	0	3

COURSE OBJECTIVES

- To impart knowledge to students on various methods of agricultural waste management foreco-friendly energy and manure production.

PREREQUISITES: NIL

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1											
CO2	3	2	2											
CO3	2	1	1											
CO4	2	1	1											
CO5	2	1	1											
CO6	2	1	1											

UNIT I **INTRODUCTION** **10**

Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics- its recycling and utilization potential- current constraints in collection and handling of agricultural wastes – its environmental impact.

UNIT II **COMPOSTING** **8**

Definition- Solid waste suitable for composting – Methods of composting - vermicomposting - Mineralization process in composting - Biochemistry of composting – Factors involved – Infrastructure required – maturity parameters – value addition – application methods

UNIT III **BIOMASS BRIQUETTING** **9**

Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant- appliances for biomass briquettes.

UNIT IV **BIOCHAR PRODUCTION** **9**

Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration

UNIT V BIOGAS AND BIO ETHANOL PRODUCTION 9

Screening of suitable lingo cellulosic substrate for biogas production -determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value- per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio- digestion – types of digesters – factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol –pre- treatment-fermentation-distillation

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Build various eco-friendly methods for agricultural waste management

CO2 To develop the process of composting of different types of solid wastes

CO3 To understand the techniques of briquetting from agro-residues

CO4 To understand the role of biochar in soil nutrition and carbon sequestration

CO5 Nutritive value and energy production potential of agro wastes

CO6 To develop and understand the techniques for processing of ethanol and biogas production

TEXT BOOKS:

T1: Rai G.D,Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.

T2: Diaz,l.F.,M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1-380.

REFERENCE BOOKS:

R1: P.D. Grover & S.K. Mishra, “Biomass Briquetting: Technology and Practices”. Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996.

R2: Magdalena Muradin and Zenon Foltynowicz, “Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland”. Sustainability, 2014, 6, 5065-5074.

R3: Biochar production from agricultural wastes via low-temperature microwave carbonization

U19AEOE002 **FARM MANAGEMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To impart the fundamental knowledge and basic concepts of Economics and Farm Management
- To understand the types of resources and Investment analysis in agriculture sector
- To understand the Farm financial analysis, Investment and Budgeting for farms.
- To expose the students to different extension methods for communication to take the work from lab to field
- To plan the financial aspects, economics related to farm management in a cost effective manner.

PREREQUISITES: NIL

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													
CO3	3	2	2	2										
CO4	3	2	2	2										
CO5	3	3	2	2										1
CO6	2	3	2	1										1

UNIT I FARM MANAGEMENT & PLANNING 10

Farm Management – definition – scope- Classification of farms – Basic concepts in farm management -Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts– Farm appraisal techniques – Valuation - Farm management- need and analysis –Elements of farm planning– Whole farm planning and partial planning – Farm level management system – Farm budgeting – whole farm budgeting and partial budgeting – Estimation of credit - examples of farm planning and budgeting

UNIT II LAWS OF ECONOMICS 8

Agricultural Economics – definition and scope – Basic laws of economics – demand and supply concepts –law of increasing, diminishing and constant returns – Equi-marginal returns - Product relationship –Production function – definition and types – Production function curves – Optimum level of input use –Economies of scale external and internal economies and diseconomies - Cost concepts – types – Opportunity cost – comparison of costs – Factor relationship – concepts.

UNIT III COST CURVES 10

Principle of substitution – isoquant, isocline, expansion path, ridge line and least cost combination of inputs-Product-product relationship – Production possibility curve, isorevenue line and optimum combination ofoutputs – Cost curves –Optimum input and output levels – Factor &relationship – Least cost combination ofinputs – Estimation of cost of cultivation and cost of production of crops - annual and perennial crops

UNIT IV **MANAGEMENT OF RESOURCESAND FINANCIAL ANALYSIS** **9**

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis –Investment analysis – Discounting techniques- Farm financial analysis – Balance sheet – Income statement –Cash flow analysis – Farm investment analysis – Time comparison principles - Preparation of interview schedule and farm visit for data collection.

UNIT V **AGRICULTURAL EXTENSION** **8**

Communication – models – elements and their characteristics – types and barriers - Programme planning – monitoring and evaluation - Extension teaching methods - Audio-Visual aids – classification – purpose,planning and selection – individual, group and mass contact methods – Modern communication sources –internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone – Diffusion - Adoption –Capacity building of extension personnel andfarmers –types of training, training to farmers, farm women and rural youth, FTC & KVK.

Total:45HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Gain knowledge in various farm management and farm layout aspects

CO2 familiarize with the various laws of economics and product relationship aspects

CO3 gain knowledege on cost curvesand its applications

CO4 Understand about the various concepts of mamagement of resources

CO5 Gain knowledege on farm management and financial analysis

CO6 Familiarize with budgeting and cost estimation for farm layout

TEXT BOOKS:

T1: Johl, S.S., and Kapur, T.R.,Fundamentals of Farm Business Management", Kalyani publishers,
Ludhiana, 2007

T2: Subba Reddy, S., Raghu Ram, P., NeelakantaSastry T.V and Bhavani 3. Devi, I., "Agricultural
Economics"Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

REFERENCE BOOKS:

R1: Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi,
2002.

R2: Subba Reddy, S., and Raghu Ram, P. ,, "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.

B.E BIOMEDICAL ENGINEERING

U19BMOE001	BIO HEALTHCARE AND TELEMEDICINE	L	T	P	C
		3	0	0	3

Course Objective

The student should be made:

- To enable the students to acquire knowledge about the principles and application of telemedicine in biomedicalindustry

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	1									2	2
CO2	2	2	3	1									2	2
CO3	2	2	3	1									2	2
CO4	2	2	3	1									2	2
CO5	3	2	3	1									3	2
CO6	2	2	3	1									2	2

UNIT I BACKGROUND OF TELEMEDICINE 9

Introduction ,definitions of telemedicine, telehealth and telecare, Origins and development of telemedicine: from beginning to modern times, modern telemedicine and telecare Drivers of telemedicine and telecare: technology drivers, non technological drivers, the funding dilemma Telemedicine in developed and underdeveloped countries ,benefits and limitations of telemedicine Types of information and transmission in telemedicine: audio, video, still images, text and data, Fax

UNIT II COMMUNICATION AND NETWORK SYSTEMSIN TELEMEDICINE 9

Types of communication and network: public switched telephone network, plain old telephone service, integrated services digital network, internet, asynchronous transfer mode Wireless communications basics and its types Wireless sensor standards and homecare concerns, medical sensors for mobile communication devices Development of disposable adhesive wearable human monitoring system Implantable systems: implantable system architecture Signal Processing in implantable neural recording microsystems, electronic health signal processing

UNIT III TECHNOLOGIES FOR SAFEGUARDING MEDICAL DATA AND PRIVACY 9

Data Exchanges: Network configuration, circuit and packetswitching, H.320 series Data security and standards: Encryption, cryptography, mechanisms of encryption, phases of encryption Cryptography, safeguarding patient medical history Anonymous data collection and processing, biometric security
and identification

UNIT IV TELEHEALTH AND MOBILE HEALTH 9

Medical robotics: surgical robots, rehabilitation robots Modern devices for tele-surgery: Main component and functionalities of a robotics tele-surgery System, design guidelines and methodology Microsurgery Systems: Robot-assisted microsurgery system,miniaturization, microsurgical tools, visualization methods and systems Image-guided microsurgery: Image guidance component and workflow, image guidance by surgical domain

UNIT V IMPLEMENTATION OF TELEMEDICINE AND FUTURE TRENDS IN TECHNOLOGY **9**

Telecardiology: Tools and devices Teleradiology and Tele-audiology Telepathology system development and implementation Acute care telemedicine and monitoring for elderly care Virtual doctor systems for medical practices, wireless electrical impedance tomography Synthetic biometrics in biomedical systems, bio-kinematics for mobility

Total:45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Explain the development and transmission techniques used in telemedicine

CO2: Describe the types of communication and network systems

CO3: Explain the technologies used in data exchange and privacy of telemedicine

CO4: Illustrate the current system of tele-health and mobile health

CO5: Describe the currents and futures perspective of telemedicine

CO6: Acquire knowledge about the principles and application of telemedicine

TEXTBOOKS:

T1 Bernard Fong, A.C.M. Fong, C.K. Li, ‑Telemedicine Technologies: Information Technologies in Medicine and Telehealth‖, Wiley, 1st edition,2010.

T2 HalitEren,JohnG.Webster,―TheE-Medicine,E-Health,M-Health,Telemedicine,and Telehealth Handbook‖, CRC Press,1st edition, 2015.

T3 OlgaFerrer-Roca,M.SosaLudicissa,―HandbookofTelemedicine‖,IOSpress,1stedition,2002.

REFERENCEBOOKS:

R1 GeorgiGraschew,StefanRakowsky,―TelemedicineTechniquesandApplications,In ech, 1stedition,2011

R2 A.C.Norris,―EssentialsofTelemedicineandTelecare,JohnWiley&Sons,1stedition**,**2002.

R3 RichardW.Carlson,‑TelemedicineintheICU, AnIssueofCriticalCareClinics,(The Clinics: Internal Medicine)‖, Elsevier, 1st edition,2015.

U19BMOE002 **EMBEDDED SYSTEMS IN MEDICAL DEVICES** **L T P C**
3 0 0 3

Course Objective

The student should be made:

- Understand the design of embedded system for various medical devices.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	2					2	2	3	3
CO2	2	2	2	2	2	2					2	2	3	3
CO3	3	3	2	3	2	1					2	2	2	2
CO4	3	3	3	2	2	2					2	2	2	2
CO5	2	2	2	3	2	1					2	2	2	2
CO6	2	2	2	2	2	1					2	2	2	2

UNIT I EMBEDDED DESIGN WITH MICROCONTROLLERS 9

Product specification – hardware / software partitioning- Detailed hardware and software design – integration,product testing- Microprocessor Vsmicro controller- Performance tools, bench marking processors- RTOS micro controller -issues in selection of processors.

UNIT II PARTITIONING DECISION 9

Hardware / software duality- Hardware-software portioning, coding for hardware/software development, ASIC revolution- Managing the risk,co-verification, execution environment- Memory organization of controller, memory enhancement- Firmware, speed and code density, system startup.

UNIT III FUNCTIONALITIES FOR SYSTEM DESIGN 9

Timers, watch dog timers- RAM, flash memory, basic toolset, integration of hardware & firmware- Application programming, IDE, target configuration- Hostbaseddebugginganalyser- Remote debugging, ROM emulators, logic

UNIT IV DESIGN OF PATIENT MONITORING DEVICES 9

Design consideration of patient monitoring systems- Basic block diagram of pulse oximeter, design requirementof device- Circuit implementation of interfacing of oximeter sensors with microcontroller- Software coding and implementation.

UNIT V DESIGNING OF PACEMAKER 9

System description of pacemaker- Design requirement and basic block diagram of pacemaker- Interfacing of pacemaker elements with processors- Software coding of pacemaker and implementation.

Total:45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Attain knowledge on the basic concepts and the building blocks for embeddedsystem

CO2: Understand the hardware and software partitioning in embeddedsystems

CO3: Gain knowledge about timers and memory organization of embeddedsystems

CO4: Design a pulse oximeter using embedded tool

CO5: Design a pacemaker using embedded tool

CO6: Understand the design of embedded system for various medical devices

TEXTBOOKS:

T1 James K. Peckol, ―Embedded system Design‖, John Wiley & Sons, 1st edition, 2010

REFERENCEBOOKS:

R1 Geo EliciaWhite,―MakingEmbeddedSystems‖,O'ReillySeries,SPD,1stedition,2011.
Georgi Graschew StefanRakowsky,―TelemedicineTechniquesandApplications,In Tech, 1stedition,2011

R2 G. Baura, "A Biosystems Approach to Industrial Patient Monitoring and DiagnosticDevices‖, Morgan&Claypool, IEEE,2008.

B.TECH BIOTECHNOLOGY

U19BTOE001	BASICS OF BIOINFORMATICS	L	T	P	C
		3	0	0	3

Course Objectives

To enable the students

- To improve the programming skills of the student
- To let the students know the recent evolution in biological science

Course Outcomes

At the end of the course, learners will be able to

CO1. Use bioinformatics tools with programming skills.
CO2. Apply computational based solutions for biological perspective
CO3. Alignment of nucleotide and protein sequences
CO4. Predict gene and protein structure.
CO5. Construct, interpret and assess the different molecular phylogenetic tree prediction and gene prediction algorithms
CO6. understand the Application of Bioinformatics

Course Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		1				2							1	
2			3		2	3							1	
3			2		3	3							2	
4		3	2			2							2	
5			2		2	3							1	
6	1				1								1	

3 - High, 2 - Medium, 1 – Low

UNIT I DATABASES 9

Introduction to Bioinformatics-Biological information resources-Genome sequence acquisition and analysis-Retrieval of biological data-Data acquisition, databases, structure and annotation-Data mining and data characteristics.

UNIT II SEQUENCE ALIGNMENT AND DATABASE SEARCHES 9

Database searches and Sequence Alignment-Pair wise and multiple sequence alignment-Methods of local and global alignment-Dynamic programming, Scoring matix, PAM, searching sequence databases by sequence similarity-BLAST and FASTA.

UNIT III PHYLOGENY ANALYSIS 9

Phylogenetics, Molecular Phylogeny and evolutionary analysis-ClustalW, MSA, Dendrogram-Maximum likelihood, Maximum Parsimony, convergent and parallel evolution, Bootstrapping, Jackknifing-Phylograms.

UNIT IV STRUCTURAL BIOINFORMATICS 9

Structural bioinformatics, analysis for protein structure, Predicting protein structure and function from

Sequence-Homology modeling-Microarray Data analysis- proteomic data analysis-Visualization of molecular structures.

UNIT V APPLICATIONS OF BIOINFORMATICS 9

Scope of bioinformatics-Bioinformatics in the Pharmaceutical Industry- Structure-Based Rational Drug Design and discovery-Chemi-informatics in Biology.

TOTAL: 45 HOURS

TEXT BOOKS:

1. Attwood, T. and P.S. David. 2006. Introduction to Bioinformatics. Pearson Education Ltd., New York.
2. Axevanis, A.D., and Ouellette, B.F.F. (eds) 2006. Bioinformatics A Practical Guide to Analysis of Gene and Proteins. 3rd Edition, John Wiley and Sons, New York.

U19BTOE002 INTRODUCTION TO BIOENERGY AND BIOFUELS

L	T	P	C
3	0	0	3

Course Objectives

To enable the students

- This course will be focussed on achievement, acquisition of knowledge and enhancement of comprehension of information regarding bioenergy and biofuel technologies and their sustainable applications..

Course Outcomes

At the end of the course, learners will be able to

CO1. Understand in depth of the bioenergy and biofuels.
CO2. Distinguish various forms of bioenergy and biofuels production
CO3. Analyse concepts related to and advantages of bioenergy.
CO4. Develop novel products from biofuels.
CO5. Understand the environmental sustainability.
CO6. Understand the yield and efficiency of Biofuels

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3										2	
2	3	2												
3	3	3	3	2	2	2		1	3					2
4	3	1	1			1		1						1
5	3	3	2	1	2			1						1
6	3	3	2	1	2			1						1

UNIT I BASIC CONCEPTS OF BIO-FUELS 9

Biopower, Bioheat, Biofuesl, advanced liquid fuels, drop-in fuels, biobased products

UNIT II FEEDSTOCKS 9

Harvested Feedstocks: First generation biofuels, Second generation biofuels, third generation biofuels. Residue Feedstocks: Agricultural wastes, forestry wastes, farm waste, organic components of residential, commercial, institutional and insdustrial waste.

UNIT III CONSERVATION TECHNOLOGIES 9

Biorefinery concept – biorefineries and end products, Biochemical conversion – hydrolysis, enzyme and acid hydrolysis, fermentation, anaerobic digestion and trans-esterification, Thermochemical conversion – Combustion, Gasification, Pyrolysis, other thermochemical conversion technologies. Scaling up of emerging technologies.

UNIT IV BIOMETHANE AND BIOHYDROGEN 9

Biomethanol − Principles, materials and feedstocks, Process technologies and techniques, Advantages and limitations − Biological hydrogen production methods, Fermentative hydrogen production, Hydrogen economy − Advantages and limitations

UNIT V SUSTAINABILITY AND RESILIENCE 9

Environmental Sustainability, bioenergy sustainability, emissions of biomass to power generation

applications, emissions from biofuels. ILUC issues, Carbon footprint, Advanced low carbon fuels

TOTAL: 45 HOURS

TEXT BOOKS:

1. Biorenewable Resources – Engineering new products. Robert C Brown. Blackwell Publishing Professional, 2003.
2. Biomass for Renewable Energy, Fuels and Chemicals. Donald Klass. Academic press. 1999
3. Introduction to Bioenergy.Vaughn C. Nelson and Kenneth L. Starcher

B.E CIVIL ENGINEERING

		L	T	P	C
U19CEOE001	**GREEN BUILDINGS**	**3**	**0**	**0**	**3**

Course Objectives:

This course aims to provide the students,

- About the importance and necessity of green buildings.
- Asses the boiling based in LEED Rating systems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		2	1	3		3					2	1	
CO2	2	1	3	2	1	2	3					1	1	
CO3	2	2	2	3	1	1	3					3	1	
CO4			1				3					2	2	
CO5	2		1	2	1		3					3	2	
CO6	3	2	1	2		1	3					1	1	

UNIT I INTRODUCTION 9

Green Building - Need for Green Building - Benefits of Green Buildings - Green Building Materials and Equipment in India - Key Requisites for Constructing a Green Building - Important Sustainable featuresfor Green Building.

UNIT II GREEN BUILDING CONCEPTS AND PRACTISES 9

Indian Green Building Council - Green Building Moment in India - Benefits Experienced in Green Buildings - Launch of Green Building Rating Systems - Residential Sector - Market Transformation. Green Building Opportunities And Benefits: Opportunities of Green Building - Green Building Features, Material and Resources - Water Efficiency - Optimum Energy Efficiency - Typical Energy Saving Approach in Buildings - LEED India Rating System and Energy Efficiency.

UNIT III GREEN BUILDING DESIGN 9

Introduction - Reduction in Energy Demand - Onsite Sources and Sinks - Maximise System Efficiency- Steps to Reduce Energy Demand and Use Onsite Sources and Sinks - Use of Renewable EnergySources. Eco-friendly captive power generation for factory - Building requirement.

UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS 9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings – Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT V GREEN COMPOSITES FOR BUILDINGS 9

Concepts of Green Composites - Water Utilisation in Buildings - Low Energy Approaches to WaterManagement, Management of Solid Wastes, Management of Sullage Water and Sewage, Urban Environment and Green Buildings, Green Cover and Built Environment.

Total: 45 Hours

Course Outcomes:

At the end of the course, students should be able to

CO1 : Know about the importance and necessity of green buildings.

CO2 : Understand the principles of green building certifications (LEED) and low-energy building strategies.

CO3 : Understand the concepts and principles in Green Building Design..

CO4 : Suggest materials and technologies to improve energy efficiency of building.

CO5 : Gain ideas various green composites used in building and sustainable development.

CO6 : Have an Insight about criteria for rating systems along with established Indian codes an guideline.

Textbooks

T1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. "Alternative Building Materials and Technologies". New Age International, 2007.

T2. Low Energy Cooling for Sustainable Buildings. John Wiley and Sons Ltd, 2009.

T3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

Reference Books

R1. Osman Attmann, "Green Architecture Advanced Technologies and Materials". McGraw Hill, 2010.

R2. Jerry Yudelson, "Green building Through Integrated Design". McGraw Hill, 2009.

R3. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke.

U19CEOE002	DISASTER PREPARDNESS AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- To Understand the basic concepts of disaster management.
- To acquire knowledge on types and categories of disasters.
- To understand the impacts and challenges posed by disasters.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				1	1	3	1	1			2	1	
CO2	1	2	2	1	1	2	3					1	1	
CO3	1	3	1		2	1	3	1				3	2	
CO4		2	3	1		2	3					1	2	
CO5	3	1	3	3	1	2	3	1				3	1	
CO6	3	2	3	3	1		3					3	1	

UNIT I INTRODUCTION TO DISASTER 9

Concepts and definitions - disaster, hazard, vulnerability, resilience, risks severity, frequency and details,capacity, impact, prevention, mitigation. Global trends in disasters - urban disasters, pandemics, complexemergencies, Climate change. Disaster's classification - natural disasters - manmade disasters - hazard and vulnerability profile of India - mountain and coastal areas, ecological fragility. Dos and Don'ts during various types of Disasters.

UNIT II DISASTER IMPACTS 9

Disaster impacts (environmental, physical, social, ecological, economic, political, etc.) - health, psycho,social issues - demographic aspects (gender, age, special needs) - hazard locations - global and nationaldisaster trends - climate change and urban disasters.

UNIT III DISASTER RISK REDUCTION 9

Disaster management cycle – its phases : prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures - risk analysis - vulnerability and capacity assessment - early warning systems - Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications) - Roles and responsibilities of government – community - local institutions - NGOs and other stakeholders - Policies and legislation for disaster risk reduction - DRR programmes in India and the activities of National Disaster Management Authority

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment,

Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTERS, ENVIRONMENT AND DEVELOPMENT 9

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmentally

friendly recovery; reconstruction and development methods.

Total: 45 Hours

Course Outcomes:

At the end of the course, students should be able to,

CO1: Explain the hierarchical structure in solid waste management and a requirement for an integrated solution.

CO2: Define and characterize solid and hazardous wastes from technical and regulatory points of view.

CO3: Make route optimization for a solid waste collection and transport system.

CO4: Understand the methods of handling, sampling and storage of solid and hazardous waste.

CO5: Select the appropriate method for solid waste processing technologies.

CO6: Describe disposal methods of solid and hazardous solid waste.

Textbooks:

T1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010.

T2. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.

T3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

Reference Books:

R1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.

R2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.

R3. Government of India, National Disaster Management Policy,2009.

B.E COMPUTER SCIENCE ENGINEERING

U19CSOE001 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To understand the phases in a software project

- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing and maintenance measures•

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1											2
CO2	2	1	1											2
CO3	3	2	2											2
CO4	3	2	2											2
CO5	3	2	2											2
CO6	3	2	2											2

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT **9**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION **9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN **9**

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components..

UNIT IV TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering..

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Identify the key activities in managing a software project and recognize different process model

CO2 Explain the concepts of requirements engineering and Analysis Modeling.

CO3 Outline the systematic procedures for software design and deployment

CO4 Compare various testing and maintenance methods

CO5 Interpret the project schedule, estimate project cost and effort required.

CO6 Develop a software using the software engineering principles

TEXT BOOKS:

T1: Roger S. Pressman, "Software Engineering – A Practitioner‟s Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010..

T2: Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

REFERENCE BOOKS:

R1: Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009

R2: Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

R3: Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.

R4: Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007.

U19CSOE002 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

PREREQUISITES: NIL

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1											2
CO2	3	2	2											3
CO3	2	1	1											2
CO4	2	1	1											2
CO5	2	1	1											3
CO6	2	1	1											2

UNIT I RELATIONAL DATABASES 10

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT II DATABASE DESIGN 8

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV TESTING AND MAINTENANCE 9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using

Heuristics and Cost Estimation.

UNIT V **PROJECT MANAGEMENT** **9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Discuss the fundamental concepts of relational database and SQL

CO2 Use ER model for Relational model mapping to perform database design effectively

CO3 Summarize the properties of transactions and concurrency control mechanisms

CO4 Outline the various storage and optimization techniques

CO5 Compare and contrast various indexing strategies in different database systems

CO6 Explain the different advanced databases

TEXT BOOKS:

T1: Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.

T2: Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011.

REFERENCE BOOKS:

R1: C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

R2: Raghu Ramakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.

R3: G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

		L	T	P	C
U19ECOE001	**SOFT COMPUTING**	3	0	0	3

COURSE OBJECTIVES

- **T**o learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

PREREQUISITES

- Basic concepts of communication theory
- Basics of Computer Networks
- Basics of Biological systems
- Linear Algebra

Course Articulation Matrix : 3- High, 2- Medium, 3- Low														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2							2	1		2
CO2	3	2	2	2							2	1		2
CO3	3	2	2	2							2	1		1
CO4	3	2	2	2							2	1		1
CO5	3	2	2	2							2	1		1
CO6	3	2	2	2							2	1		1

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization - Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III FUZZY SYSTEMS 9

– Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS 9

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS 9

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Apply suitable neural computing techniques for various applications.

CO2: Explain various ANN models

CO3: Apply fuzzy concepts for various applications

CO4: Apply genetic algorithms to solve problems

CO5: Integrate various soft computing techniques for complex problems.

TEXT BOOKS:

T1: N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.

T2: S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.

T3: S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

REFERENCE BOOKS:

R1: Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2002.

R2: Kwang H.Lee, ―First course on Fuzzy Theory and Applications‖, Springer, 2005.

R3: George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications‖, Prentice Hall, 1996.

U19ECOE006 **MEDICAL ELECTRONICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques

PREREQUISITES

- Basic Electronics
- Electronic devices

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2							2	1	2	
CO2	3	2	2	2							2	1	2	
CO3	3	2	2	2							2	1	2	
CO4	3	2	2	2							2	1	2	
CO5	3	2	2	2							2	1	2	
CO6	3	2	2	2							2	1	3	

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II NON ELECTRICAL PARAMETER MEASUREMENTS 9

Blood flow meter-Types, Cardiac output measurements-Types, respiratory measurement, blood pressure measurement, temperature and pulse measurement, Blood Cell Counters

UNIT III THERAPEUTIC EQUIPMENTS 9

Cardiac pacemakers - types, Cardiac defibrillators-types, Dialyzers, Heart Lung Machines – Oxygenations, Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy

UNIT IV MEDICAL IMAGING 9

X-Ray machine, computer axial tomography- CT scans, Positron Emission Tomography- PET Scans. MRI and NMR Ultrasonic Imaging systems, Medical Thermograph

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION AND APPLICATION IN MEDICINE 9

Bio medical telemetry- remote patient monitoring systems, Telemedicine, Radio pill, Application of cryogenics in medicine, Application of LASERS in medicines. Diagnosis of Cancers and tumors using image processing, diagnosis of dental plague using image processing, diagnosis of various eye problems using image processing

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: now the human body electro- physiological parameters and recording of bio-potentials

CO2: mprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.

CO3: terpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators

CO4: mprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods

CO5: now about recent trends in medical instrumentation

TEXT BOOKS:

T1: lie Cromwell, Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi,
2007. (UNIT I – V)

T2: andpur, R.S., -Handbook of Biomedical Instrumentation‖, TATA McGraw-Hill, New Delhi,
2003.(UNIT I – V)

REFERENCE BOOKS:

R1: Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006

R2: Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015

B.E ELECTRICAL AND ELECTRONICS ENGINEERING

U19EEOE001 RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To get exposure on renewable energy source.
- To know about the solar radiation and its environmental impact to power.
- To learn about the wind energy and its economic aspects.
- To know about geothermal energy with other energy sources.
- To get exposure on distributed generation in storage systems

PREREQUISITES

- Fundamentals of electrical engineering
- Basic concepts of Differentiation
- Basic concepts of Integration
- Fundamentals of Battery concepts

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2	2		1	3				2		2	
CO2	3		2	2		1	3				2		2	
CO3	3		2	2		1	3				2		2	
CO4	3		2	2		1	3				2		2	
CO5	3		2	2		1	3				2		2	
CO6	3		2	2		1	3				2		3	

UNIT I INTRODUCTION 9

Energy scenario: National and International – Energy resources and their availability – Conventional power generation plant (Thermal power plant) - Environmental aspects of fossil fuels – Necessity for renewable energy sources – Types of renewable energy source and its limitation.

UNIT II SOLAR PHOTOVOLTAIC SYSTEM 9

Introduction – Solar radiation and measurements – Basic principle of SPV conversion – Solar energy collectors – Solar energy storage: Solar pond – Types of solar PV cells – PV cell connections – Characteristics of PV module and its parameters - Application of solar energy: Solar pumping and solar cooking.

UNIT III WIND ENERGY SYSTEM 9

Introduction – Wind energy conversion – Power produced from wind - Relationship between wind speed and power – Components of wind power plant (WPP) – Types of WPP – Selection of site for WPP – Advantages and challenges of WPP.

UNIT IV **ENERGY FROM OTHER SOURCES** **9**

Geothermal energy (GTE): operation of GTE power plants - Types– Advantage of GTE- Tidal energy: Operation of tidal power plant – Ocean Thermal Energy Conversion system: Open and closed cycles - Fuel cell: Construction and working principle- Advantage and applications of Fuel cell.

UNIT V **DISTRIBUTED GENERATION** **9**

Concept of DG – Benefits of DG – Types of DG resources – Security issues in integrating DG with power grid - Energy storage elements: Batteries, super-capacitors, flywheels - Captive power plants

Total: 45 HOURS

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO.1: Acquire knowledge on power demand scenario of world and the importance of renewable energy sources in meeting the power demand

CO.2: Understand the working principle of solar photovoltaic system and its applications

CO.3: Outline the various components and performance of wind energy conversion system

CO.4: Explain the operation of geothermal and tidal power plants, fuel cell and ocean thermal energy conversion scheme.

CO.5: Understand the necessity of distributed generation and energy storage elements.

CO6: Understand about the power generation through renewable energy sources

TEXT BOOKS:

T1: Rai, G.D., "Non-Conventional Energy Sources", Khanna Publishers, Sixth Edition 2017

T2: Khan, B.H, Non-Conventional Energy Resources", Mc. Graw Hill Education Ltd, third reprint 2017.

REFERENCE BOOKS:

R1: Rao S. Paruklekar,B.B, "Energy Technology –Non Conventional, Renewable and Conventional", KhannaPublishers,1994

R2: John Twidell and Tony Weir, "Renewable Energy Resources", Tyalor and Francis Publications, Third edition, 2015.

R3: Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC..

U19EEOE002 **INTRODUCTION TO CONTROL SYSTEMS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To understand the concepts of control systems-open loop and closed loop control systems.
2. To understand the (mathematical modelling) Transfer function from mechanical, electrical, block diagram and signal flow graph.
3. To learn the concepts of steady state and transient responses from first and second order systems at different inputs and also steady state errors.
4. To learn the stability concepts are Root locus, Bode plot and Polar plot
5. To learn the concept of state space analysis applying on multi-input/output state of the system to find the stability.

PREREQUISITES

- Basic concepts of circuit analysis
- Fundamentals of electrical engineering
- Basic concepts of Differentiation
- Basic concepts of Integration

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3			2			2			2	2	
CO2	1	2	3			2			2			2	2	
CO3	1	2	3			2			2			2	2	
CO4	1	2	3			2			2			2	2	
CO5	1	2	3			2			2			2	2	
CO6	1	2	3			2			2			2	3	

UNIT I **INTRODUCTION** **9**

Concepts of control systems-open loop and closed loop control systems and their differences-different examples of control systems-classification of control systems, feed-back characteristics, effects of feedback. Mathematical models-differential equations, impulse response and transfer functions.

UNIT II **TRANSFER FUNCTION REPRESENTATION** **9**

Block diagram representation of systems considering electrical systems as examples-block diagram algebra-representation by signal flow graph-reduction using mason's gain formula.

UNIT III **TIME RESPONSE ANALYSIS** **9**

Standard test signals-time response of first order systems- characteristic equation of feedback control systems, transient response of second order systems-time domain specifications-steady state response-steady state errors and error constants-effects of proportional derivative, proportional integral systems, PID controllers

UNIT IV **STABILITY AND FREQUENCY RESPONSE ANALYSIS** **9**

The concept of stability-routh's stability criterion- The root locus concept –construction of root loci-effects of adding poles and zeros to G(S) H(S) on the root loci - Frequency domain specifications - bode diagrams- determination of frequency domain specifications and transfer function from the bode diagram-phase margin and gain margin-stability analysis from bode plots. Polar plots.

UNIT V **STATE SPACE ANALYSIS** **9**

Concepts of state, state variables and state model, derivation of state models from block diagrams, diagonalization-solving the time invariant state equations-state transition matrix and it's properties-concepts of controllability and observability.

Total: 45 HOURS

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1 Ability to find the Mathematical models-differential equations, impulse response and transfer functions.

CO2 Ability to find the transfer function from mechanical, electrical, block diagram, signal flow graph and electronic system

CO3 Describe the concept of steady state and transient response at different inputs

CO4 Apply the concepts of stability in s-domain and Routh criteria and the concepts of plotting the response of a system on a graph

CO5 Design and implement any system using state space analysis

CO6 Ability to implement the real time applications of control systems

TEXT BOOKS:

T1: C. Kuo, Automatic Control Systems, 8th edition, John Wiley and sons, India, 2003

T2: J. Nagrath, M. Gopal, Control Systems Engineering, 2nd edition, New Age International (P) Limited, New Delhi.

REFERENCE BOOKS:

R1: Katsuhiko Ogata, Modern Control Engineering, 3rd edition, Prentice Hall of India Pvt. Ltd., India, 1998

R2: Norman S. Nice, Control Systems Engineering, 6th edition, John Wiley, India, 2015

R3: N. K. Sinha(1998), Control Systems, 3rd edition, New Age International (P) Limited Publishers, India.

ENGLISH

U19ENOE01	ENGLISH for COMPETITIVE EXAMS (Common to ALL)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To prepare learners to face the challenges of regular/online competitive exams I the English language globally.
- To enable students to prepare for competitive exams of various kinds especially meant for testing ability in the English language.
- To introduce students to the common question types asked in competitive examinations concerning English- grammar, vocabulary, comprehension, and other significant topics.
- To help the students to overcome the fear of English as a compulsory subject in various competitive exams.
- To encourage students to appear and prepare for the competitive exams.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							2	2	2	3		2	2	
CO2								1	2	3		2	2	
CO3						2		2	3	3		2	2	
CO4							3	2	1	3		3	2	
CO5						3	3	3	3	3		3	2	
CO6							2	2	2	3		2	3	

PRE-REQUISITES: Nil

UNIT I **9**

TypesofSentences - Sentencecorrection -Sentencesequence –Word Reordering - Data Interpretation: Tree Diagram, Flow Chart, Table, Line Graph – Discourse Markers – Identifying the exams interested to appear for - Online Course: Udemy, Edx, Future Learn

UNIT II **9**

Reading Comprehension: Focus on different levels of Comprehension- Literal, Inferential, Analytical, and Critical reasoning – Identifying keywords and signal words, decoding the building blocks of a passage, understanding the jargon and double distractors – Error Spotting Rules - IdentificationCommonErrors

UNIT III **9**

Listening Comprehension: Micro skills and Macro skills of Listening – Idioms and Phrases- Homonyms and Homophones – Collocations- Synonyms and Antonyms: Banking, Indian Constitution, Education, Corporate, and Higher Education - Para jumbles

UNIT IV **9**

Speaking: Presentation and Public: Record of videos – Verbal Ability; Sentence Completion, and Verbal analogies –Confirmation of registering for competitive exams.

UNIT V **9**

Speech Project – Time Management – Stress Management –Standard Assessment: 5 Mock Tests

Total: 45 HOURS

COURSE OUTCOME

At the end of the course, students should be able to

CO1	Confidently use the English language at an advanced level sharing their points of view with effective conclusions.
CO2	Construct correct sentences with the advanced vocabulary of the fields like Banking, Indian polity, Education, Corporate, etc.
CO3	Read accurately using contextual, analytical thinking and logical thinking skills
CO4	Aware of the opportunities available in the government and private sectors
CO5	Demonstrate excellent Time Management skills with regard to various competitive exam patterns

TEXT BOOKS

T1	Richards, C. Jack. Interchange Students Book-3 New Delhi: CUP, 2015.
T2	Means,L. Thomas and Elaine Langlois. English and Communication For Colleges. Cengage Learning, USA: 2007.
T3	The Official Guide to the GRE General Test, Third Edition (TEST PREP)by Educational Testing Service | 16 February 2017
T4	The Yearly Current Affairs 2022 for Competitive Exams (Upsc, State Psc, Ssc, Bank Po/ Clerk, Bba, MBA, Rrb, Nda, Cds, Capf, Crpf), Disha Publication, Genre: General, ISBN: 9789355640888

REFERENCE BOOKS

R1	Brians, Paul. (2013). Common errors in English usage: Third edition. Wilsonville:Franklin,Beedle& AssociatesInc
R2	Harrison, Louis. (2009). Achieve IELTS grammar and vocabulary: English forinternationaleducation. London: Cengage LearningEMEA.
R3	Khashoggi, K.,&Astuni.A. (2014)SATreadingcomprehension workbook:Advancedpracticeseries. New York:IlexPublications.
R4	Prasad, Hari Mohan.(2013). Objective English for competitive exams.New Delhi:TataMcGraw-Hill EducationIndia.
R5	Seely, John. (2013). Oxford guide to effective writing and speaking: How tocommunicateclearly. Oxford: Oxford UniversityPress.

WEB RESOURCES

W1	https://www.edubull.com/exams/competitive-exams
W2	https://sscstudy.com/
W3	https://examsdaily.in/important-study-materials-pdf
W4	http://www.recruitmenttopper.com/study-material-for-all-competitive-exams/

B.TECH FOOD TECHNOLOGY

		L	T	P	C
U19FTOE001	**FOOD SCIENCE AND NUTRITION**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

lain the basic concepts of food and nutrition. Define the overall classification, function, and source of carbohydrates, lipids and proteins. Discuss the overall aspects of vitamins. Outline the role of health and nutritional importance of micro and macro minerals. Summarize the recent trends in nutrition

PREREQUISITES

- Basic idea on biomolecules
- Knowledge of essential nutrition requirement
- Health benefits and function of nutrition
- Diet based nutrition
- Effect of storage and processing on nutrition

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1													2	
2	3	2		3									2	
3	1	3			3			2					1	
4	1				3			2					1	
5													1	
6	1	1		2									1	

UNIT I HUMAN NUTRITION 9+3

Historical perspective of nutrient requirements – Assessment of nutritional status – recommended dietary allowances of macronutrients for all age groups – Assessment of protein quality – Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II BIOMOLECULES 9+3

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Refined & Hydrogenated fats process. Proteins – Definitions, Classification, Function, Amino Acids, Sources of Proteins.

UNIT III VITAMINS 9+3

Physiological role, bio-availability, requirements, sources and deficiency of Fat Soluble Vitamins: Vitamin A, Vitamin D, E & K. Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.

UNIT IV MINERALS 9+3

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.

UNIT V RECENT TRENDS IN DIETETICS 9+3

Principles of dietary management in gout, rheumatism, AIDS/HIV – Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

Total: 60 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: scuss the basics in the area of nutritional assessment in health and disease and to categorize the recommended dietary allowances for different age groups

CO2: press the classifications, functions and sources of carbohydrates, lipids and proteins

CO3: st the various attributes of fat- and water-soluble vitamins

CO4: Report the role, bioavailability, sources and deficiency diseases of macro and micro minerals

CO5: Recognize the diets and concepts of foods suggested for nutritional, chronic and acute disorders

CO6: Classify and to analyse the different techniques of qualitative and quantitative analysis

TEXT BOOKS:

T1: ordon M. Wardlaw. Perspectives in Nutrition. WCB McGraw-Hill Publishers, Boston, 9th Edition. 2013.

T2: hubhangini A. Joshi. Nutrition and Dietetics. Tata Mc Grow- Hill publishing Company Ltd, New Delhi. 4th Edition. 2016.

T3: rilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6th Edition. 2017.

REFERENCE BOOKS:

R1: Ronald Ross Watson. Functional foods and Nutraceuticals in Cancer Prevention. Ed. Wiley – Blackwell. 2003.

R2: Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018.

U19FTOE002 **FOOD PRESERVATION TECHNIQUES**

L	T	P	C
3	0	0	3

Course Objectives

To introduce the students to the area of Food Processing and preservation.
To have an effective understanding of food processing and technology subjects.
To enable students to appreciate the importance of food processing with respect to the large-scale production.
To import knowledge on processing of food waste

Course Outcomes

At the end of the course, learners will be able to:
C01: Describe the fundamentals of food processing and preservation
C02: Familiar with the functional properties of Carbohydrates, fats, lipids, proteins in food
C03: Knowledge about the importance of food additives and their function and will develop strategies that will promote food safety and prevent food borne illness
C04: Analyze the uses of enzymes, modified proteins and develop novel products, explain, analyze and evaluate scenarios related to various unit operations in food processing and preservation
C05: Identify spoilage and deterioration mechanism in food and methods to control deterioration and spoilage
C06: Demonstrate packing methods, materials and factors affecting food packing

Course Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		3											
2	3													
3	2		3										3	
4	3	3	2								3			
5		3	2								3			
6	3	2	2	2	2	1	2							

3 - High, 2 - Medium, 1 – Low

UNIT I **PROCESSING OF FOOD AND ITS IMPORTANCE** **12**

Source of food - significance for processing and preservation of foods – Different food groups-, food pyramids, classification and functions, cooking of foods – methods and cooking media, advantages of processing of foods, changes of nutritional components in cooking, effects of processing of foods on anti-nutritional components.

UNIT II **FOOD COMPONENTS** **12**

Classification, Structure, nutritive value, processing outlines of major Cereals and millets-Pulses-fruits and vegetables, fats, oilseeds and nuts. Major and minor nutrients, sugar and related products, spices and aromatics, beverages and appetizers, organic foods

UNIT III **PROCESSING OF ANIMAL FOODS** **12**

Meat, Poultry and Fish-Structure, composition, nutritive value and processing outline. Processing of milk and milk products, egg processing and storage, need and nutritional benefits of animal products, value added products

UNIT IV **INTRODUCTION TO FOOD PROCESSING AND PRESERVATION** **12**

Food spoilage, fermentation, methods of preservation - High temperature and Low temperature Preservation, traditional methods of food processing and preservation, radiation processing, microwave, non-thermal techniques. Role of enzymes and additives in food preservation

UNIT V **FOOD PACKAGING AND QUALITY** **12**

Food packaging – importance, types and functions, packaging materials – synthetic and natural, Impact of packaging materials on food quality, shelf-life of foods, bottling and canning, nutritional labelling, labelling of vegan and animal based products

TOTAL: 60 PERIODS

TEXT BOOKS

Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge, 2003.
Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.

REFERENCES

Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005

WEBSITES:

1. https://www.heartfoundation.org.nz/educators/edu-resources/food-tech
2. https://www.stemcrew.org/guides/subjects/food-technology-teaching-resources/

B.TECH INFORMATION TECHNOLOGY

		L	T	P	C
U19ITOE001	**UI AND UX DESIGN**	2	0	2	3

COURSE OBJECTIVES

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype.

COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3		2				3		2	2		
CO2	3	2	3		2				3		2	2		
CO3	3	2	3		2				3		2	2		
CO4	3	2	3		2				3		2	2		
CO5	3	2	3		2				3		2	2		
CO6	3	2	3		2				3		2	2		

UNIT I: FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II: FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides 126

UNIT III: FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding

User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV: WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V: RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

Total: 45 HOURS

TEXT BOOKS

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021 127

3. Ralf Steinmetz, Klara Nahrstedt, "Multimedia Systems", Springer IE, 2004. **REFERENCE BOOKS**

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015
4. https://www.nngroup.com/articles/

5. https://www.interaction-design.org/literature.

COURSE OUTCOMES:

At the end of the course students should be able to
CO1: Understand the principles of UI and UX design, including user-centered design, information architecture, visual hierarchy, and usability testing.
CO2:Build UI for user Applications
CO3:Evaluate UX design of any product or application
CO4:Demonstrate UX Skills in product development
CO5:Implement Sketching principles
CO6:Create Wireframe and Prototype

L T P C

U19ITOE002 **MULTIMEDIA SYSTEMS** 3 0 0 3

COURSE OBJECTIVES

- To enrich student learning in multimedia systems.
- To train the students to acquire knowledge in multimedia related technologies.
- To acquire knowledge about multimedia techniques to enhance quality of service.
- To acquire knowledge on multimedia architecture.
- To learn about the multimedia elements in a comprehensive way.

COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3		3	2	2			3	2			1
CO2	3	2	3		3	2	2			3	2			1
CO3	3	2	3		3	2	2			3	2			2
CO4	3	2	3		3	2	2			3	2			2
CO5	3	2	3		3	2	2			3	2			2
CO6	3	2	3		3	2	2			3	2			2

UNIT I: INTRODUCTION TO MULTIMEDIA ELEMENTS 9

Multimedia – Medium – Properties of a Multimedia System – Traditional Data Stream Characteristics – Data Stream Characteristics of Continuous Media – Basic Sound Concepts – Speech – Images and Graphics – Computer Image Processing – Video and Animation – Computer Based Animation.

UNIT II: MULTIMEDIA COMPRESSION 9

Storage Space – Coding Requirements – Hybrid Coding – JPEG: Image Preparation, Lossy Mode, Lossless Mode, Hierarchical Mode – H.261 – MPEG: Video Encoding, Audio Encoding, Data Stream, MPEG 3, MPEG 7, MPEG 21 – DVI – Audio Encoding

UNIT III: MULTIMEDIA ARCHITECTURES 9

User Interfaces – OS multimedia support – Multimedia Extensions – Hardware Support – Distributed multimedia applications – Real time protocols – Play back Architectures – Synchronization – Document and document architecture – Hypermedia concepts – Hypermedia design – Digital copyrights – Digital Library – Multimedia Archives.

UNIT IV: MULTIMEDIA OPERATING SYSTEM AND DATABASES 9

Real Time – Resource Management – Process Management – File systems – Interprocess communication and synchronization – Memory management – Device Management – Characteristics of MDBMS – Data Analysis – Data structures – Operations on data – Integration in a database model.

UNIT V: MULTIMEDIA COMMUNICATION &APPLICATIONS 9

Tele Services – Implementation of Conversational Services, Messaging Services, Retrieval Services, Tele Action Services, Tele Operation Services – Media Consumption – Media Entertainment – Virtual Reality – Interactive Audio – Interactive Video – Games.

Total: 45 HOURS

TEXT BOOKS

1. Ralf Steinmetz, Klara Nahrstedt, "Multimedia computing, communications, and applications", Pearson India, 2009.
2. Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw Hill Education, 2017.

3. Ralf Steinmetz, Klara Nahrstedt, "Multimedia Systems", Springer IE, 2004. **REFERENCE BOOKS**

1. Tay Vaughan, "Multimedia: Making it Work", McGraw – Hill Education, Ninth Edition, 2014.
2. Mark S Drew, Zee Nian Li, "Fundamentals of multimedia", Prentice Hall, 2006.

3. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh, Richard L. "Baker Digital Compression for Multimedia: Principles and Standards", Elsevier, 2006.

COURSE OUTCOMES:

At the end of the course students should be able to
CO1: Handle the multimedia elements effectively
CO2: Encode and decode the multimedia elements.
CO3: Understand the underlying multimedia computing architectures used for media development.
CO4: Develop effective strategies to deliver Quality-of-Experience in multimedia applications.
CO5: Design and implement algorithms and techniques related to multimedia objects.
CO6: Design and develop multimedia applications in various domains.

PHYSICS

		L	T	P	C
U19PHOE001	**NANOTECHNOLOGY AND ENGINEERING APPLICATIONS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- To introduce the concept of nanotechnology and understand the importance of nanotechnology
- To give deep insight into fabrication and characterization techniques for nanostructures
- To provide an overview of the wide applications of nanotechnology in various technological fields.

PRE-REQUISITES: As a prerequisite for this course Nanotechnology and Engineering Applications, knowledge in Engineering Physics and Applied Physics is essentially required.

Mapping of Course outcomes (COs) to Program outcomes (POs)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO 1	2	1	3		3		2		2		2		1	
CO 2	2	1	3		3		2		2		2		1	
CO 3	2	1	3		3		2		2		2		2	
CO 4	2	1	3		3		2		2		2		2	
CO 5	2	1	3		3		2		2		2		1	
CO 6	2	1	3		3		2		2		2		1	

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION AND SYNTHESIS OF NANOMATERIALS 9

Introduction to nanotechnology –definition, invention, building blocks of nanotechnology, chemical bonds - Van der Waals Interactions, Dipole-Dipole interactions, Microstructure and Defects in Nanocrystalline Materials – dislocations, twins, stacking points and voids; grain boundaries, triple junctions and disclinations.

Synthesis of nanomaterials**:** Bottom – Up Approaches: physical vapour deposition (PVD), chemical vapour deposition (CVD), spray pyrolysis. Top- Down Approaches: Mechanical alloying, high pressure torsion (HPT)

UNIT II TYPES OF NANOMATERIALS 9

Carbon Nanotubes (CNT): Introduction, classification of CNT'S, synthesis and physical properties of CNT (Electrical, Transport, Mechanical), applications.

Fullerenes: Introduction, synthesis and purification, physical properties, applications. Semiconductor Quantum dots: Introduction, synthesis of Quantum dots, physical and chemical properties, applications.

Nanocomposites: Introduction, synthesis and processing of Inorganic nanotubes and polymeric nanocomposites, applications.

Nanowires: Introduction, physical properties of nanowires – (structural, Optical, Chemical), Applications.

UNIT III PROPERTIES OF NANOMATERIALS 9

Mechanical Properties: Introduction, Grain Size Effect, Creep, Hardness, Fracture Strength, Strengthening and Toughening Mechanisms, Crack Healing (Annealing Treatment). [From Advanced

nanomaterials by Hofman, Powder Technology Laboratory, IMX, EPFL, Version 1 Sept 2009].
Electrical and Optical properties: Electrical conduction and tunnelling conduction in nanoparticles, electronic conduction with nanoparticles (AC Conductivity & DC Conductivity).
Optical properties: Transmission, Absorption, Reflection in nanoparticles, optical constants (Absorption coefficient, extinction coefficient and Refractive index).

UNIT IV CHARACTERIZATION TOOLS 9

XRD (X-Ray diffraction), SAXS (Small Angle X-ray Emission Spectroscopy), SEM (Scanning Electron Microscopy), TEM (Transmission Electron Microscopy), STM (Scanning Tunnelling Microscopy), AFM (Atomic Force Microscopy).

UNIT V APPLICATIONS OF NANOTECHNOLOGY 9

Electrical and electronic applications: MEMS (Micro Electro Mechanical Systems), NEMS (Nano Electro Mechanical Systems), Nanosensors, nanolithography.
Nanotechnology for Renewable Energy: Hydrogen energy, fuel cell technology, wind and solar energy. Nanotechnology for information technology and Data Storage applications.

Total:45 Hours

COURSE OUTCOME

At the end of the course, students should be able to

CO1	Apply the basic concepts of nanotechnology and gain basic knowledge on various synthesis and characterization techniques involved in Nanotechnology
CO2	Understand the general types and different classes of Nanomaterials
CO3	Apply the knowledge on different properties of Nanomaterials and selection of material for the specific purpose of application.
CO4	Understand and apply the knowledge of different characterization tools and characterization of Nanomaterials
CO5	Apply the basic knowledge about the wide applications of nanotechnology in various technological fields.
CO6	Understand about different energy technology

TEXT BOOKS

T1	Köhler, Michael, and Wolfgang Fritzsche. Nanotechnology - An Introduction to Nanostructuring Techniques 2nd ed. Wiley.
T2	T. Pradeep, Nano: The Essentials – Understanding Nano Science and Nano Technology, McGraw-Hill
T3	A. K. Bandyopadhyay, Nano Materials, New Age International Publishers.
T4	M. H. Fulekar, Nanotechnology - Importance and applications. I.K. International publishing house pvt. ltd

REFERENCE BOOKS

R1	B.S. Murty, P. Shankar, Baldev Raj, James Murday, Textbook of Nanoscience and Nanotechnology, Springer Berlin Heidelberg
R2	B. Bhushan, Springer Handbook of Nano Technology

B.E MECHANICAL ENGINEERING

		L	T	P	C
19MEOE001	**ENGINEERING DRAWING**	**2**	**0**	**2**	**3**

COURSE OBJECTIVES

- To have the knowledge of interpretation of dimensions of different quadrant projections.
- To understand the basic principles of engineering drawing.
- To have the knowledge of generating the pictorial views

PRE-REQUISITES

Nil

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3									3	
CO2	3	2		3				2					3	
CO3	3	3		3									3	
CO4	3	2		3				2					2	
CO5	3	2		3									3	

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO ENGINEERING DRAWING 12

. Principles of engineering graphics and theirsignificance – drawing instruments and their use – conventions in drawing – lettering – BISconventions. Dimensioning rules, geometrical construction**CURVES USED IN ENGINEERING PRACTICE AND THEIR CONSTRUCTIONS**: Conic Sections,Special Curves-Cycloids, Epicycloids, and Hypocycloids.

UNIT II ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY 12

Principles oforthographic projections – conventions – first and third angle projections. Projections of points andlines inclined to both the planes.

UNIT III PROJECTIONS OF PLANES AND SOLIDS 12

Projections of regular planes, inclined to both planes.Projections of regular solids inclined to both planes.

UNIT IV DEVELOPMENT OF SURFACES 12

Development of surfaces of right, regular solids – development ofprisms, cylinders, pyramids, cones and their parts.

UNIT V ISOMETRIC PROJECTIONS 12

Principles of Isometric Projections-Isometric Scale- Isometric Views-Conventions-Plane Figures, Simple and Compound Solids.**TRANSFORMATION OF PROJECTIONS**: Conversion of isometric Views to Orthographic Views.Conversion of orthographic views to isometric projections vice-versa

Total:60 Hours

COURSE OUTCOMES

On completion of this course students will be able to

CO1 : Prepare and understand drawings.

CO2 : Identify various D curves used in Engineering Drawing and their applications.

CO3 : Use the principles of orthographic projections.

CO4 : By studying about projections of solids students will be able to visualize three dimensionalobjects and that will enable them to design new products.

CO5 : Design and fabricate surfaces of different shapes.

TEXT BOOKS

T1. BasantAgarwal, "Engineering Drawing", TMH.

T2. Jolhe, Dhananjay, "Engineering Drawing: With an Introduction to CAD", Tata McGrawHill, India. 2006.

REFERENCE BOOKS

R 1. N. D. Bhat, "Engineering Drawing" Charotar Publications, New Delhi., 2006.

R2. Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. International Publishers, 2007

		L	T	P	C
U19MEOE002	**MODERN MANUFACTURING TECHNIQUES**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- To understand the various advancements in casting processes
- To learn about the different types of welding techniques.
- To understand the principles and process of forming.
- To understand the significance of different advancements such as CAE in manufacturing.
- To learn about the mechanics of high speed machining.

PRE-REQUISITES

1. Fundamentals of manufacturing processes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2		2		2		2		2			2	
CO2				1									1	
CO3		1		2									2	
CO4	1	1		1		1				1			1	
CO5	2			1		1		2					1	

THEORY COMPONENT CONTENTS

UNIT I ADVANCED CASTING PROCESSESES 9

Expendable-Mold - shell mould casting, Vacuum Mould casing, investment casting, plaster-mold and ceramic-mold casting, Permanent-Mold casting processes - squeeze casting and semisolid metal casting, centrifugal casting, uses of Rapid Prototyping to produce pattern, process selection - dimensional tolerances for various casting processes and metals.

UNIT II ADVANCED WELDING PROCESSES 9

Electron beam welding, laser beam welding, Solid-State welding - diffusion welding, friction welding, ultrasonic welding, physics of welding, design considerations in welding, NDT methods for testing.

UNIT III ADVANCED FORMING PROCESSES 9

Material behavior in metal forming, temperature in metal forming, strain rate sensitivity, friction and lubrication in metal forming, bulk deformation processes, sheet metalworking, HERF, hydro forming, explosive forming, magnetic forming process

UNIT IV APPLICATION OF CAE IN MANUFACTURING 9

Need for CAE in manufacturing, simulation of molten metal flow using CAE Techniques, solidification process in casting, inspections of casting. Thermal analysis of Heat-Affected Zone (HAZ), analysis of forging process using CAE, CL data generation for machining process.

UNIT V HIGH-SPEED MACHINING 9

High-Speed machining centers, high-speed spindles, spindle sped, feed rate, cutting velocity, surface finish, selection of process parameters, ultra-high-speed machining centers, hard machining.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should have the

CO1 : Use appropriate casting technique to develop a given component

CO2 : Make the right choice of welding technique as per the required application

CO3 : Understand about the different significant factors in forming

CO4 : Formulate real time problems with the help of computer simulation tools

CO5 : Implementing the probable capabilities of artificial intelligence to develop end user products such as robots.

TEXT BOOKS

T1. Mikell P Grover "Principles of Modern Manufacturing (SI Version)" John Wiley & Sons, 2014.

T2. Paul DeGarmo E, Black J T and Ronald A Kohjer, "Materials and Processes in Manufacturing, John Wiley India, 2011.

REFERENCE BOOKS

R 1. Philip F Ostwald and Jairo Munoz, "Manufacturing Processes and Systems" John Wiley India, New Delhi, 2013.

R2. Kaushish J P, "Manufacturing Processes", Prentice Hall India, 2013.

R3. Sanjay K Mazumdar, "Composite Manufacturing: Materials, Product and Process Engineering", CRC Press, 2010.

U19ENOE01	ENGLISH for COMPETITIVE EXAMS (Common to ALL)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To prepare learners to face the challenges of regular/online competitive exams I the English language globally.
- To enable students to prepare for competitive exams of various kinds especially meant for testing ability in the English language.
- To introduce students to the common question types asked in competitive examinations concerning English- grammar, vocabulary, comprehension, and other significant topics.
- To help the students to overcome the fear of English as a compulsory subject in various competitive exams.
- To encourage students to appear and prepare for the competitive exams.

PRE-REQUISITES: Nil

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							2	2	2	3		2	1	
CO2								1	2	3		2	1	
CO3						2		2	3	3		2	1	
CO4							3	2	1	3		3	1	
CO5						3	3	3	3	3		3	1	

UNIT I **9**

TypesofSentences - Sentencecorrection -Sentencesequence –Word Reordering - Data Interpretation: Tree Diagram, Flow Chart, Table, Line Graph – Discourse Markers – Identifying the exams interested to appear for - Online Course: Udemy, Edx, Future Learn

UNIT II **9**

Reading Comprehension: Focus on different levels of Comprehension- Literal, Inferential, Analytical, and Critical reasoning – Identifying keywords and signal words, decoding the building blocks of a passage, understanding the jargon and double distractors – Error Spotting Rules - IdentificationCommonErrors

UNIT III **9**

Listening Comprehension: Micro skills and Macro skills of Listening – Idioms and Phrases- Homonyms and Homophones – Collocations- Synonyms and Antonyms: Banking, Indian Constitution, Education, Corporate, and Higher Education - Para jumbles

UNIT IV **9**

Speaking: Presentation and Public: Record of videos – Verbal Ability; Sentence Completion, and Verbal analogies –Confirmation of registering for competitive exams.

UNIT V **9**

Speech Project – Time Management – Stress Management –Standard Assessment: 5 Mock Tests

Total: 45 HOURS

COURSE OUTCOME

At the end of the course, students should be able to

CO1	Confidently use the English language at an advanced level sharing their points of view with effective conclusions.
CO2	Construct correct sentences with the advanced vocabulary of the fields like Banking, Indian polity, Education, Corporate, etc.
CO3	Read accurately using contextual, analytical thinking and logical thinking skills
CO4	Aware of the opportunities available in the government and private sectors
CO5	Demonstrate excellent Time Management skills with regard to various competitive exam patterns

OPEN ELECTIVE II

B.TECH AGRICULTURAL ENGINEERING

		L	T	P	C
U19AEOE003	**Introduction to Bio-Energy**	3	0	0	3

COURSE OBJECTIVES

To introduce to the students the concepts of bio energy resources

- To expose the students to types of energy resources
- To enhance knowledge on estimation of bio energy plants.
- To expose the students to bio fuel production.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				2	2						1	
CO2	3	2				2	2						1	
CO3	3	2				2	2						1	
CO4	3	2				2	2						1	
CO5	3	2				2	2						1	
CO6	3	2				2	2						1	

UNIT I BIO RESOURCE - AN INTRODUCTION 9

Bio resource – origin – biomass types and characteristics- biomass conversion technology- Biodegradation - steps in biogas production- parameters affecting gas production- Types of biogas plants- Construction details- operation and maintenance.

UNIT II BIO ENERGY 9

Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics –Biocatalysis –Kinetics of product formation.

UNIT III BIO REACTORS AND FERMENTORS 9

Bio reactors/ fermentors – Batch type – continuous stirred tank reactors- Biological waste water treatment- Activated sludge process- Down stream processing-Recovery and purification of products.

UNIT IV ALCOHOL PRODUCTION 9

Alcohol ethanol production - Acid hydrolysis - enzyme hydrolysis-Methanol synthesis - Antibiotics- enzymes- principles of thermochemical conversion – combustion - pyrolysis- Gasification – types of gasifiers

UNIT V **ENERGY AND ENVIRONMENT** **9**

Principles of operation- chemical reaction- cleaning and cooling - Utilization- Improved wood burning stove - Energy plantations- Biomass briquetting - co generation- Impact on Environment – Bioenergy policy.

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Understanding the importance of bio resources .

CO2 Ability to classify the bio energy and characteristics of bio energy.

CO3 Knowledge in bio reactors and fermentors.

CO4 Ability to gain knowledge in Alcohol production process

CO5 Understanding the importance of Energy and Environment

CO6 Knowledge in capturing and applying bioenergy on replacement of fossil fuels.

TEXT BOOKS:

T1: Rai G.D,Non conventional sources of Energy, Khanna publishers, New Delhi, 1995.

T2: Bouley James .E & David Follis - Biochemical Engineering Fundamentals Mc Graw-Hill publishing company, Tokyo.1986

REFERENCE BOOKS:

R1: Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986

R2: Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.

R3: Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. Technology and application of biogas. Jain Brothers, New Delhi.

R4: Mathur,A.N.and Rathore,N.S.1993.,Biogas production Management and Utilisation. Himanshu Publication. New Delhi

U19AEOE004 **ROBOTICS IN AGRICULTURE**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce the overview of robotic systems and their dynamics
- To impart knowledge on system stability
- To acquire knowledge on joint space and task space control schemes
- To understand the concept of nonlinear control and observer schemes

PREREQUISITES: NIL

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												1	
CO2	3												1	
CO3	3	2	2	2									1	
CO4	3	2	2	2									1	
CO5	3	3	2	2									1	
CO6	2	3	2	1									1	

UNIT I **INTRODUCTION AND OVERVIEW OF ROBOTIC SYSTEMS AND THEIR DYNAMICS** **10**

Forward and inverse dynamics. Properties of the dynamic model and case studies. Introduction to nonlinear systems and control schemes.

UNIT II **SYSTEM STABILITY AND TYPES OF STABILITY** **8**

Lyapunov stability analysis, both direct and indirect methods. Lemmas and theorems related to stability analysis.

UNIT III **JOINT SPACE AND TASK SPACE CONTROL SCHEMES** **10**

Position control, velocity control, trajectory control and force control.

UNIT IV **NONLINEAR CONTROL SCHEMES** **9**

Proportional and derivative control with gravity compensation, computed torque control, sliding mode control, adaptive control, observer based control, robust control and optimal control

UNIT V **NONLINEAR OBSERVER SCHEMES** **8**

Design based on acceleration, velocity and position feedback. Numerical simulations using software packages namely MATLAB/MATHEMATICA.

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Understand basic concept of robotic systems and their dynamics.

CO2 Analyze system stability and types of stability

CO3 Know about joint space and task space control schemes

CO4 Understand the concept of nonlinear control and observer schemes

CO5 Gain knowledege on farm management and financial analysis

CO6 Familiarize with budgeting and cost estimation for farm layout

TEXT BOOKS:

T1: R Kelly, D. Santibanez, LP Victor and Julio Antonio, ―Control of Robot Manipulators in Joint Space‖, Springer, 2005.

T2: A Sabanovic and K Ohnishi, ―Motion Control Systems‖, John Wiley & Sons (Asia), 2011

REFERENCE BOOKS:

R1: R M Murray, Z. Li and SS Sastry, ―A Mathematical Introduction to Robotic Manipulation‖, CRC Press, 1994.

R2: J J Craig, ―Introduction to Robotics: Mechanics and Control, Prentice Hall, 4th Ed, 2018.

B.E BIOMEDICAL ENGINEERING

		L	T	P	C
U19BMOE003	**HOSPITAL MANAGEMENT SYSTEM**	**3**	**0**	**0**	**3**

Course Objective

The student should be made:

- To understand the fundamentals of hospital administration and management.
- To know the market related research process
- To explore various information management systems and relative supportive services.
- To learn the quality and safety aspects in hospital.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3		1	2				1		2	2
CO2	2	3	3	3		1	3				1		3	2
CO3	2	3	3	3		1	3				1		3	3
CO4	3	2	3	3		1	2				1		2	3
CO5	2	2	3	3		1	2				1		2	2
CO6	2	2	3	3		1	2				1		2	2

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio Medical Waste Management.

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL 9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS 9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES 9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department –Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL 9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

TOTAL: 45 HOURS

Course Outcomes

At the end of the course, learners will be able to:

CO1: Explain the principles of Hospital administration.
CO2: Identify the importance of Human resource management.
CO3:List various marketing research techniques.
CO4: Identify Information management systems and its uses.
CO5: Understand safety procedures followed in hospitals
C06: Analyze the quality and safety aspects in hospital.

TEXT BOOKS

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006.
2. G.D.Kunders, ―Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

REFERENCE BOOKS

1. Cesar A.Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger, ―Handbook of Health Care Human Resources Management‖, 2nd edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3. Peter Berman ―Health Sector Reform in Developing Countries‖ - Harvard University Press, 1995.
4. William A. Reinke ―Health Planning For Effective Management‖ - Oxford University Press.1988
5. Blane, David, Brunner, ―Health and SOCIAL Organization: Towards a Health Policy for the 21st Century‖, Eric Calrendon Press 2002.
6. Arnold D. Kalcizony & Stephen M. Shortell, ―Health Care Management‖, 6th Edition Cengage Learning, 2011.

U19BMOE004 BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

Course Objective

The student should be made:

To impart knowledge of the principle of operation and design of sensory equipment's.

To render a broad and modern account of neurological, muscular, cardiological and respiratory instruments.

To introduce idea about instrumentation in patient care and diagnosis.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3						2	2	2	3	3
CO2	3	3	3	3						2	3	2	3	3
CO3	3	3	3	3						2	2	3	3	3
CO4	3	3	3	3						2	2	2	3	3
CO5	3	3	3	3						2	3	2	3	3
CO6	3	3	3	3						2	2	2	3	3

UNIT I RECORDING OF BIOSIGNALS 9

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, Lead configuration, 12 lead ECG machine circuit, common mode and interference reduction circuits, Vector cardiograph EEG – 10-20 electrode system. EMG– Recording, Electro encephalogram, Magneto encephalogram, EOG & ERG: origin, measurement of EOG, electroretinogram

UNIT II SENSORY INSTRUMENTATION 9

Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Hearing and speech aids: conductive and nervous, hearing aids- Types, constructional and functional characteristics. Cochlear implants-Need, constructional details, speech trainer.

UNIT III CARDIAC EQUIPMENTS 9

Normal and abnormal ECG waveform, diagnosis interpretation, cardiac pacemaker-external pacemaker, implantable pacemaker, different types of pacemakers, fibrillation, defibrillator, AC defibrillator, DC defibrillator, electrodes, synchronised and unsynchronised types. EEG diagnostic interpretation, recording and analysis of EMG waveforms.

UNIT IV RESPIRATORY MEASUREMENT SYSTEM 9

Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer – Airway resistance measurement, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators – Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT V ADVANCED DEVICES **9**

Cardiac pacemakers and modern stimulators, Hemodyalysis ventilators, incubators, drug delivery devices, surgical instruments, Therapeutic application of laser, Neonatal Monitoring.

Total:45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Demonstrate the principle of operation and design of sensory equipments

CO2: Determine the basic parameters of the equipment used in patientdiagnosis

CO3: Analyze the broad and modern account of neurological equipments.

CO4: Illustrate the principle and working of muscular and respiratory instruments

CO5: Impart knowledge of the principle of operation and design of sensory equipment's

CO6: Understand a broad and modern account of neurological, muscular, cardiological and respiratory instruments

TEXTBOOKS:

T1 SiamakNajarian, Javad Dargahi, Ali AboueiMehrizi, ―Artificial Tactile Sensing in Biomedical Engineering‖,McGraw Hill publication,2009

T2 Martin Grunwald, ―Human HapticPerception‖, Birkhaeuser Verlag AG, Boston Basel Berlin publication,2008

REFERENCE BOOKS:

R1 Abdulmotaleb El Saddik, Mauricio Orozco, Mohamad Eid, Jongeun Cha,―Haptics Technologies: Bringing touch to multimedia‖, Springer,2011

R2 MyerKutz.,―BiomedicalEngineeringandDesignHandbook‖Vol2,McGrawHill

U19BTOE003 ANALYTICAL METHODS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

Course Objectives

- To inculcate the entrepreneurship spark among the student community by converting their research ideas into commercial products
- To develop the entrepreneurial skill in the field of biotechnology
- To study the Business strategy and Technology Transfer

Course Outcomes

At the end of the course, learners will be able to

CO1. Learn the different bio potential and its propagation.
CO2. get Familiarize the different electrode placement for various physiological recording
CO3. design bio amplifier for various physiological recording
CO4. understand various technique non electrical physiological measurements
CO5. Understand the different biochemical measurements
CO6. Characterize and analyze various macromolecules

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3			2										2
2	3	1	2	1		1							1	2
3	3	2	3										1	1
4	2	2	3											2
5	2	2	3			3								
6	2	2												

UNIT I SPECTROMETRY 9

Properties of electromagnetic radiation- wave properties – components of optical instruments-Sources of radiation – wavelength selectors – sample containers – radiation transducers -Signal process and read outs – signal to noise ratio – sources of noise – Enhancement of signal to noise – types of optical instruments – Applications.

UNIT II MOLECULAR SPECTROSCOPY 9

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beers law – Instrumentation – Applications -Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications - Theory of Raman spectroscopy – Instrumentation – applications.

UNIT III NMR AND MASS SPECTROMETRY 9

Theory of NMR — chemical shift- NMR-spectrometers – applications of 1H and 13C NMR-Molecular mass spectra – ion sources. Mass spectrometer. Applications of molecular mass -Electron paramagnetic resonance- g values – instrumentation.

UNIT IV SEPARATION METHODS 9

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography principles of GC and applications – HPLC- Capillary electrophoresis – Applications.

UNIT V ELECTRO ANALYSIS AND SURFAVE MICROSCOPY 9

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry - Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

TOTAL: 45 HOURS

TEXT BOOKS:

1. Skoog, D.A. F. James Holler, and Stanky, R.Crouch Instrumental Methods of Analysis.Cengag Learning , 2007
2. Willard, Hobart, etal., Instrumental Methods of Analysis. VIIth Edition, CBS, 1986
3. Haven, Mary C., etal., Laboratory Instrumentation .IVth Edition, John Wiley, 1995.

U19BTOE004 **INDUSTRIAL WASTE MANAGEMENT** **L T P C**
3 0 0 3

Course Objectives

- To emphasize on the importance of waste management in the industries

Course Outcomes

At the end of the course, learners will be able to

- CO1. This course will make the students to design biological treatment units
- CO2. To undertake projects on biological wastewater treatment
- CO3. To design the treatment plants with fundamental understanding
- CO4. Be familiar with sampling of wastes.
- CO5. The students will undertake projects related to waste management.
- CO6. Understand various case studies related to waste management

Course Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3										2	
2	3	2												
3	3	3	3	2	2	2		1	3					2
4	3	1	1			1		1						1
5	3	3	2	1	2			1						1
6	3	3	2	1	2			1						1

UNIT I **INTRODUCTION TO WASTE MANAGEMENT** **9**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

UNIT II **CLEANER PRODUCTION** **9**

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

UNIT III **POLLUTION FROM MAJOR INDUSTRIES** **9**

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

UNIT IV **REACTORS USED IN WASTE WATER TREATMENT** **9**

Theory: Modeling of Ideal Attached Growth Reactors, Bio-film Modeling Aerobic Growth of Biomass

in PackedTowers, Aerobic Growth of Heterotrophs in Rotating Disc Reactors, Fluidized Bed Biological Reactors.

UNIT V CASE STUDIES 9

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries- Textiles- Pulp and PaperMetal finishing – Sugar and Distilleries.

TOTAL: 45 HOURS

TEXT BOOKS

1. Bhatia, Handbook of Industrial Pollution and Control, Volume I and II, CBS Publishers, New Delhi, 2003
2. Mahajan, S.P.Pollution Control in Process Industries, Tata McGraw Hill Publishing Co., New Delhi, 1991.

U19CEOE003	REMOTE SENSING AND GIS	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Understanding about the basic concepts of remote sensing and analyse satellite imagery andextract the required units.
- Usage of thematic maps for various application.

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3	1	2	3	3		1			3	2	
2	3	2	2		3	1	3					2	2	
3	2	3	2			3	3					2	2	
4	2	2				3	3		1			2	2	
5	1	1			3	3	3		1			1	2	
6	2	2			3	3	3		-			2	2	

UNIT I REMOTE SENSING 9

Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration

and Image and False colour composite, elements of visual interpretation techniques.

UNIT II REMOTE SENSING PLATFORMS AND SENSORS 9

Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms – IRS, sensors, sensor resolutions, Basics of digital image processing - introduction to digital data, systematic errors and non-systematic errors, Image

enhancements, image filtering.

UNIT III GEOGRAPHIC INFORMATION SYSTEM 9

Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute Data

- Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management,Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected

coordinate Systems. UTM Zones.

UNIT IV DATA MODELS 9

Vector data model: Representation of simple features – Topology and its importance; coverage and itsdata structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model,

Types of Raster Data, Raster Data Structure, Data conversion.

UNIT V INTEGRATED APPLICATIONS OF REMOTE SENSING AND GIS **9**

Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services and Its Applications.

Total: 45 Hours

Course Outcomes:

At the end of the course, students should be able to,

CO1: Understand the principles of aerial and satellite remote sensing, Able to comprehend theenergy interactions with earth surface features.

CO2: Understand the basic concepts of remote sensing and know about different types of satelliteand sensors.

CO3: Illustrate spatial and non-spatial data features in GIS and understand the map projections and coordinates systems

CO4: Collect data and delineate various elements from the satellite imagery using their spectral signature.

CO5: Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.

Textbooks:

T1. Anji Reddy M., "Remote sensing and Geographical information system", B.S. Publications 2008.

T2. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13:
9788173716287, University Press 2008.

T3. Basudeb Bhatta, "Remote sensing and GIS", Oxford University Press 2011

Reference Books:

R1. Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006

R2. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical
Information system", Oxford Publications 2004.

R3. S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005.

U19CEOE004	AIR POLLUTION AND CONTROL ENGINEEIRNG	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims to provide the students,

- Knowledge on the principle and design of control of Indoor/ particulate / gaseous air pollutant and its emerging trends.

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2				1								2	
2	2	1			3								2	
3	3			1	2								2	
4	2		1	1	2								2	
5	2	1	2	1									2	
6	2				1								2	

UNIT I **INTRODUCTION** **9**

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards

UNIT II **METEROLOGY** **9**

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns - Atmospheric Diffusion Theories – Dispersion models, Plume rise

UNIT III **CONTROL OF PARTICULATE CONTAMINANTS** **9**

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

UNIT IV **CONTROL OF GASEOUS CONTAMINANTS** **9**

Factors affecting Selection of Control Equipment – Working principle - absorption, Adsorption, condensation, Incineration, Bio filters – Process control and Monitoring.

UNIT V INDOOR AIR QAULITY MANAGEMENT 9

Sources, types and control of indoor air pollutants, sick building syndrome and building related illness Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

Total: 45 Hours

Course Outcomes:

At the end of the course, students should be able to,

CO1: Understanding of the nature and characteristics of air pollutants and basic concepts of air quality management.

CO2: Understand the type and nature of air pollutants, the behaviour of plumes and relevant meteorological determinants influencing the dispersion of air pollutants.

CO3: Ability to identify, formulate and solve air and noise pollution problems.

CO4: Ability to design stacks and particulate air pollution control devices to meet applicable standards.

CO5: Ability to select control equipment's.

CO6: Ability to ensure quality, control and preventive measures

Textbooks:

T1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science media LLC,2004.

T2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017. **T3.** Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

T1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science media LLC,2004.

Reference Books:

R1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
R2. Arthur C. Stern, "Air Pollution (Vol. I – Vol. VIII)", Academic Press, 2006.
R3. Wayne T. Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.

B.E COMPUTER SCIENCE ENGINEERING

		L	T	P	C
U19CSOE003	**DATA STRUCTURES AND ALGORITHMS**	3	0	0	3

COURSE OBJECTIVES

- Understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

PREREQUISITES: NIL

Course Articulation Matrix : 3- High, 2- Medium, 3- Low														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													1
CO2	3													2
CO3	3	2	2	2										2
CO4	3	2	2	2										2
CO5	3	3	2	2										1
CO6	2	3	2	1										1

UNIT I ALGORITHM ANALYSIS, LIST ADT 11

Algorithms: Notation - analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array-based implementation – linked list implementation – singly linked lists- applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

UNIT II STACKS AND QUEUES 9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

UNIT III SEARCHING AND SORTING ALGORITHMS 8

Divide and conquer methodology - Searching: Linear Search - Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort. Analysis of searching and sorting techniques. Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

UNIT IV TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT – applications of trees. Heap – applications of heap. Implementation of Binary search tree and its operations, tree traversal methods, finding height of the tree using C. Implementation of heap and heap sorting using arrays in C

UNIT V **GRAPHS** **8**

Definition – Representation of Graph – Breadth-first traversal - Depth-first traversal – Dynamic programming Technique – Warshall's and Floyd's algorithm – Greedy method - Dijkstra's algorithm – applications of graphs. Implementation of graph, graph traversal methods, finding shortest path using Dijkstra's algorithm in C

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Define data structures like array, stack, queues and linked list.

CO2 Explain insertion, deletion and traversing operations on data structures.

CO3 Identify the asymptotic notations to find the complexity of an algorithm.

CO4 Compare various searching and sorting techniques.

CO5 Choose appropriate data structure while designing the algorithms.

CO6 Design advance data structures using non linear data structures.

TEXT BOOKS:

T1: Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997..

T2: Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988.

REFERENCE BOOKS:

R1: Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983

R2: S.Sridhar, "Design and Analysis of Algorithms", First Edition, Oxford University Press. 2014

R3: Byron Gottfried, Jitender Chhabra, "Programming with C" (Schaum's Outlines Series), Mcgraw Hill Higher Ed., III Edition, 2010

R4: Yashvant Kanetkar, "Data Structures Through C", BPB publications, II edition, 2003

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

U19ECOE003 CONSUMER ELECTRONICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- .Understand troubleshooting in loudspeakers and Microphones
- Gain knowledge on television signals and components
- Gain knowledge on various types of audio recording and playback techniques
- Understand communication systems
- Understand principle of working of home appliances

PREREQUISITES

- Basic Electronics
- Electronic devices

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2							2	1	2	
CO2	3	2	2	2							2	1	2	
CO3	3	2	2	2							2	1	2	
CO4	3	2	2	2							2	1	2	
CO5	3	2	2	2							2	1	2	
CO6	3	2	2	2							2	1	3	

UNIT I LOUDSPEAKERS AND MICROPHONES 9

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones

UNIT II TELEVISION STANDARDS AND SYSTEMS 9

Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL,SECAM - Components of a Remote Control.

UNIT III OPTICAL RECORDING AND REPRODUCTION 9

Audio Disc – Processing of the Audio signal – read out from the Disc –Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems.

UNIT IV TELECOMMUNICATION SYSTEMS 9

Telephone services - telephone networks – switching system principles –PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems

UNIT V **HOME APPLIANCES** **9**

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1 Troubleshoot different types of microphones and speakers

CO2: Maintain audio systems

CO3: Analyse composite video signal used in TV transmission

CO4: Troubleshoot TV Receivers

CO5: Maintain various home appliances

TEXT BOOKS:

T1: S.P.Bali, "Consumer Electronics", Pearson Education, 2005.

T2: Gupta. R.G, " Audio Video Systems principles maintenance and trouble shooting, Mc graw Hill, New Delhi, India, 2010

REFERENCE BOOKS:

R1: Dhake .A.M, " Television and Video Engineering", Mc graw Hill, New Delhi, India, 2006

R2: Modern television practice: Transmission, reception and applications, New age International, New Delhi, 2015

U19ECOE004 **ADVANCED WIRELESS COMMUNICATION**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To expose the students to the importance of improving capacity of wireless channel using MIMO
- To enable understanding of channel impairment mitigation using space-time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems

PREREQUISITES

- Basic concepts of communication theory
- Basics of Computer Networks
- Limits and Continuity
- Basic concepts of Differentiation
- Basic concepts of Integration

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2							2	1	2	
CO2	3	2	2	2							2	1	2	
CO3	3	2	2	2							2	1	2	
CO4	3	2	2	2							2	1	2	
CO5	3	2	2	2							2	1	2	
CO6	3	2	2	2							2	1	2	

UNIT I **CAPACITY OF WIRELESS CHANNELS** **9**

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to the TX – capacity of deterministic channels, Random channels and frequency selective channels.

UNIT II **RADIO WAVE PROPAGATION** **9**

Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods

UNIT III **SPACE TIME BLOCK CODES** **9**

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

UNIT IV **SPACE TIME TRELLIS CODES** **9**

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

UNIT V **LAYERED SPACE TIME CODES** **9**

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

Total: 45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world

CO2: Apply the knowledge about the importance of MIMO in today's communication

CO3: Appreciate the various methods for improving the data rate of wireless communication system

CO4: Explain the working of layered space time transmitter and receiver

CO5: Describe various radio propagation techniques

TEXT BOOKS:

T1: Mohinder Jankiraman, Space-time codes and MIMO systems, Artech House, Boston, London . www.artech house.com, ISBN 1-58053-865-7-2004

T2: Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.

REFERENCE BOOKS:

R1: David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication‖, Cambridge University Press, 2005.

R2: Sergio Verdu ― Multi User Detection‖ Cambridge University Press, 1998

B.E ELECTRICAL AND ELECTRONICS ENGINEERING

U19EEOE003 SENSORS AND TRANSDUCERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand the concepts of measurement technology
- To learn the various sensors used to measure various physical parameters
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		3		3	2			2		2		2	
CO2	2		3		3	2			2		2		3	
CO3	2		3		3	2			2		2		2	
CO4	2		3		3	2			2		2		3	
CO5	2		3		3	2			2		2		2	
CO6	2		3		3	2			2		2		3	

UNIT I INTRODUCTION 9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Total: 45 HOURS

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1:	Expertise in various calibration techniques and signal types for sensors.
CO2:	Understand about the various sensors
CO3:	Apply the various sensors in the Automotive and Mechatronics applications
CO4:	Study the basic principles of various smart sensors.
CO5:	Implement the DAQ systems with different sensors for real time applications
CO6	Understand about different sensors with applications

TEXT BOOKS:

T1: Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.

T2: Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCE BOOKS:

R1: Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2010.

R2: John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999

R3: Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press,2015.

U19EEOE004 **ENERGY TECHNOLOGY**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Students will gain knowledge about different energy scenario
- To understand about the conventional energy sources.
- To understand about the non-conventional energy sources.
- To understand about the biomass energy sources.
- To learn the concept of energy conservation

PREREQUISITES

- Fundamentals of electrical engineering
- Basic concepts of Differentiation
- Basic concepts of Integration

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3		3		2		2		2		2	
CO2	2	1	3		3		2		2		2		2	
CO3	2	1	3		3		2		2		2		2	
CO4	2	1	3		3		2		2		2		3	
CO5	2	1	3		3		2		2		2		2	
CO6	2	1	3		3		2		2		2		3	

UNIT I **ENERGY** **9**

Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives.

UNIT II **CONVENTIONAL ENERGY** **9**

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants

UNIT III **NON-CONVENTIONAL ENERGY** **9**

Solar energy, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, energy plantations. Wind energy, types of windmills, types of wind rotors, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV **BIOMASS ENERGY** **9**

Biomass origin - Resources – Biomass estimation. Thermo chemical conversion – Biological conversion,– Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.

UNIT V ENERGY CONSERVATION 9

Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management.

Total: 45 HOURS

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1: Understand energy scenario in India

CO2: Understand conventional Energy sources,

CO3: Understand Non- conventional Energy sources,

CO4: Understand biomass sources and develop design parameters for equipment to be used in Chemical process industries

CO5: Understand energy conservation in process industries

CO6: Understand about different energy technology

TEXT BOOKS:

T1: Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.

T2: Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.

T3: Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

REFERENCE BOOKS:

R1: Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York.

R2: Handbook of Energy Audit by 7th edition Albert Thumann, P.E., C.E.M & William J Younger C.E.M, Faiment Press 2008

R3: El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.

ENGLISH

U19ENOE02	ENGLISH for EMPLOYABILITY SKILLS (Common to ALL)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To hone the employability-related communication skills of the students on the foundations built during Executive
- To assist students in becoming well-versed, responsible, creative communicators.
- To develop students' knowledge of communication skills in the structure, elucidation, and delivery of messages in diverse cultural and global communities; and
- To promote theoretical understanding and professional/personal practice of effective and ethical human communication between and within a broad range of contexts and communities.
- To write responses appropriately, organize ideas, and use vocabulary accurately
-

CO/PO MAPPING													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1							2	2	2	3		2	1	
CO2								1	2	3		2	1	
CO3						2		2	3	3		2	1	
CO4							3	2	1	3		3	1	
CO5						3	3	3	3	3		3	1	

PRE-REQUISITES: Nil

UNIT I **9**

SWOT Analysis – Perception Management – Positive Attitude – Empathy – Altruism – Self Management - Etiquette: Social, Dinner, Corporate, Telephone and Netiquette – Interview Skills

UNIT II **9**

Reading Comprehension: Technical passages –Kinds of sentences –Sentence correction – Error spotting – Idioms – Vocabulary: Jargon and Distractors – Punctuation errors – Online Course: Udemy, Edx, FutureLearn

UNIT III **9**

Letter writing: Formal Letters – Letters accepting Offers - Chart description – process description – Essays — Internship Reports

UNIT IV **9**

Self-Introduction - Talking about friends and Family –Resume Preparation: Single Page and Detailed– Persuasion Skills – Emotional Intelligence – Teamwork - Establishing Credibility: Understanding the Workplace – Body Language

UNIT V **9**

Industry Psychology: Characteristics of the workplace: Physical working conditions: Noise, Illumination, Colour, Music, Miscellaneous Factors; Work Schedules: Working Hours, Permanent Part-Time Employment, Flexible Work Schedules; Psychological and Social Issues - Stress management – Time management

Total: 45 HOURS

COURSE OUTCOME

At the end of the course, students should be able to

CO1	Be prepared for the personal interview through mock interviews while being aware of the various kinds of interviews.
CO2	Introspect & develop a planned approach towards his career & life in general.
CO3	Have clarity on his career exploration process and match his skills and interests with a chosen career path.
CO4	Explain the use of a functional and chronological resume.
CO5	Develop thinking ability and polish his expression in group discussions.

TEXT BOOKS

T1	Richards, C. Jack. Interchange Students Book-3 New Delhi: CUP, 2015.
T2	Skills for Employability, Dr. M. Sen Gupta, ISBN: 978-81-933819-1-5, 2020, First Edition
T3	Soft Skills & Employability Skills, SABINA PILLAI, AGNA FERNANDEZ, Cambridge, ISBN: 9781316981320, 1316981320, 2017

REFERENCE BOOKS

R1	Bridging the Soft Skills Gap: How to Teach the Missing Basics to Todays Young, ASIN : 8126563435, ISBN-10 : 9788126563432, ISBN-13 : 978-8126563432, Pan Macmillan India; 2016
R2	Soft Skills Training: A workbook to develop skills for employment, Amazon Digital Services; Large edition, 2012, ISBN-10: 1468096494, ISBN-13 : 978-1468096491
R3	https://www.sirc-icai.org/images/cabf/Soft%20Skills%20&%20Personality%20Development.pdf
R4	http://worldwideuniversity.org/library/bookboon/soft-skills.pdf
R5	https://www.futurelearn.com/subjects/business-and-management-courses/soft-skills

WEB RESOURCES

W1	https://bharatskills.gov.in/pdf/E_Books/EmployabilitySkillsSWB2W.pdf
W2	https://link.springer.com/book/10.1007/978-3-319-75166-5
W3	https://cbseacademic.nic.in/web_material/Curriculum21/publication/secondary/Employability_Skills10.pdf
W4	https://www.oreilly.com/library/view/soft-skills-for/9781119875536/

B.TECH FOOD TECHNOLOGY

		L	T	P	C
U19FTOE003	**BEVERAGE TECHNOLOGY**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

Impart knowledge on processing and ingredients applied for beverage preparation according to the standard categorization of beverages. Based on the ingredients incorporated and type of processing method applied will give a classification of beverages. Sanitization schemes and quality control measures according to standards and regulations.

PREREQUISITES

- Basic classification of beverages in the market
- Storage and preparation of beverages
- Purpose of preparing beverages
- Market and trends in beverages sector

UNIT I INGREDIENTS IN BEVERAGES 9+3

Beverage-definition--ingredients- water, quality evaluation and raw and processed water, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nano-emulsions of flavors and colors in beverages, preservatives, emulsifiers and stabilizers.

UNIT II CARBONATED BEVERAGES 9+3

Procedures- ingredients- preparation of Syrup making, carbonation of soft drinks. Carbonation equipments and machineries- -containers and closures. low-calorie and dry beverages; isotonic and sports drinks; Fruit based carbonated beverages, carbonated water

UNIT III NON-CARBONATED BEVERAGES 9+3

Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy based beverages, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages. bottled. Water; mineral water, natural spring water, flavored water.

UNIT IV ALCOHOLIC BEVERAGES 9+3

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipment's used for brewing and distillation, wine and related beverages, distilled spirits

UNIT V SANITATION AND QUALITY CONTROL 9+3

Quality control, Filling-inspection and quality controls-sanitation and hygiene in beverage industry-Quality of water used in beverages threshold limits of ingredients. FSSAI, EFSA and FDA regulations

Total: 60 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Capable of formulating beverages using various ingredients.

CO2: Demonstrate various unit operations involved in the food beverage manufacturing

CO3: Understand the various production techniques in beverages

CO4: Evaluate the quality parameters of all beverages

CO5: Familiarize with food laws and regulations of beverages

CO6: Understand the natural and artificial colourants used in beverages

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2											1	
2	1	3											1	
3	1			3									2	
4					3			2					2	
5					3			2					1	
6	1	1		2									1	

TEXT BOOKS:

T1: Jagan Mohan Rao and K.Ramalakshmi (2011)"Recent trend in Soft beverages", Woodhead Publishing India Pvt Ltd.

T2: oulton, Christopher, and David Quain (2008) Brewing yeast and fermentation. John Wiley & Sons.

REFERENCE BOOKS:

R1: ui, Yiu H., et al., eds. (2004) Handbook of food and beverage fermentation technology. Vol. 134. CRC Press.

R2: itchell, Alan J. (199) "Formulation and Production Carbonated Soft Drinks". Springer Science & Business Media.

R3: oodroof, Jasper Guy, and G. Frank Phillips. (1981) Beverages: carbonated and noncarbonated. AVI Pub. Co

U19FTOE004	PROCESSING OF FOOD MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

lain the milling, extraction and manufacture of tremendous products from cereals, pulses and oil seeds. Summarize the production and processing methods of fruits and vegetables and to discuss the chemical composition, processing, production, spoilage and quality of milk and milk product. Outline the overall processes involved in the production of meat, poultry and fish products Review the production and processing methods of plantation and spice products

PREREQUISITES

- Need an idea of nature of food materials to be handled
- Prior storage conditions before processing the materials
- Basic handling techniques of materials
- Preparation of materials prior to processing

UNIT I CEREAL, PULSES AND OIL SEEDS TECHNOLOGY 9+3

Rice milling, Pulse milling, Wheat milling - Oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies - Pasta products -Tortilla - Method of manufacture.

UNIT II FRUITS AND VEGETABLE PROCESSING 9+3

Production of Fruits and vegetables in India, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing.

UNIT III DAIRY PROCESSING 9+3

Basic dairy terminology, composition, General tests at reception, Dairy Processing - Method of manufacture of Standardized, toned and double toned milk, milk powder - Equipment - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products – Ice cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk.

UNIT IV MEAT, POULTRY AND FISH PROCESSING 9+3

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Fish and other Marine Products Processing.

UNIT V PLANTATION PRODUCT TECHNOLOGY 9+3

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric

Total: **60 HOURS**

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Discuss the various processing technologies involved in cereal, pulses and oilseed technology

CO2: Demonstrate the major operations applied in fruits and vegetable processing

CO3: Illustrate the techniques involved in the processing of dairy products

CO4: List the overall processing of meat, poultry and fish processing

CO5: Outline the processing of spices and plantation products

CO6: Analyse the manufacturing methods involved in various byproducts of food materials

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2													
2	1	3		3											
3	1													1	
4						3			2					1	
5						3			2						
6	1	1		2											

3 - High, 2 - Medium, 1 – Low

TEXT BOOKS:

T1: Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3rd Edition. 2010.

T2: Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition. 2003.

REFERENCE BOOKS:

R1: Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23rd impression. 2016.

B.TECH INFORMATION TECHNOLOGY

		L	T	P	C
U19ITOE003	**FOUNDATION OF INFORMATION TECHNOLOGY**	3	0	0	3

COURSE OBJECTIVES

- Understand the basic concepts and terminology of information technology
- Identify the components of a computer system and their functions
- Describe different types of software and their applications
- Explain the principles of computer networking and internet technologies
- Understand the basics of database design and management
- Use IT effectively in personal and professional settings

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		3			2		2		3	2	3		
2	3		3			2		2		3	2	3		
3	3		3			2		2		3	2	3		
4	3		3			2		2		3	2	3		
5	3		3			2		2		3	2	3		
6	3		3			2		2		3	2	3		

UNIT I: Basics of Information Technology **9**

Internet: World Wide Web, Web servers, Web Clients, Web sites, Web Pages, Web Browsers, Blogs, News groups, HTML, Web address, E-mail address, URL, HTTP, FTP, downloading and uploading files from remote site; Services available on Internet: Information Retrieval, Locating sites using search engines and finding people on the net; Web Services: Chat, email, Video Conferencing, e-Learning, e-Banking, e-Shopping, e-Reservation, e-Governance, e-Groups, Social Networking

UNIT II: Information Processing Tools **9**

Office Tools: Database Management Tool: Basic Concepts and need for a database, Creating a database. DataTypes-Text, Number, Date, Time, Setting the Primary Key, Entering data into a database, Inserting and deleting Fields, Inserting and deleting Records, Field Size, Default Value, Creating Query using Design view.

UNIT III: Hyper Text Markup Language **9**

Introduction to Web Page Designing using HTML, Creating and saving an HTML document, accessing a web page using a web browser (Google Chrome, Internet Explorer, Mozilla Firefox, Opera, Apple Safari, Net scape Navigator);

Elements in HTML.

UNIT IV: XML 9

Introduction to XML, Difference between XML and HTML with respect to the following: Data separation, data sharing, document structure, tags, nesting of elements, attributes, values. XML Elements - Defining own tags in XML, root elements, child elements and their attributes; Comments in XML, White space and new line in XML, well formed XML documents, validating XML documents, XML Parser, Viewing XML documents in a web browser.

UNIT V: Societal Impacts of IT 9

Information Security: Virus, Worms, Trojans and Anti-Virus Software, Spyware, Malware, Spams, Data Backup and recovery tools and methods, Online Backups, Hacker and Cracker with regard to Computer Data and Applications, Social Networking Information security provisions in e-commerce, Benefits of ICT in Education, Healthcare, Governance, Virtual, School, emergence of Knowledge economy, Impact of ICT on Society: Knowledge based society, Infomania, Digital Unity and Digital Divide

Total: 45 HOURS

TEXT BOOKS

1. Introduction to Information Technology" by Turban, Rainer, and Potter (Wiley, 2015)
2. Discovering Computers" by Vermaat, Sebok, and Freund (Cengage Learning, 2019)

REFERENCE BOOKS

1. Computer Science Illuminated" by Nell Dale and John Lewis (Jones & Bartlett Learning, 2018)
2. Computer Science Illuminated" by Nell Dale and John Lewis (Jones & Bartlett Learning, 2018)

COURSE OUTCOMES:

At the end of the course students should be able to

CO1: Understand fundamental concepts, principles, and applications of information technology
CO2: Understand the different types of software and their applications
CO3: Understand the basics of database design and management.
CO4: Understand the role of information systems in organizations and their applications
CO5: Understand the principles of computer networking and internet technologies
CO6: Apply IT effectively in personal and professional settings.

		L	T	P	C
U19ITOE004	**WEB DESIGN AND MANAGEMENT**	3	0	0	3

COURSE OBJECTIVES

- To Learn the basic concepts in HTML, CSS, Javascript.
- To Understand the responsive design and development.
- To Understand the responsive design and development.
- To Design a Website with HTML, JS, CSS / CMS - Word press.

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		3		3	3	2		3		3	3		1
2	3		3		3	3	2		3		3	3		1
3	3		3		3	3	2		3		3	3		2
4	3		3		3	3	2		3		3	3		2
5	3		3		3	3	2		3		3	3		1
6	3		3		3	3	2		3		3	3		1

UNIT I: WEB DESIGN - HTML MARKUP FOR STRUCTURE 9

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5

UNIT II: CSS AND JAVASCRIPT 9

CSS - Formatting text - Colours and Background - Padding, Borders and Margins - Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation - Javascript - Using Java Script

UNIT III: RESPONSIVE WEB DESIGN 9

Sass for Responsive Web Design - Marking Content with HTML5 - Mobile-First or Desktop-First - CSS Grids, CSS Frameworks, UI Kits, and Flexbox for RWD - Designing small UIs by Large Finger - Images and Videos in Responsive Web Design - Meaningful Typography for Responsive Web Design

UNIT IV: WEB PROJECT MANAGEMENT 9

Project Life Cycle - Project Definition - Discovery and Requirements - Project Schedule and Budgeting - Running the project - Technical Documentation - Development ,Communicaton, Documentation - QA and testing -Deployment - Support and operations

UNIT V: PROJECT CASE STUDY 9

Using HTML, CSS, JS or using Opensource CMS like Wordpress, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project - Host and manage the project live in any public hosting.

Total: 45 HOURS

TEXT BOOKS

1. Jennifer Niederst Robbins, "Learning Web Design", O'REILLY 4th Edition
2. Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015
3. Justin Emond, Chris Steins, "Pro Web Project Management", Apress,2011

REFERENCE BOOKS

1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, edition 2014
2. Jon Duckett, Jack Moore, "JavaScript &JQuery: Interactive Front-End Web Development", John Wiley and Sons, edition 2014
3. Uttam K. Roy "Web Technologies" Oxford University Press, 13th impression, 2017
4. Wordpress - http://www.wpbeginner.com/category/wp-tutorials/

COURSE OUTCOMES:

At the end of the course students should be able to
CO1: Understand the principles of web design, including layout, color theory, typography, and user experience design.
CO2: Design Website using HTML CSS and JS
CO3: Design Responsive Sites
CO4: Manage, Maintain and Support Web Apps
CO5: Gain practical experience working on real-world web design projects, and learn how to collaborate with clients, stakeholders, and team members.
CO6:Develop an understanding of web analytics and digital marketing, and learn how to use data to improve website performance and user engagement**.**

B.E MECHANICAL ENGINEERING

		L	T	P	C
U19MEOE003	**AUTOMOBILE TECHNOLOGY**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- To gain knowledge on the automobile architecture and understand its performance.
- To learn about the significant parameters that determine the engine performance.
- To learn about the different types of transmission systems used in automobiles
- To understand the different components and mechanism of a suspension system
- To learn about the mechanism involved in operation of steering

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

PRE-REQUISITES

Nil

THEORY COMPONENT CONTENTS

UNIT I AUTOMOBILE ARCHITECTURE AND PERFORMANCE 9

Automotive components, subsystems and their positions- Chassis, frame and body, front, rear and four wheel drives, Operation and performance, Traction force and traction resistance, Power required for automobile- Rolling, air and gradient resistance.

UNIT II ENGINE ARCHITECTURE AND PERFORMANCE 9

Types of engine, multi valve engine, in-line engine, vee-engine, Petrol enginedirect, single point and multipoint injection, diesel engine-common rail diesel injection, supercharging and turbo charging, alternate fuels-ethanol and ethanol blend, compressed natural gas, fuel cells, hybrid vehicles, Engine Control Unit.

UNIT III TRANSMISSION SYSTEMS 9

Clutch : Types-coil spring and diaphragm type clutch, single and multi plate clutch, centrifugal clutch, Gear box : Types-constant mesh, sliding mesh and synchromesh gear box, layout of gear box, gear selector and shifting mechanism, overdrive, automatic transmission, Propeller shaft, universal joint, slip joint, differential and real axle arrangement, hydraulic coupling

UNIT IV SUSPENSION SYSTEM 9

Types-front and rear suspension, conventional and independent type suspension, leaf springs, coil springs, dampers, torsion bars, stabilizer bars, arms, air suspension systems.

UNIT V STEERING SYSTEM 9

Types of steering systems, Ackermann principle, Davis steering gear, steering gear boxes, steering linkages, power steering, wheel geometry-caster, camber toe-in, toe out etc., wheel Alignment and balancing.

Total: 45 Hours

COURSE OUTCOMES

At the end of the course students should have the ability to

CO1 : Apply the concepts of automobile architecture in an automobile assembly.

CO2 : Device the right choice of process parameters to fine tune the performance.

CO3 : Choose the right choice of transmission system as per the requirements

CO4 : Make the right choice of suspension system for the given application

CO5 : Visualize and understand the working mechanism of steering.

TEXT BOOKS

T1. Gupta .R.B, "Automobile Engineering ", SatyaPrakashan, 2009.

T2. Kirpal Singh, “Automobile Engineering Vol-I & II”, Standard publishers, New Delhi, 2011.

REFERENCE BOOKS

R 1. Julian Happian Smith, “An Introduction to Modern Vehicle Design”, Butterworth-Heinemann, New Delhi, 2002

R2. Crouse W H, “Automotive Transmissions and Power trains”, McGraw Hill Book Co., New Delhi, 1976.

R3 Heinz Heisler, “Vehicle and Engine Technology”, SAE International and Elsevier, 1999.

U19MEOE004	CAD/CAM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

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

PRE-REQUISITES

Engineering Drawing

THEORY COMPONENT CONTENTS

UNIT I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 9

. Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotation) windowing - view ports - clipping transformation.

UNIT II CURVES AND SURFACES MODELING 9

Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations. Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermitebicubic surface- Bezier surface and B-Spline surface- surface manipulations.

UNIT III NURBS AND SOLID MODELING 9

NURBS- Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations – constructive solid Geometry - comparison of representations - user interface for solid modelling.

UNIT IV VISUAL REALISM 9

Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.

UNIT V ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE 9

Assembly modeling - interferences of positions and orientation - tolerances analysis – mass property calculations - mechanism simulation. Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc– Communication standards.

Total:45 Hours

COURSE OUTCOMES

At the end of the course students should be able to

CO1 : Understand the fundamentals of computer graphics.

CO2 : Apply different techniques for geometric modelling.

CO3 : Apply different algorithm to create prismatic and lofted parts.

CO4 : Discuss tolerance analysis and mass property calculations.

CO5 : Explain data exchange standards and communication standards.

TEXT BOOKS

T1. David F. Rogers, James Alan Adams, "Mathematical elements for computer graphics", second edition, Tata McGraw-Hill edition.

T2. Ibrahim Zeid, "Mastering CAD/CAM", McGraw Hill, International Edition, 2007.

REFERENCE BOOKS

R 1. Donald Hearn and M. Pauline Baker, "Computer Graphics" Prentice Hall, Inc., 1992.

R2. William M Neumann and Robert F.Sproul, "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.

U19CHOE001	ENVIRONMENTAL SCIENCES	L	T	P	C
		3	0	0	3

Course Objective

The student should be made:

- To study the nature and facts about environment management
- To finding and implementing scientific, technological, economic and political solutions to environmental problems
- To study the interrelationship between living organism and environment
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To study the dynamic processes and understand the features of the earth's interior and surface
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3						2	
CO2						3	3						2	
CO3						3	3						2	
CO4						3	3						2	
CO5						3	3						3	
CO6						3	3						2	

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation

– hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes,etc

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes causedby agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternateenergy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources forsustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies
– role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, globalwarming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water(Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

Total:45 HOURS

COURSE OUTCOMES

At the end of the course students should be able to

CO1: Awareness on environmental factors

CO2: Finds scientific, technological, economic and political solutions to environmental problems

CO3: Knowledge on interrelationship between living organism and environment

CO4: Assess impact on the human world envision the surrounding environment, its functions and its value

CO5: Knowledge on the dynamic processes and understand the features of the earth's interior and surface

CO6: Understands the integrated themes and biodiversity, natural resources, pollution control and waste management.

TEXTBOOKS:

T1 Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

T2 Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCEBOOKS:

R1 Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.

R2 Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad, 2015.

R3 G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt, Ltd, Delhi, 2014.

R4 Rajagopalan.R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005

U19EDOE01 INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To give an idea about IPR, registration and its enforcement.

PREREQUISITES

- Fundamentals of Products

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		3	2		2			2			2	2	
CO2	1		3	2		2			2			2	2	
CO3	1		3	2		2			2			2	2	
CO4	1		3	2		2			2			2	2	
CO5	1		3	2		2			2			2	2	
CO6	1		3	2		2			2			2	3	

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

Total: 45 HOURS

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1: Ability to manage Intellectual Property portfolio to enhance the value of the firm.

CO.2: Ability to learn the registration of IPRs

CO.3: Ability to learn the agreements and legislations process

CO.4: Ability to understand the digital products and law

CO.5: Ability to learn the enforcement of IPRs.

CO6: Ability to patent filing and publishing

TEXT BOOKS:

T1: V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

T2: S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCE BOOKS:

R1: Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

R2: Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

R3: Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.