ARUNAI Engineering College
(An Autonomous Institution)
Tiruvannamalai

(Approved by AICTE, Affiliated to Anna University, 'A' Grade

Accredited by NAAC, NBA Accredited, ISO 9001: 2015 Certified)

CURRICULA AND SYLLABI

B.TECH. Agricultural Engineering

(Regulations 2024)

HoD/BOS Chairman **Principal**

ARUNAI ENGINEERING COLLEGE, THIRUVANNAMALAI
(An Autonomous Institution)

B.TECH. Agricultural Engineering

REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the programme B.TECH Agricultural Engineering will

I. To train and educate students with general knowledge and skills in agricultural water management, agricultural production process, farm machinery and farm management.
II. To provide a sound theoretical knowledge in engineering principles applied to agriculture.
III. To prepare students for a successful agricultural engineering career integrating all aspects of engineering in agriculture.
IV. To develop innovative capacity of students for increasing agricultural production with scarce water resources available.
V. To impart positive and responsive out their mission as engineers .reach attitudes, initiative and creative thinking in their mission as engineers.
VI. To understand ethical issues and responsibility of serving the society and the environment at large.

PROGRAM OUTCOMES (POs)

PO# Graduate Attribute

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Washington Accord Knowledge and Attitude Profile (WKs)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of the programme B. Tech. Agricultural Engineering will be able to

1. To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.

2. To enhance the ability of the students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.

3. To inculcate entrepreneurial skills through strong Industry-Institution linkage.

PEOs / POs Mapping:

PEOs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
I	3	3	-	-	-	-	-	-	1	-	-	3	3	3
II	-	-	3	3	3	-	-	-	-	1	-	3	3	3
III	2	2	2	-	-	-	-	1	-	1	-	3	3	3
IV	-	-	-	-	-	3	-	-	2	1	-	3	3	3
V	-	-	2	-	-	3	3	3	-	-	3	3	3	3

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Mapping of Course Outcomes and Programme Outcomes

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
YEAR I	SEMESTER I	Professional English–I	1.6	2.2	1.8	2.2	1.5	3	3	1.6	3	3	3	-	-	-
		Matrices and Calculus	3	3	1	1	0	0	0	2	0	2	3	-	-	-
		Engineering Physics	3	3	1.6	1.2	1.8	1	-	-	-	-	1	-	-	-
		Engineering Chemistry	2.8	1.3	1.6	1	-	1.5	-	-	-	-	1.5	-	-	-
		Problem Solving and Python Programming	2	3	3	3	2	-	-	-	-	2	2	3	3	-
		□□□□□□ □□□□/Heritage of Tamils														
		Problem Solving and Python Programming Laboratory	2	3	3	3	1	-	-	-	-	2	2	3	3	-
		Physics and Chemistry Laboratory	3	2.4	2.6	1	1	-	-	-	-	-	-	-	-	-
			2.6	1.3	1.6	1	1	1.4	-	-	-	-	1.3	-	-	-
		English Laboratory	3	3	3	3	1	3	3	3	3	3	3	-	-	-
	SEMESTER II	Professional English–II	3	3	3	3	2.75	3	3	2.2	3	3	3	-	-	-
		Statistics and Numerical Methods	3	3	1	1	1	0	0	2	0	2	3	-	-	-
		Principles and Practices of Crop Production	3	2	1	1	2	2	1	2	2	1	3	3	2	2
		Basic Electrical, Electronics and Instrumentation Engineering	2	1	1	-	-	-	1	-	-	-	-	-	-	-
		Engineering Graphics	3	1	2	-	2	-	-	-	3	-	2	2	2	-
		□□□□□□□□ □□□□□□□□□□□□□□□ /Tamils and Technology														
		Engineering Practices Laboratory	3	2	-	-	1	1	-	-	-	-	2	2	1	1
		Basic Electrical, Electronics and Instrumentation Engineering Laboratory	1.6	1.4	0.8	1.6	-	-	1.2	1.6	-	-	-	-	-	-
		Communication Laboratory/Foreign Language	2.4	2.8	3	3	1.8	3	3	3	3	3	3	-	-	-

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		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
YEAR II	SEMESTER III	Fourier Series and Boundary Value Problems	3	3	1	1	-	-	-	-	2	-	3	-	-	-
		Principles of Soil Science and Engineering	3	2	2	1	1	1	-	-	-	-	1	2	1	1
		Unit Operations in Agricultural Processing	2	3	1	2	1	1	-	-	-	-	1	1	1	1
		Fluid Mechanics and Pumps	3	3	2	3	3	2	3	2	2	1	2	3	3	2
		Engineering Thermodynamics	3	3	2	1	-	1	-	1	-	1	2	1.8	0.8	1.2
		Surveying and Levelling	3	2	3	3	3	3	3	3	3	3	1	3	3	3
		Fluid Mechanics Laboratory	3	3	2	3	1	2	2	1	2	1	2	3	2	1
		Soil Science Laboratory	2	1	1	3	2	1	-	-	-	-	1	2	2	1
		Surveying and Levelling Labora3ory	3	2	3	3	3	3	3	3	3	3	1	3	3	3
		Professional Development														
	SEMESTER IV	Probability and Linear Programming Problems	3	2.8	2.6	2	1.6	-	-	-	-	-	1.6	-	-	-
		Tractor and Engine systems	2	3	3	2	3	-	2	-	-	2	2	3	3	2
		Strength of Materials for Agricultural Engineering	3	2	2	1	-	1	-	-	-	1	1	3	3	1
		Hydrology and Water Resources Engineering	2	2	1	2	1	2	1	2	2	1	2	2	2	3
		Machines of Theory	3	2	2	-	2	-	1	-	-	-	1	3	-	1
		Environmental Sciences and Sustainability	2.8	1.8	1	1	-	2.2	-	-	-	-	1.8	-	-	-
		NCC Credit Course Level 2[#]														
		Tractor and Farm Engines Laboratory	3	2	2	1	2	1	-	-	-	1	2	3	3	3
		Strength of Materials Laboratory	3	2	2	1	-	1	-	-	-	-	2	3	3	1

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		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
YEAR III	SEMESTER V	Farm Equipment and Machinery	2	3	3	2	3	-	2	-	1	-	2	3	3	1
		Soil and Water Conservation Engineering	2	2	3	2	2	2	2	1	2	2	2	2	2	1
		Professional Elective I														
		Professional Elective II														
		Professional Elective III														
		Professional Elective IV														
		Mandatory Course -I[&]														
		Farm Machinery Laboratory	2	3	3	2	3	1	2	-	1	-	2	3	3	1
		ICT in Agricultural Engineering and Laboratory	1	1	2	2	2	2	1	-	1	1	2	3	3	3
		Summer Training (2 Weeks)[**]														
	SEMESTER VI	Post Harvesting Technology	2	2	3	1	1	1	-	-	-	-	1	3	3	1
		Irrigation and Drainage Engineering	2	2	2	2	2	2	2	1	2	2	2	2	2	1
		Professional Elective V														
		Professional Elective VI														
		Open Elective – II[*]														
		Mandatory Course – II[&]														
		NCC Credit Course Level 3[#]														
		CAD for Agricultural Machinery Laboratory	2	1	3	1	3	1	-	-	-	1	1	3	3	3
		Post- Harvesting Technology Laboratory	2	1	3	1	1	1	-	-	1	-	1	3	3	2
		Irrigation Field Laboratory	1	1	2	2	2	2	1	-	1	1	2	3	3	2

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		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
YEAR IV	SEMESTER VII	Remote Sensing and Geographical Information	3	3	2	1	1	1	1	1	1	2	3	2	2	2
		Renewable Energy in Agricultural Engineering	3	3	2	1	1	1	1	1	1	2	3	2	2	2
		Human Value and Ethics														
		Open Elective - III***														
		Open Elective - III****														
		Management Elective														
		Remote Sensing and GIS Laboratory	1	1	2	2	2	2	1	-	1	1	2	2	2	2
		Renewable Energy in Agricultural Engineering Laboratory	1	1	2	2	2	2	1	-	1	1	2	2	2	2
	SEMESTER VIII	Project Work/Internship	3	2	1	3	3	3	3	2	2	2	2	2	2	2
		Value Added Course														

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PROFESSIONAL ELECTIVE COURSES

S.No	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	Refrigeration and Cold Storage	3	2	2	2	2	2	2	-	-	1	1	2	2	2
2	Food and Dairy Engineering	2	1	1	3	2	1	-	-	-	1	-	2	2	2
3	Process Engineering of Fruits and Vegetables	1	1	2	1	2	1	1	1	1	2	2	2	2	2
4	Storage and Packaging	2	1	1	3	2	1	1	1	1	2	2	1	1	1
5	Food process Equipment and Design	1	2	2	1	2	1	1	1	1	2	2	1	1	1
6	Food Plant design and management	2	1	3	2	1	2	2	-	-	3	1	3	3	3
7	Emerging Technologies in Food Processing	2	2	1	3	2	2	1	-	-	-	-	1	1	1
8	Farm Power and Machinery Management	3	2	2	2	3	3	2	2	1	3	3	3	3	1
9	Testing and Evaluation of farm Machinery & equipment	3	1	2	-	1	1	1	3	-	2	3	2	2	2
10	Biochemical and Thermochemical conversion of biomass	3	2	2	2	3	3	-	2	1	3	2	2	2	2
11	Waste and by product utilization	3	2	2	2	3	3	2	2	1	3	2	2	2	2
12	Human Engineering and Safety in Farm Machinery Operations	3	2	2	2	3	3	2	2	1	3	3	1	1	1
13	Precision Farming Equipment	3	2	2	1	3	3	2	2	1	3	3	2	2	2
14	Solar and Wind energy system	3	2	2	1	3	3	2	2	1	3	2	2	2	2
15	Watershed planning and Management	3	2	2	2	2	2	3	1	2	2	2	2	2	2
16	Groundwater and Well Engineering	2	2	2	2	2	2	3	1	2	2	2	2	2	2
17	Design of Micro-irrigation system	2	2	3	2	2	2	2	2	3	2	2	3	3	3
18	Protected Cultivation	3	2	2	2	2	2	2	3	1	2	2	1	1	1
19	On-farm water management	2	2	2	2	3	2	3	2	2	2	3	1	1	1
20	Irrigation Water Quality and Waste Water Management	2	2	2	2	3	2	3	2	2	2	3	3	3	3
21	Climate change and Adaptation	2	2	2	2	3	2	3	1	2	2	2	2	2	2
22	Integrated farming system	2	2	3	3	2	3	3	2	2	3	2	2	3	3
23	Agricultural Business Management	2	3	3	2	3	2	1	1	2	2	2	2	2	2

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24	Sustainable Agriculture and Food Security	2	2	1	2	3	1	3	3	3	1	3	2	2	2
25	Systems Analysis in Agricultural Engineering	3	3	3	3	2	3	2	2	2	2	2	3	2	1
26	IT in Agricultural System	2	3	3	2	3	2	3	1	3	3	3	2	2	2
27	Automation in Agriculture	2	1	1	1	3	1	-	-	-	1	-	2	2	2
28	Landscape Architecture	2	3	3	3	2	3	1	1	2	3	2	3	2	3

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ARUNAI ENGINEERING COLLEGE
(AUTONOMOUS)
TIRUVANNAMALAI
REGULATIONS 2024
CHOICE BASED CREDIT SYSTEM

B.TECH. AGRICULTURAL ENGINEERING

CURRICULUM AND SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	IP24101	Induction Programme						0
THEORY								
2	HS24101	Professional English-I	HSMC	3	0	0	3	3
3	MA24101	Matrices and Calculus	BSC	3	1	0	4	4
4	PH24101	Engineering Physics	BSC	3	0	0	3	3
5	CY24101	Engineering Chemistry	BSC	3	0	0	3	3
6	GE24101	Problem Solving and Python Programming	ESC	3	0	0	3	3
7	GE24102	□□□□□□ □□□□ /Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8	GE24111	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9	BS24111	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10	GE24112	English Laboratory $	EEC	0	0	2	2	1
		TOTAL		**16**	**1**	**10**	**27**	**22**

$ - Skill Based Course

SEMESTER II

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS24201	Professional English – II	HSMC	2	0	0	2	2
2	MA24201	Statistics and Numerical Methods	BSC	3	1	0	4	4
3	AI24201	Principles and Practices of Crop Production	BSC	2	0	2	3	3
4	BE24204	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5	GE24201	Engineering Graphics	ESC	2	0	4	6	4
6	GE24202	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	1	0	0	1	1
7		NCC Credit Course Level 1 #		2	0	0	2	2#
PRACTICALS								
8	GE24211	Engineering Practices Laboratory	ESC	0	0	4	4	2
9	BE24211	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
10	GE24212	Communication Laboratory / Foreign Language $	EEC	0	0	4	4	2
		TOTAL		**14**	**1**	**16**	**31**	**23**

 # NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
$ Skill Based Course

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SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA24303	Fourier Series and Boundary Value Problems	BSC	3	1	0	4	4
2	AI24301	Principles of Soil Science and Engineering	PCC	3	0	0	3	3
3	AI24302	Unit Operations in Agricultural Processing	PCC	2	0	2	4	3
4	AI24303	Fluid Mechanics and Pumps	PCC	3	0	0	3	3
5	ME24302	Engineering Thermodynamics	ESC	3	0	0	3	3
6	CE24351	Surveying and Levelling	PCC	3	0	0	3	3
PRACTICALS								
7	AI24311	Fluid Mechanics Laboratory	PCC	0	0	4	4	2
8	AI24312	Soil Science Laboratory	PCC	0	0	3	3	1.5
9	CE24361	Surveying and Levelling Laboratory	PCC	0	0	3	3	1.5
10	GE24903	Professional Development	EEC	0	0	2	2	1
			TOTAL	**17**	**1**	**14**	**30**	**25**

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA24404	Probability and Linear Programming Problems	BSC	3	1	0	4	4
2	AI24401	Tractors and Engine Systems	PCC	3	0	0	3	3
3	AI24403	Strength of Materials for Agricultural Engineering	PCC	3	0	0	3	3
4	AI24404	Hydrology and Water Resources Engineering	PCC	3	0	0	3	3
5	ME24405	Theory of Machines	PCC	3	0	0	3	3
6	GE24451	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
7		NCC Credit Course Level 2[#]		3	0	0	3	3[#]
PRACTICALS								
8	AI24411	Tractor and Farm Engines Laboratory	PCC	0	0	2	3	2
9	AI24412	Strength of Materials Laboratory	PCC	0	0	4	4	2
			TOTAL	**17**	**1**	**6**	**24**	**22**

[#]NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

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SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	AI24501	Farm Equipment and Machinery	PCC	3	0	0	3	3
2	AI24502	Soil and Water Conservation Engineering	PCC	3	0	0	3	3
3		Professional Elective I	PEC	3	0	0	3	3
4		Professional Elective II	PEC	3	0	0	3	3
5		Professional Elective III	PEC	3	0	0	3	3
6		Professional Elective IV	PEC	3	0	0	3	3
7		Mandatory Course-I[&]	MC	3	0	0	3	Non-credit course
PRACTICALS								
8	AI24511	Farm Machinery Laboratory	PCC	0	0	4	4	2
9	AI24512	ICT in Agricultural Engineering Laboratory	PCC	0	0	4	4	2
10	AI24513	Summer Training (2 week)**	EEC	0	0	0	0	1
			TOTAL	**18**	**0**	**8**	**29**	**23**

[&]Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)

****Summer training has to be completed during the summer vacation, after the completion of Semester**

SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	AI24601	Post-Harvest Technology	PCC	3	0	0	3	3
2	AI24602	Irrigation and Drainage Engineering	PCC	3	0	0	3	3
3		Professional Elective V	PEC	3	0	0	3	3
4		Professional Elective VI	PEC	3	0	0	3	3
5		Open Elective–I[*]	OEC	3	0	0	3	3
6		Mandatory Course-II[&]	MC	3	0	0	3	Non- credit course
7		NCC Credit Course Level 3[#]		3	0	0	3	3[#]
PRACTICALS								
1.	AI24611	CAD for Agriculture Machinery Laboratory	PCC	0	0	4	4	2
2.	AI24612	Post – Harvest Technology	PCC	0	0	2	4	2
3.	AI24613	Irrigation Field Laboratory	PCC	0	0	2	4	2
			TOTAL	**21**	**0**	**8**	**33**	**21**

***Open Elective –I shall be chosen from the emerging technologies**

[&]Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC-II)

[#]NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

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SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AI24701	Remote Sensing and Geographical Information	PCC	3	0	0	3	3
2.	AI24702	Renewable Energy in Agricultural Engineering	PCC	3	0	0	3	3
3.	GE24791	Human Values and Ethics	HSMC	2	0	0	2	2
4.		Open Elective–III***	OEC	3	0	0	3	3
5.		Open Elective–IV***	OEC	3	0	0	3	3
6		Management Elective	HSMC	3	0	0	3	3
PRACTICALS								
8.	AI24711	Remote Sensing and GIS Laboratory	PCC	0	0	4	4	2
9.	AI24712	Renewable Energy in Agricultural Engineering Laboratory	PCC	0	0	2	2	1
			TOTAL	**17**	**0**	**6**	**20**	**20**

***If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VII**

****Open Elective– II shall be chosen from the emerging technologies**

*****Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes)**

SEMESTER VIII

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AI24811	Project Work/Internship	EEC	0	0	20	20	8
2.		VAC		0	0	0	0	2
			TOTAL	**0**	**0**	**20**	**20**	**10**

***If students under go internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII**

TOTAL CREDITS: 166

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SUMMARY

NAME OF THE PROGRAMME: B. TECH AGRICULTURAL ENGINEERING										
S.No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	4	3	-	-	-	-	5	-	12
2.	BSC	12	7	4	6	-	-	-	-	29
3.	ESC	5	11	3	-	-	-	-	-	19
4.	PCC	-	-	17	16	7	12	9	-	61
5.	PEC	-	-	-	-	12	6	-	-	18
6.	OEC	-	-	-	-	3	3	6	-	12
7.	EEC	1	2	1	-	1	-	-	10	15
8.	Mandatory Course (Non credit)					✓	✓			
TOTAL		22	23	25	22	23	21	20	10	166

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I Food Processing	VERTICAL II Farm Machinery and Energy	VERTICAL III Water Management and Protected cultivation	VERTICAL IV IT and Agricultural Business management
.Refrigeration and cold Storage	Farm Power and Machinery Management	Watershed planning and Management	Integrated Farming System
Food and Dairy Engineering	Testing and Evaluation of farm Machinery and equipment	Groundwater and Well Engineering	Agri Business Management
Process Engineering of Fruits and Vegetables	Biochemical and Thermochemical conversion of biomass	Design of Micro-irrigation system	Sustainable Agriculture and Food Security
Storage and Packaging Technology	Waste and by product utilization	Protected Cultivation	Systems Analysis in Agricultural Engineering
Food Process Equipment and Design	Human Engineering and Safety in Farm Machinery Operations	On-farm water management	IT in Agricultural System
Food Plant Design and Management	Precision Farming Equipment	Irrigation Water Quality and Waste Water Management	Automation in Agriculture
Emerging Technologies in Food Processing	Solar and Wind energy system	Climate change and Adaptation	Landscape architecture

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PROFESSIONAL ELECTIVE COURSES

VERTICAL I (FOOD PROCESSING)

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AI24001	Refrigeration and Cold Storage	PEC	3	0	0	3	3
2.	AI24002	Food and Dairy Engineering	PEC	3	0	0	3	3
3.	AI24003	Process Engineering of Fruits and Vegetables	PEC	3	0	0	3	3
4.	AI24004	Storage and Packaging Technology	PEC	3	0	0	3	3
5.	AI24005	Food Process Equipment and Design	PEC	3	0	0	3	3
6.	AI24006	Food Plant Design and Management	PEC	3	0	0	3	3
7.	AI24007	Emerging Technologies in Food Processing	PEC	3	0	0	3	3

VERTICAL II (FARM MACHINERY AND ENERGY)

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AI24008	Farm Power and Machinery Management	PEC	3	0	0	3	3
2.	AI24009	Testing and Evaluation of Farm Machinery and Equipment	PEC	3	0	0	3	3
3.	AI24010	Biochemical and Thermochemical Conversion of Biomass	PEC	3	0	0	3	3
4.	AI24011	Waste and By Product Utilization	PEC	3	0	0	3	3
5.	AI24012	Human Engineering and Safety in Farm Machinery	PEC	3	0	0	3	3
6.	AI24013	Precision Farming Equipment	PEC	3	0	0	3	3
7.	AI24014	Solar and Wind Energy System	PEC	3	0	0	3	3

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VERTICAL III (WATER MANAGEMENT AND PROTECTED CULTIVATION)

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AI24015	Watershed Planning and Management	PEC	3	0	0	3	3
2.	AI24016	Groundwater and Well Engineering	PEC	3	0	0	3	3
3.	AI24017	Design of Micro- Irrigation System	PEC	3	0	0	3	3
4.	AI24018	Protected Cultivation	PEC	3	0	0	3	3
5.	AI24019	On-farm Water Management	PEC	3	0	0	3	3
6.	AI24020	Irrigation Water Quality and Waste Water Management	PEC	3	0	0	3	3
7.	AI24021	Climate Change and Adaptation	PEC	3	0	0	3	3

VERTICAL IV (IT AND AGRICULTURAL BUSINESS MANAGEMENT)

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AI24022	Integrated Farming System	PEC	3	0	0	3	3
2.	AI24023	Agricultural Business Management	PEC	3	0	0	3	3
3.	AI24024	Sustainable Agriculture and Food Security	PEC	3	0	0	3	3
4.	AI24025	Systems Analysis in Agricultural Engineering	PEC	3	0	0	3	3
5.	AI24026	IT in Agricultural System	PEC	3	0	0	3	3
6.	AI24027	Automation in Agriculture	PEC	3	0	0	3	3
7.	AI24028	Landscape Architecture	PEC	3	0	0	3	3

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OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

OPEN ELECTIVE – I

EMERGING TECHNOLOGIES

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS2401	Artificial Intelligence and Machine Learning fundamentals	OEC	2	0	2	4	3
2.	OCS2402	Data science fundamentals	OEC	2	0	2	4	3
3.	OCS2403	Augmented Reality/ Virtual Reality	OEC	2	0	2	4	3
4.	OCS2404	IOT and its applications	OEC	2	0	2	4	3
5.	OCS2405	Deep Learning Techniques	OEC	2	0	2	4	3
6.	OEC2401	Introduction to ASIC design	OEC	2	0	2	4	3

OPEN ELECTIVE – II

INDUSTRIAL

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OME2401	Applied design thinking	OEC	3	0	0	3	3
2.	OME2402	Introduction to industrial automation systems	OEC	3	0	0	3	3
3.	OME2403	Industrial Management	OEC	3	0	0	3	3
4.	OME2404	Quality Engineering	OEC	3	0	0	3	3
5.	OME2405	Sustainable Manufacturing	OEC	3	0	0	3	3
6.	OME2406	Industrial design and rapid prototyping techniques	OEC	3	0	0	3	3
7.	OEE2401	Industrial IOT and industry 4.0	OEC	3	0	0	3	3
8.	OEC2402	Robotics and Industrial Automation	OEC	3	0	0	3	3

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OPEN ELECTIVE – III& IV (Other Domains)

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	OAG2401	Urban agriculture	OEC	3	0	0	3	3
2	OAG2402	Agriculture Entrepreneurship	OEC	3	0	0	3	3
3	OBT2401	Basics of Biomolecules	OEC	3	0	0	3	3
4	OBT2402	Basics of Microbial Technology	OEC	3	0	0	3	3
5	OBT2403	Biotechnology for Waste Management	OEC	3	0	0	3	3
6	OBT2404	Food Processing Technology	OEC	3	0	0	3	3
7	OEC2403	VLSI Design	OEC	3	0	0	3	3
8	OEC2404	Remote Sensing Concepts	OEC	3	0	0	3	3
9	OEC2405	Drone technologies	OEC	3	0	0	3	3
10	OEE2402	Basics of Electric Vehicle Technology	OEC	3	0	0	3	3
11	OEE2403	Introduction To Control Systems	OEC	3	0	0	3	3
12	OEE2404	Integrated energy planning for sustainable development	OEC	3	0	0	3	3
13	OHS2401	Nano technology	OEC	3	0	0	3	3
14	OHS2402	Operations research	OEC	3	0	0	3	3
15	OME2407	Additive Manufacturing	OEC	3	0	0	3	3

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MANDATORY COURSES I*

S. NO.	COURSE CODE	COURSETITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS
				L	T	P	
1	MX24101	Introduction to women and gender studies	MC	3	0	0	3
2	MX24102	Elements of literature	MC	3	0	0	3
3	MX24103	Disaster risk reduction and management	MC	3	0	0	3
4	MX24104	History of science and technology in India	MC	3	0	0	3
5	MX24105	State, nation building and politics in India	MC	3	0	0	3
6	MX24106	Political and economic thought for a humane society	MC	3	0	0	3
7	MX24107	Understanding Society & Culture through Literature	MC	3	0	0	3
8	MX24108	Work Ethics & Social Responsibility	MC	3	0	0	3
9	MX24109	Technology & Society	MC	3	0	0	3
10	MX24110	Social Innovation & Entrepreneurship	MC	3	0	0	3
11	MX24111	Education & Social Change	MC	3	0	0	3

***Mandatory Courses are offered as Non-Credit Courses**

MANDATORY COURSES II*

S. NO.	COURSE CODE	COURSETITLE	CATE GORY	PERIODS			TOTAL CONTACT PERIODS
				L	T	P	
1	MX24201	Industrial Safety	MC	3	0	0	3
2	MX24202	Wellbeing with Traditional Practices - Yoga, Ayurveda and siddha	MC	3	0	0	3
3	MX24203	Application of Psychology in Everyday Life	MC	3	0	0	3
4	MX24204	Stress Management & Well Being	MC	3	0	0	3
5	MX24205	Health & Well Being in Education	MC	3	0	0	3
6	MX24206	Physical fitness & Mental Resilience	MC	3	0	0	3
7	MX24207	Food, Nutrition and Health	MC	3	0	0	3
8	MX24208	Life style diseases	MC	3	0	0	3

***Mandatory Courses are offered as Non-Credit Courses**

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MANAGEMENT ELECTIVES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	GE24M01	Principles of Management	HSMC	3	0	0	3	3
2	GE24M02	Total Quality Management	HSMC	3	0	0	3	3
3	GE24M03	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4	GE24M04	Human Resource Management	HSMC	3	0	0	3	3
5	GE24M05	Knowledge Management	HSMC	3	0	0	3	3
6	GE24M06	Industrial Management	HSMC	3	0	0	3	3
7	GE24M07	Foundations of Entrepreneurship	HSMC	3	0	0	3	3

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Subject Code	Subject Name	Category	L	T	P	C
IP24101	Induction Programme		0	0	0	0

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

"Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

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They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

Guide to Induction program from AICTE

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Subject Code	Subject Name	Category	L	T	P	C
HS24101	PROFESSIONAL ENGLISH- I	HSMC	3	0	0	3

Course Objectives:

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT – I	INTRODUCTION TO EFFECTIVE COMMUNICATION	1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT – II	NARRATION AND SUMMATION	9

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT – III	DESCRIPTION OF A PROCESS / PRODUCT	9

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT – IV	CLASSIFICATION AND RECOMMENDATIONS	9

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc,). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from nonverbal (chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT – V	EXPRESSION	9

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	To use appropriate words in a professional context
CO2	To gain understanding of basic grammatical structures and use them in right context.
CO3	To read and infer the denotative and connotative meanings of technical texts
CO4	To read and interpret information presented in tables, charts, and other graphic forms
CO5	To write definitions, descriptions, narrations, and essays on various topics

Textbooks:	
1.	English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2.	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference books/other materials/web resources:	
1.	Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi
2.	A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3.	English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4.	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House. 5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.
5.	Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3	3	3	1	3	-	-	-	-
CO2	1	1	1	1	1	3	3	3	1	3	-	-	-	-
CO3	2	3	2	3	2	3	3	3	2	3	3	-	-	-
CO4	2	3	2	3	2	3	3	3	2	3	3	-	-	-
CO5	2	3	3	3	-	3	3	3	2	3	-	-	-	-
Average:	1.6	2.2	1.8	2.2	1.5	3	3	3	1.6	3	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
MA24101	MATRICES AND CALCULUS	BSC	3	1	0	4

Course Objectives:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT – I	MATRICES	9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNIT – II	DIFFERENTIAL CALCULUS	9+3

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT – III	FUNCTIONS OF SEVERAL VARIABLES	9+3

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT – IV	INTEGRAL CALCULUS	9+3

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT – V	MULTIPLE INTEGRALS	9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use the matrix algebra methods for solving practical problems.
CO2	Apply differential calculus tools in solving various application problems.
CO3	Able to use differential calculus ideas on several variable functions.
CO4	Apply different methods of integration in solving practical problems.
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.

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Textbooks:	
1.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Grewal.B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition, 2018.
3.	James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].
Reference books/other materials/web resources:	
1.	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2.	Bali. N., Goyal. M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Jain. R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4.	Narayanan. S. and Manicavachagom Pillai. T. K.,“Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6.	Srimantha Pal and Bhunia. S.C, "Engineering Mathematics " Oxford University Press, 2015.
7.	Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO2	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	2	-	-	-
CO5	3	3	1	1	0	0	0	0	2	0	2	-	-	-
Average:	**3**	**3**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
PH24101	ENGINEERING PHYSICS	BSC	3	0	0	3

Course Objectives:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I	MECHANICS	9

Multiparticle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia – theorems of MI –moment of inertia of continuous bodies – M.I of a diatomic molecule – torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule – gyroscope – torsional pendulum – double pendulum – Introduction to nonlinear oscillations.

UNIT II	ELECTROMAGNETIC WAVES	9

The Maxwell's equations – wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field – properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter – polarization – Producing electromagnetic waves – Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure – Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium- vacuum interface for normal incidence.

UNIT III	OSCILLATIONS, OPTICS AND LASERS	9

Simple harmonic motion – resonance –analogy between electrical and mechanical oscillating systems – waves on a string – standing waves – traveling waves – Energy transfer of a wave – sound waves – Doppler effect. Reflection and refraction of light waves – total internal reflection – interference – Michelson interferometer –Theory of air wedge and experiment. Theory of laser – characteristics- Spontaneous and stimulated emission – Einstein's coefficients – population inversion – Nd-YAG laser, CO_2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV	BASIC QUANTUM MECHANICS	9

Photons and light waves – Electrons and matter waves –Compton effect – The Schrodinger equation (Time dependent and time independent forms) – meaning of wave function – Normalization –Free particle – particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V	APPLIED QUANTUM MECHANICS	9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope – Resonant diode – Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the importance of mechanics.
CO2	Express their knowledge in electromagnetic waves.
CO3	Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4	Understand the importance of quantum physics.
CO5	Comprehend and apply quantum mechanical principles towards the formation of energy bands.

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Textbooks:	
1.	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2.	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3.	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

Reference books/other materials/web resources:	
1.	R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2.	Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3.	K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5.	N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer- Verlag, 2012.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	1	1	-	-	-	-	-	-	-	-
CO2	3	3	2	1	2	1	-	-	-	-	-	-	-	-
CO3	3	3	2	2	2	1	-	-	-	-	-	-	-	-
CO4	3	3	1	1	2	1	-	-	-	-	-	-	-	
CO5	3	3	1	1	2	1	-	-	-	-	-	-	-	-
Average:	**3**	**3**	**1.6**	**1.2**	**1.8**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
CY24101	ENGINEERING CHEMISTRY	BSC	3	0	0	3

Course Objectives:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I	WATER AND ITS TREATMENT	9

Water: Sources and impurities, Water quality parameters: Definition and significance of-colour, odour, turbidity, Ph, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

UNIT II	NANOCHEMISTRY	9

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III	PHASE RULE AND COMPOSITES	9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV	FUELS AND COMBUSTION	9

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil- cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO_2 emission and carbon foot print.

UNIT V	ENERGY SOURCES AND STORAGE DEVICES	9

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles-working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2	To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3	To apply the knowledge of phase rule and composites for material selection requirements.
CO4	To recommend suitable fuels for engineering processes and applications.
CO5	To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

Textbooks:

1.	P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2.	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3.	S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

Reference books/other materials/web resources:

1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2.	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4.	Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	1	1	-	-	-	-	-	-	-
CO2	2	-	-	1	-	2	2	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	1	-	-	1	2	-	-	-	-	-	-	-
CO5	3	1	2	1	-	2	2	-	-	-	-	-	-	-
Average:	**2.8**	**1.3**	**1.6**	**1**	**-**	**1.5**	**1.8**	**-**		**-**	**-**	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24101	PROBLEM SOLVING AND PYTHON PROGRAMMING	ESC	3	0	0	3

Course Objectives:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II	DATA TYPES, EXPRESSIONS, STATEMENTS	9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III	CONTROL FLOW, FUNCTIONS, STRINGS	9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV	LISTS, TUPLES, DICTIONARIES	9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V	FILES, MODULES, PACKAGES	9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Develop algorithmic solutions to simple computational problems.
CO2	Develop and execute simple Python programs.
CO3	Write simple Python programs using conditionals and looping for solving problems.
CO4	Decompose a Python program into functions.
CO5	Represent compound data using Python lists, tuples, dictionaries etc.
CO6	Read and write data from/to files in Python programs.

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Textbooks:	
1.	Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3.	John V Guttag, & quot ;Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press 2021
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	https://www.python.org/
6.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill,2018.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	-	-	-	-	-	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	-	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	-	2	3	-	-
CO4	2	2	-	2	2	-	-	-	-	-	1	3	-	-
CO5	1	2	-	-	1	-	-	-	-	-	1	2	-	-
CO6	2	2	-	-	2	-	-	-	-	-	1	2	-	-
Average:	**2**	**3**	**3**	**3**	**2**	-	-	-	-	-	**2**	**3**	**3**	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24102	**தமிழர் மரபு**	HSMC	1	0	0	1

அலகு 1	**மொழி மற்றும் இலக்கியம்**	**3**

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

அலகு II	**மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்கலை**	**3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை ஐம்பொன்சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் தேர்செய்யும் கலை சுடுமண்சிற்பங்கள் நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III	**நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள்**	**3**

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

அலகு IV	**தமிழர்களின் திணைக் கோட்பாடுகள்**	**3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் தமிழர்கள் போற்றிய அறக் கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்க கால நகரங்களும் துறைமுகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி

அலகு V	**இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின்** □□□□□□□□□□	**3**

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

	Total Contact Hours :15

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

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Subject Code	Subject Name	Category	L	T	P	C
GE24102	HERITAGE OF TAMILS	HSMC	1	0	0	1

UNIT I	**LANGUAGE AND LITERATURE**	**3**
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		
UNIT II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	**3**
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
UNIT III	**FOLK AND MARTIAL ARTS**	**3**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT IV	**THINAI CONCEPT OF TAMILS**	**3**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature- Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3**
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		
		Total Contact Hours : 15

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

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11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Subject Code	Subject Name	Category	L	T	P	C
GE24111	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	ESC	0	0	4	2

Course Objectives:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Develop algorithmic solutions to simple computational problems
CO2	Develop and execute simple Python programs.
CO3	Implement programs in Python using conditionals and loops for solving problems.
CO4	Deploy functions to decompose a Python program.
CO5	Process compound data using Python data structures.
CO6	Utilize Python packages in developing software applications.

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Textbooks:	
1.	Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference books/other materials/web resources:	
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	https://www.python.org/
6.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	-	-	3	3	3	-
CO2	3	3	3	3	3	-	-	-	-	-	3	3	-	-
CO3	3	3	3	3	2	-	-	-	-	-	2	3	-	-
CO4	3	2	-	2	2	-	-	-	-	-	1	3	-	-
CO5	1	2	-	-	1	-	-	-	-	-	1	2	-	-
CO6	2	-	-	-	2	-	-	-	-	-	1	2	-	-
Average	**2**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	-

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Subject Code	Subject Name	Category	L	T	P	C
BS24111	PHYSICS AND CHEMISTRY LABORATORY	BSC	0	0	4	2

PHYSICS LABORATORY

Course Objectives:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

EXPERIMENTS:

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the functioning of various physics laboratory equipment.
CO2	Use graphical models to analyze laboratory data.
CO3	Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4	Access, process and analyze scientific information.
CO5	Solve problems individually and collaboratively.

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	2	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	3	2	1	1	-	-	-	-	-	-	-	-	-
CO5	3	2	3	1	1	-	-	-	-	-	-	-	-	-
Average:	**3**	**2.4**	**2.6**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

CHEMISTRY LABORATORY

Course Objectives:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

EXPERIMENTS:

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2	To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3	To analyse and determine the composition of alloys.
CO4	To learn simple method of synthesis of nanoparticles
CO5	To quantitatively analyse the impurities in solution by electroanalytical techniques"

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Textbooks:	
1.	J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	1	-	-	2	2	-	-	-	-	-	-	-
CO2	3	1	2	-	-	1	2	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	1	-	-	-	-	-	-	-
CO4	2	1	2	-	-	2	2	-	-	-	-	-	-	-
CO5	2	1	2	-	1	2	2	-	-	-	-	-	-	-
Average:	**2.6**	**1.3**	**1.6**	**1**	**1**	**1.4**	**1.8**	**-**	**-**	**-**	**-**	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24112	ENGLISH LABORATORY	EEC	0	0	2	1

Course Objectives:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I	**INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**	**6**
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies-making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions (filling out a bank application for example).		
UNIT II	**NARRATION AND SUMMATION**	**6**
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.		
UNIT III	**DESCRIPTION OF A PROCESS PRODUCT**	**6**
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking — Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights-talking about quantities(large & small)-talking about precautions.		
UNIT IV	**CLASSIFICATION AND RECOMMENDATIONS**	**6**
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-		
UNIT V	**EXPRESSION**	**6**
Listening — Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes		
		Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To listen to and comprehend general as well as complex academic information
CO2	To listen to and understand different points of view in a discussion
CO3	To speak fluently and accurately in formal and informal communicative contexts
CO4	To describe products and processes and explain their uses and purposes clearly and accurately
CO5	To express their opinions effectively in both formal and informal discussions

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	1	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	1	3	3	3	3	3	3	-	-	-
Average:	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
HS24201	PROFESSIONAL ENGLISH – II	HSMC	2	0	0	2

Course Objectives:

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I	**MAKING COMPARISONS**	**6**
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases		
UNIT II	**EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING**	**6**
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds		
UNIT III	**PROBLEM SOLVING**	**6**
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences		
UNIT IV	**REPORTING OF EVENTS AND RESEARCH**	**6**
Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions		
UNIT V	**THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY**	**6**
Reading — Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar –Numerical adjectives, Relative Clauses.		
		Total Contact Hours : 30

Textbooks

1.	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2.	English for Science & Technology Cambridge University Press 2021.
3.	Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To compare and contrast products and ideas in technical texts.
CO2	To identify and report cause and effects in events, industrial processes through technical texts
CO3	To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
CO4	To present their ideas and opinions in a planned and logical manner
CO5	To draft effective resumes in the context of job search.

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Reference books/other materials/web resources:	
1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3.	Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4.	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5.	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	3	3	3	2	3	3	-	-	-
CO2	3	3	3	3	3	3	3	3	2	3	3	-	-	-
CO3	3	3	3	3	3	3	3	3	2	3	3	-	-	-
CO4	3	3	3	3	2	3	3	3	2	3	3	-	-	-
CO5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**-**	**-**
Average:	**3**	**3**	**3**	**3**	**2.75**	**3**	**3**	**3**	**2.2**	**3**	**3**	**-**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
MA24201	STATISTICS AND NUMERICAL METHODS	BSC	3	1	0	4

Course Objectives:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	TESTING OF HYPOTHESIS	9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) — Tests for single variance and equality of variances — Chi square test for goodness of fit — Independence of attributes.

UNIT II	DESIGN OF EXPERIMENTS	9+3

One way and two way classifications - Completely randomized design – Randomized block design — Latin square design - 2^2 factorial design.

UNIT III	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	9+3

Lagrange's and Newton's divided difference interpolations — Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	9+3

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

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Textbooks:	
1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference books/other materials/web resources:	
1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4.	Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	-	-	-
Average:	**3**	**3**	**1**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**2**	**-**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
AI24201	PRINCIPLES AND PRACTICES OF CROP PRODUCTION	PCC	2	0	2	3

Course Objectives:

- To introduce the students to principles of agricultural and horticultural crop production
- Understand the crop selection and establishment procedures.
- Learn about the different management practices during crop establishment and growth.
- To introduce the production practices of agricultural and horticultural crops.
- To delineate the role of agricultural engineers in relation to various crop production practices..

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 Contact Hours : (L: 30 + P:30) = 60 PERIODS

Practical

Identification of field and horticultural crops. Seeds - estimation of seed rate, germination of seeds. Nursery, demonstration on different types in field. Fertilizers-type, estimation of recommended dose. Weeds, identification of major weed type, demonstration on simple weeding implements. Weedicide uses and caution. Pest identification and control, demonstration of IPM methods. Harvesting methods for various field and horticultural crops and implements used. Observing in demonstration field, cultivation of wet land, dry land and garden land crops and documenting of growth stage and recording of biometric observations.

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Students completing this course would have acquired knowledge on the basic principles of crop production.
CO2	Students will be able to select suitable crops and decide upon its establishment procedures
CO3	Students will get knowledge on the different crop management practices.
CO4	The students will have the required knowledge in the area of production of agricultural and horticultural crops.
CO5	Students will be able to delineate their role in relation to various crop production practices.

Textbooks:	
1.	Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, Krishi Anusandhan Bhavan, Pusa, New Delhi, 2015.
2.	Reddy T. Sankara G.H. Yellamanda Reddi, Principles of Agronomy, Kalyani Publishers, New Delhi, 2005.
3.	Handbook of Agriculture. ICAR Publications, New Delhi, 2011.

Reference books/other materials/web resources:	
1.	Bose T. K. and L.P.Yadav. Commercial Flowers, Naya Prakash, Calcutta.1989.
2.	Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2005
3.	Kumar, N., Abdul Khader, M. Rangaswami, P. and Irulappan, I. Introduction to spices, plantation crops, medicinal and aromatic plants. Rajalakshmi Publications, Nagercoil. 1993.
4.	Kumar, N.,"Introduction to Horticulture", Rajalakshmi Publications. Nagercoil, 7th edition, 2015.
5.	Shanmugavel, K.G. Production Technology of Vegetable Crops. Oxford India Publications, New Delhi. 1989.

	CO-PO Mapping													**CO-PSO Mapping**	
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	-	-	-	2	1	-	-	2	3	-
CO2	3	-	-	-	-	-	-	-	-	2	-	-	2	-	-
CO3	3	2	1	-	3	3	-	-	-	2	-	2	3	2	2
CO4	-	-	-	1	2	2	-	1	-	3	1	3	3	1	2
CO5	-	-	-	1	2	2	1	1	-	3	1	3	3	1	2
Average	**3**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**3**	**3**	**2**	**2**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
BE24204	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING	ESC	3	0	0	3

Course Objectives:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers.

UNIT I	ELECTRICAL CIRCUITS	9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws — Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply — star and delta connection — power in three- phase systems

UNIT II	MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS	9

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.
Domestic wiring, types of wires and cables, earthing, protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III	ELECTRICAL MACHINES	9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT IV	ANALOG ELECTRONICS	9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium — PN Junction Diodes, Zener Diode –Characteristics Applications — Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT — Types, I-V Characteristics and Applications, Rectifier and Inverters, harmonics

UNIT V	SENSORS AND TRANSDUCERS	9

Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors,Strain gauge, LVDT, differential pressure transducer,optical and digital transducers, Smart sensors, Thermal Imagers.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Compute the electric circuit parameters for simple problems
CO2	Explain the concepts of domestics wiring and protective devices
CO3	Explain the working principle and applications of electrical
CO4	Analyze the characteristics of analog electronic devices
CO5	Explain the types and operating principles of sensors and transducers

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Textbooks:	
1.	D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2.	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
3.	S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
	James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

Reference books/other materials/web resources:	
1.	John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2.	Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3.	Albert Malvino, David Bates, '**Electronic Principles**, McGraw Hill Education; 7th edition,
4.	Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition., Cengage India,2019.
5.	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO5	2	1	1	-	-	-	-	1	-	-	-	-	-	-
Average:	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
GE24201	ENGINEERING GRAPHICS	ESC	2	0	4	4

Course Objectives:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I	**PLANE CURVES**	**6+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III	**PROJECTION OF SOLIDS AND FREEHAND SKETCHING**	**6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**6+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+12**

Principles of isometric projection — isometric scale —Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software(Not for examination)

Total Contact Hours :(L=30+P=60) 90 PERIODS

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use BIS conventions and specifications for engineering drawing.
CO2	Construct the conic curves, involutes and cycloid.
CO3	Solve practical problems involving projection of lines.
CO4	Draw the orthographic, isometric and perspective projections of simple solids.
CO5	Draw the development of simple solids.

Textbooks:

1.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charota Publishing House,53 Edition, 2019.
2.	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3.	Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

Reference books/other materials/web resources:	
1.	Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3.	Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4.	Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:
1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	1	-	-	-	-	-	-
CO5	2	1	1	-	-	-	-	1	-	-	-	-	-	-
Average:	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
GE24202	தமிழரும் தொழில் நுட்பமும்	HSMC	1	0	0	1

அலகு 1	**நெசவு மற்றும் பானைத் தொழில்நுட்பம்**	**3**
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள்		
அலகு II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**	**3**
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அலகு III	□□□□□□□□□□□ □□□□□□ □□□□□□□	**3**
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அலகு IV	□□□□□□□□ □□□□□□□ □□□□□□□□□□□□ □□□□□□ □□□□□□□	**3**
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அலகு V		**3**
அறிவியல் தமிழின் வளர்ச்சி -கணித் தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் தமிழ்மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்		
		Total Contact Hours :15

HoD/BOS Chairman **Principal**

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

Subject Code	Subject Name	Category	L	T	P	C
GE24202	**TAMILS AND TECHNOLOGY**	**HSMC**	**1**	**0**	**0**	**1**

UNIT I	**WEAVING AND CERAMIC TECHNOLOGY**	**3**
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) — Graffiti on Potteries.		
UNIT II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3**
Designing and Structural construction House & Designs in household materials during Sangam Age- Building materials and Hero stones of Sangam age — Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.		
UNIT III	**MANUFACTURING TECHNOLOGY**	**3**
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins — Beads making-industries Stone beads -Glass beads- Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.		
UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3**
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries — Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries		

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Text-Cum-Reference Books	
1.	தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.	கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3.	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறைவெளியீடு)
4.	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.
– Sorkuvai Project.	
	Toal Contact Hours : 15

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Subject Code	Subject Name	Category	L	T	P	C
	(ARMY WING) NCC Credit Course Level – I	**NCC**	**2**	**0**	**0**	**2**

NCC GENERAL	**6**
NCC 1 Aims, Objectives & Organization of NCC	1
NCC 2 Incentives	2
NCC 3 Duties of NCC Cadet	1
NCC 4 NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS	**4**
NI 1 National Integration: Importance & Necessity	1
NI 2 Factors Affecting National Integration	1
NI 3 Unity in Diversity & Role of NCC in Nation Building	1
NI 4 Threats to National Security	1
PERSONALITY DEVELOPMENT	**7**
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2 Communication Skills	3
PD 3 Group Discussion: Stress & Emotions	2
LEADERSHIP	**5**
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2 Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	**8**
SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4 Protection of Children and Women Safety	1
SS 5 Road / Rail Travel Safety	1
SS 6 New Initiatives	2
SS 7 Cyber and Mobile Security Awareness	1
Total Contact Hours : 30	

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Subject Code	Subject Name	Category	L	T	P	C
	(NAVAL WING) NCC Credit Course Level - I	**NCC**	**2**	**0**	**0**	**2**

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1
	Total Contact Hours : 30	

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Subject Code	Subject Name	Category	L	T	P	C
	(AIR FORCE WING) NCC Credit Course Level – I	**NCC**	**2**	**0**	**0**	**2**

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

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Subject Code	Subject Name	Category	L	T	P	C
GE24211	ENGINEERING PRACTICES LABORATORY	ESC	0	0	4	2

Course Objectives:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipment's; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,
b) Planning and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

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b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations**.**

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity**.**

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop

Total Contact Hours : 90

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
CO2	Wire various electrical joints in common household electrical wire work.
CO2	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
CO3	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	1	1	1	-	-	-	-	2	1	1
CO2	3	2	-	-	1	1	1	-	-	-	-	2	-	-
CO3	3	2	-	-	1	1	1	-	-	-	-	2	-	-
Average:	**3**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

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Subject Code	Subject Name	Category	L	T	P	C
BE24211	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY	ESC	0	0	4	2

Course Objectives:

- To train the students in conducting load tests electrical machines
- To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers
- To train the students to measure three phase power and displacement

List of Experiments

1. Verification of ohms and Kirchhoff's Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

Total Contact Hours:60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use experimental methods to verify the Ohm's law and Kirchhoff's Law and to measure three phase power
CO2	Analyze experimentally the load characteristics of electrical machines
CO3	Analyze the characteristics of basic electronic devices
CO4	Use LVDT to measure displacement

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	-	-	-	1.5	2	-	-	-	-	-
CO2	2	3	1	2	-	-	-	1.5	2	-	-	-	-	-
CO3	2	3	1	2	-	-	-	1.5	2	-	-	-	-	-
CO4	2	3	1	2	-	-	-	1.5	2	-	-	-	-	-
Average:	1.6	1.4	0.8	1.6	-	-	-	1.2	1.6	-	-	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
GE24212	COMMUNICATION LABORATORY	EEC	0	0	4	2

Course Objectives:

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT I		**12**
Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).		
UNIT II		**12**
Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.		
UNIT III		**12**
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.		
UNIT IV		**12**
Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.		
UNIT V		**12**
Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations) talking about electrical devices-describing controlling actions- Writing: job application(Cover letter + Curriculum vitae)-writing recommendations.		
		Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Speak effectively in group discussions held in ~~a~~ formal/semi formal contexts.
CO2	Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
CO3	Write emails, letters and effective job applications.
CO4	Write critical reports to convey data and information with clarity and precision
CO5	Give appropriate instructions and recommendations for safe execution of tasks

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO2	2	3	3	3	1	3	3	3	3	3	3	-	-	-
CO3	2	2	3	3	1	3	3	3	3	3	3	-	-	-
CO4	3	3	3	3	3	3	3	3	3	3	3	-	-	-
CO5	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Average:	**2.4**	**2.8**	**3**	**3**	**1.8**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**

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Subject Code:	Subject Name	Category	L	T	P	C
MA24303	FOURIER SERIES AND BOUNDARY VALUE PROBLEMS	BSC	3	1	0	4

Course Objectives:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To introduce the effective mathematical tools for the solutions of partial differential equations in various situations.
- To acquaint the student with Fourier series techniques in solving wave equations used in various situations.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Non- Parametric tests problems used in various situations.

UNIT – I	**FOURIER SERIES**	**9+3**
Dirichlet's conditions – General Fourier series – Odd and Even functions – Half range sine series–Half range cosine series–Parseval's identity –Harmonic Analysis.		
UNIT – II	**PARTIAL DIFFERENTIAL EQUATIONS**	**9+3**
Formation of PDE - Eliminating arbitrary constants- Eliminating arbitrary functions – First order nonlinear PDE: f(p , q)= 0,f(z ,p ,q)= 0,f (x, p)= g(y , q) , Clairaut's equation - Lagrange's linear equation – Homogeneous linear PDE of Higher order with constant coefficients.		
UNIT – III	**WAVE EQUATION**	**9+3**
Classification of second order Quasi linear partial differential equation - Solution of one dimensional wave equation with one non-zero boundary conditions – one dimensional wave equation by explicit method		
UNIT – IV	**HEAT EQUATION**	**9+3**
.One dimensional heat equation – Steady of state solution of two dimensional heat equation (Insulated edge excluded).		
UNIT – V	**NON-PARAMETRIC TESTS**	**9+3**
Sign test for paired data. Rank sum test. Kolmogorov-Smirnov test –Mann – Whitney U test and Kruskal Wallis test. One sample run test.		
		Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO2	Solve differential equations using Partial differential equations which plays a vital role in engineering applications.
CO3	Appreciate the physical significance of Fourier series techniques in solving one dimensional wave equations.
CO4	Appreciate the physical significance of Fourier series techniques in solving one dimensional heat flow problems
CO5	Appreciate the physical significance of Non-Parametric tests techniques in solving problems in Engineering field.

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Textbooks:	
1.	Grewal B.S.,"Higher Engineering Mathematics", 44thEdition, Khanna Publishers, New Delhi, 2018
2.	Kreys zig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016

Reference books/other materials/web resources:	
1.	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt.Ltd, 2015.
2.	Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
3.	Ramana.B.V.,"Higher Engineering Mathematics" ,McGraw Hill Education Pvt.Ltd, New Delhi, 2018.
4.	Conover, W.J. (1971). Practical Non-Parametric Statistics. David, H.A. (1970). Order Statistics. Fraser, D.A.S. (1957). Nonparametric Methods in Statistics.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO2	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO3	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO4	3	3	1	1	-	-	-	-	2	-	3	-	-	-
CO5	3	3	1	1	-	-	-	-	2	-	3	-	-	-
Average:	3	3	1	1	-	-	-	-	2	-	3	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
AI24301	PRINCIPLES OF SOIL SCIENCE AND ENGINEERING	PCC	3	0	0	3

Course 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 Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the fundamental knowledge of soil physical parameters.
CO2	Perform soil survey and classify soil based on its characteristics
CO3	Explain the phase relationship and soil compaction.
CO4	Analyze Engineering properties of soil
CO5	Understand Concepts of bearing capacity and slope stability.

Textbooks:

1.	NyleC.Brady,"TheNatureandPropertiesofSoil",MacmillanPublishingCompany,10th Edition, New York, 2008.
2.	Punmia,B.C.,"SoilMechanicsandFoundation"LaxmiPublishers,NewDelhi,2007.

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Reference books/other materials/web resources:	
1.	EdwardJ.Plaster.,"SoilScience",CengageLearningIndiaLtd,NewDelhi,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.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	1	2	-	-	-	-	2	1	1
CO2	3	1	2	1	1	1	-	-	-	-	-	2	1	1
CO3	3	2	2	1	1	1	-	-	-	-	-	1	1	1
CO4	3	1	2	1	1	1	2	-	-	-	-	2	1	1
CO5	3	2	2	1	1	1	1	-	-	-	-	2	1	1
Average:	3	2	2	1	1	1	1	-	-	-	-	2	1	1

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Subject Code	Subject Name	Category	L	T	P	C
AI24302	UNIT OPERATIONS IN AGRICULTURAL PROCESSING	PCC	2	0	2	3

Course Objectives:

- The students would be exposed to the fundamental knowledge in Evaporation, Filtration, Sedimentation, Processing, Sieve analysis, Crystallization and Distillation in processing of agricultural produce.

UNIT – I	**EVAPORATION AND CONCENTRATION**	**6**
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**	**6**
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.		
UNIT – III	**SIZE REDUCTION**	**6**
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 equipment – 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**	**6**
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 – equipment		
UNIT – V	**CRYSTALLISATION AND DISTILLATION**	**6**
Crystallization-Equilibrium –Rate of crystal growth stage-Equilibrium crystallization-Crystallizers- Equipment-Classification- Construction and operation —Crystallizers-Tank-Agitated batch- Swenson-Walker and Vacuum crystallizers-Distillation-Binary mixtures-Flash and differential distillation-Steam distillation –Theory-Continuous distillation with rectification – Vacuum distillation - Batch distillation-Operation and process-Advantages and limitation-Distillation equipment- Construction and operation-Factors influencing the operation.		
		Total Contact Hours : 30

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PRACTICAL

1. Determination of thermal efficiency and economy of evaporator
2. Determination of separation efficiency of centrifugal separator
3. Determination of collection efficiency in cyclone separator
4. Determination of efficiency of liquid-solid separation by filtration
5. Determination of absorption efficiency in a packing tower
6. Performance evaluation of a sieve and determination of particle size of granular foods by sieve analysis
7. Determination of energy requirement in size reduction using the burr mill
8. Determination of energy requirement in size reduction using the ball mill and hammer mill
9. Determination of mixing index for solids
10. Determination of economy and thermal efficiency of rotary flash evaporator for
11. Concentration of juice
12. Performance evaluation of a steam distillation process

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Examine the evaporation process and types of evaporators for food industry
CO2	Analyze the principles of filtration and mechanical separation equipment
CO3	Identify size reduction and grinding equipment and understand the factors affecting the process
CO4	Identify the gas-liquid and solid-liquid equilibrium concepts and factors influencing equilibrium separation process.
CO5	Differentiate crystallization and distillation processes and identify processing equipment.

Textbooks:	
1.	Earle,R.L.,"Unit operations in Food Processing",Pergamon Press,Oxford,U.K,1985.
2.	McCabe, W.L., and Smith, J.C., "Unit Operations of Chemical Engineering", Mc-Graw-Hill Inc., Kosaido Printing Ltd., Tokyo, 1990.
3.	Geankoplis,C.J."Transport Processesand Separation Process Principles",4thEdition, Prentice Hall, 2003.

Reference books/other materials/web resources:	
1.	Coulson, J.M and J.F. Richardson. Chemical Engineering. Volume I to V. The Pergamon Press. New York, 1999.
2.	Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press LLC, Florida, 2003..

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	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	1	2	1	1	1	-	-	-	-	1	1	1
CO2	2	3	1	2	1	1	-	-	-	-	-	1	1	1
CO3	2	3	1	1	1	1	1	-	-	-	-	1	1	1
CO4	2	3	1	1	1	1	1	-	-	-	-	1	1	1
CO5	2	3	1	2	1	1	1	-	-	-	-	1	1	1
Average:	2	3	1	2	1	1	1	-	-	-	-	1	1	1

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Subject Code	Subject Name	Category	L	T	P	C
AI24303	FLUID MECHANICS AND PUMPS	PCC	3	0	0	3

Course Objectives:

- To introduce the students about the properties of the fluids, behaviour of fluids under static, kinematic and dynamic conditions through the control volume approach and expose them to the applications of the conservation laws and to impart basic knowledge of the dimensional analysis and model studies along with flow through pipes.
- The students will be exposed to the basic concepts of open channel flows with significance to steady uniform flows along with flow measurements in open channels
- To expose the students to the classification of pumps the basic principles of working and to design centrifugal pump.

UNIT – I	**FLUID PROPERTIES AND FLUID STATICS**	**9**

Definition and properties of fluid - Mass density – Specific weight - Specific volume – Specific gravity - Equation of state – Perfect gas - Viscosity – Vapour pressure – Compressibility and elasticity - Surface tension – Capillarity- Fluid statics – Fluid pressure and measurement – simple, differential and micro manometers - Mechanical gauges - Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies.

UNIT – II	**FLUID KINEMATICS AND FLUID DYNAMICS**	**9**

Classification of flows - Methods of analysis- Continuum hypothesis - System and Control volume approach - Streamline, streak-line and path-lines - Stream function - Velocity potentials - Flow nets - Application of control volume to continuity, energy and momentum - Euler's equation of motion along a stream line - Bernoulli's equation - Linear momentum equation – Applications.

UNIT – III	**FLOW THROUGH PIPES AND MODEL STUDIES**	**9**

Reynolds experiment - Laminar flow through circular pipe - Darcy-Weisbach equation - Moody diagram - Major and minor losses in pipe flow – Total energy line – Hydraulic grade line – Siphon - Pipes in series and parallel- Equivalent pipes- Fundamental dimensions - Dimensional homogeneity - Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT – IV	**OPEN CHANNEL FLOWS**	**9**

Types of flow – Characteristics of open channel - Chezy's equation - Manning equation – Hydraulically efficient channel sections - Critical depth – Specific energy application to channel transitions – Flow measurement in channels – Notches – Weirs - Parshall flume - Flow measurement in natural streams – float method – current meter.

UNIT – V	**PUMPS**	**9**

Types of pumps – Head of pump – Losses and efficiencies -Selection of pump capacity - Centrifugal pump – Components – Working principle – Types of impellers - Priming – NPSH - Cavitation – Minimum speed to start the pump - Specific speed – Characteristics curves - Turbine pump - Submersible pump - Jet pump – Air lift pump - Reciprocating pump - Sludge pump.

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Demonstrate the properties of fluid and its behaviour in static conditions along with pressure measurements.
CO2	Apply the conservation laws applicable to fluid flows and its application through fluid kinematics and dynamics.
CO3	Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel and to understand the concept of application of dimensional analysis in model studies.
CO4	Describe the basics characteristics of open channel flows and analysis of steady uniform flow with hydraulically efficient channel sections and to measure the flows in artificial/natural channels.
CO5	Explain the classification, design and working principles of various pumps.

Textbooks:	
1.	Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2017.
2.	Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi, 2019..
3.	Subramanya K., Flow in Open Channels, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2019.

Reference books/other materials/web resources:	
1.	Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
2.	S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill Education (India) Pvt. Ltd., 2017.
3.	Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017
4.	Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
5.	Subramanya K, Fluid Mechanics and Hydraulic Machines: Problems and Solutions, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2018.

	CO-PO Mapping											**CO-PSO Mapping**		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	1	2	1	1	1	2	1	3	2	1
CO2	3	3	2	1	1	2	2	2	1	2	1	3	3	2
CO3	3	3	2	3	3	2	2	3	2	2	1	3	3	2
CO4	3	3	3	3	3	2	3	3	2	2	1	3	3	3
CO5	3	3	3	3	3	2	3	3	2	2	1	3	3	3
Average:	3	3	3	3	3	2	2	3	2	2	1	3	3	2

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Subject Code	Subject Name	Category	L	T	P	C
ME24302	ENGINEERING THERMODYNAMICS	ESC	3	0	0	3

Course Objectives:

- Impart knowledge on the basics and application of zeroth and first law of thermodynamics
- Impart knowledge on the second law of thermodynamics in analyzing the performance of thermal devices
- Impart knowledge on availability and applications of second law of thermodynamics
- Teach the various properties of steam through steam tables and Mollierchart.
- Impart knowledge on the macroscopic properties of ideal and real gases.

UNIT – I	**BASICS, ZEROTH AND FIRST LAW**	**9**

Review of Basics – Thermodynamic systems, Properties and processes Thermodynamic Equilibrium - Displacement work - P-V diagram. Thermal equilibrium - Zeroth law- First Law- Concept of temperature and Temperature Scales, Steady flow energy equation-problems.

UNIT – II	**HEATING AND EXPANSION OF GASES**	**9**

Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.

UNIT – III	**SECOND LAW AND ENTROPY**	**9**

Heat Engine – Refrigerator - Heat pump. Statements of second law and their equivalence & corollaries. Carnot cycle - Reversed Carnot cycle - Performance - Clausius inequality. Concept of entropy - T-s diagram – Tds Equations - Entropy change for a pure substance.

UNIT – IV	**COMPOSITION OF PURE SUBSTANCES**	**9**

Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart.

UNIT – V	**GAS MIXTURES AND THERMODYNAMIC RELATIONS**	**9**

Properties of Ideal gas, real gas - comparison. Equations of state for ideal and real gases. vander Waal's relation - Reduced properties - Compressibility factor - Principle of Corresponding states - Generalized Compressibility Chart. Maxwell relations - TdS Equations - heat capacities relations -Energy equation, Clausius-Clapeyron equation.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply the zeroth and first law of thermodynamics by formulating temperature scales and calculating the property changes in closed and open engineering systems.
CO2	Apply the second law of thermodynamics in analyzing the performance of thermal devices through energy and entropy calculations.
CO3	Apply the second law of thermodynamics in evaluating the various properties of steam through steam tables and Mollier chart
CO4	Apply the properties of pure substance in computing the macroscopic properties of ideal and real gases using gas laws and appropriate thermodynamic relations.
CO5	Apply the properties of gas mixtures in calculating the properties of gas mixtures and applying various thermodynamic relations to calculate property changes.

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Textbooks:	
1.	Nag.P.K.,"EngineeringThermodynamics",6thEdition,TataMcGrawHill(2017),New Delhi.
2.	Natarajan, E., "Engineering Thermodynamics: Fundamentals and Applications", 2nd Edition (2014), Anuragam Publications, Chennai

Reference books/other materials/web resources:	
1.	Cengel,Y and M.Boles, Thermodynamics-An Engineering Approach, Tata McGraw Hill,9th Edition, 2019.
2.	Chattopadhyay,P,"EngineeringThermodynamics",2ndEditionOxfordUniversityPress, 2016.
3.	Rathakrishnan, E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.
4.	ClausBorgnakkeandRichardE.Sonntag,"FundamentalsofThermodynamics",10thEdition, Wiley Eastern, 2019.
5.	5.Venkatesh. A, "Basic Engineering Thermodynamics", Universities Press (India) Limited, 2007.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	-	-	-	-	-	-	1	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	1	-	-	-
CO3	3	3	2	1	-	-	-	-	1	-	1	3	-	3
CO4	3	3	2	1	-	1	-	-	2	-	1	3	2	-
CO5	3	3	2	1	-	1	-	-	2	-	1	3	2	3
Average:	3	3	2	1	-	1	-	-	1	-	1	1.8	0.8	1.2

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Subject Code	Subject Name	Category	L	T	P	C
CE24351	SURVEYING AND LEVELLING	PCC	3	0	0	3

Course Objectives:

- To introduce the rudiments of plane surveying and geodetic principles to Agricultural Engineers and to learn the various methods of plane and geodetic surveying to solve the real world problems. To introduce the concepts of Control Surveying. To introduce the basics of Astronomical Surveying

UNITI	**FUNDAMENTALS OF CONVENTIONAL SURVEYING**	**9**

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging – Well conditioned triangles – Chain traversing – Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction – Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits – Radiation – Intersection – Resection – Plane table traversing.

UNITII	**LEVELLING**	**9**

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling – Contouring

UNITIII	**THEODOLITE SURVEYING**	**9**

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric leveling – Single Plane method – Double Plane method.

UNITIV	**CONTROL SURVEYING AND ADJUSTMENT**	**9**

Horizontal and vertical control —Methods—Triangulation—Traversing—Gale'stable—Trilateration–Concepts of measurements and errors–Error propagation and Linearization–Adjustment methods – Least square methods – Angles, lengths and leveling network.

UNITV	**MODERNSURVEYING**	**9**

Total Station :Digital Theodolite, EDM, Electronic field book–Advantages–Parts and accessories—Working principle —Observables —Errors - COGO functions —Field procedure and applications.GPS:Advantages–Systemcomponents–Signalstructure–Selectiveavailability and anti spoofing receiver components and antenna –Planning and data acquisition – Data processing–Errors in GPS–Field procedure and applications.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Introduce the rudiments of various surveying and its principles.
CO2	Imparts knowledge in computation of levels of terrain and ground features
CO3	Imparts concepts of Theodolite Surveying for complex surveying operations
CO4	Understand the procedure for establishing horizontal and vertical control
CO5	Imparts the knowledge on modern surveying instruments

Textbooks:

1.	Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016
2.	T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.

Reference books/other materials/web resources:

1.	R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2.	James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.

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3.	Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
4.	S. K. Roy, Fundamentals of Surveying, Second Edition, Prenticeˆ Hall of India2010.
5.	K.R.Arora, Surveying VolI& II,Standard Bookhouse,Twelfth Edition2013.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	2	2	3	-	2	2	-	2	3	3	3
CO2	3	3	2	2	2	3	-	2	2	-	2	3	3	3
CO3	3	3	3	2	3	3	-	2	2	-	2	3	3	3
CO4	3	3	3	3	3	3	2	2	3	-	2	3	-	3
CO5	3	3	3	3	3	3	2	3	2	-	2	3	-	3
Average:	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**3**	**-**	**3**

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Subject Code	Subject Name	Category	L	T	P	C
A124311	FLUID MECHANICS LABORATORY	PCC	0	0	4	2

Course Objectives:

- Students should able to verify the principles studied in theory by performing the experiments in the laboratory

LISTOF EXPERIMENTS:

1. Flow Measurement

- Calibration of Rotameter
- Flow through Venturimeter
- Flow through a circular Orifice
- Determination of mean velocity by Pitot tube
- Flow through a Triangular Notch
- Flow through a Rectangular Notch

2. Losses in Pipes

- Determination of friction coefficient in pipes
- Determination of losses due to bends, fittings and elbows

3. Pumps

- Characteristics of Centrifugal pump
- Characteristics of Submersible pump
- Characteristics of Reciprocating pump

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Apply Bernoulli equation for calibration of flow measuring devices.
CO2	Measure friction factor in pipes and compare with Moody diagram
CO3	Determine the performance characteristics of rotodynamic pumps.
CO4	Determine the performance characteristics of positive displacement pumps.

Reference books/other materials/web resources:

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2015.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2017.
3. Subramanya K, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill Edu. Pvt. Ltd. 2011

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	1	2	1	2	1	2	1	1
CO2	3	2	1	3	1	2	1	2	1	2	1	3	1	1
CO3	3	3	2	3	1	3	1	2	1	2	1	3	2	1
CO4	3	3	2	3	1	3	1	2	1	2	1	3	2	1
Average:	**3**	**3**	**2**	**3**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
AI24312	SOIL SCIENCE LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- Students should able to verify various quality aspects of soil and water studied in theory by performing experiments in the laboratory.

LIST OF EXPERIMENTS:

1. Identification of rocks and minerals
2. Collection and processing of soil samples
3. Determination of soil moisture, EC and pH
4. Field density determination by Core Cutter and Sand Replacement method
5. Specific gravity determination by Pycnometer
6. Textural analysis of soil by International Pipette method
7. Grain size analysis by using Mechanical shaker
8. Determination of Organic carbon
9. Estimation of Gypsum requirements

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Explain soil physical properties and compare the properties based on soil and water system
CO2	Analyse the soil chemical properties to classify the arable and problem soils to develop different reclamation practices

Reference books/other materials/web resources:

1. Punmia, B.C, "Soil Mechanics and Foundation Engineering", Laxmi Publishers, New Delhi. 2007.
2. Laboratory Manual, Centre for Water Resources, Anna University, Chennai. 2012..

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	3	2	1	1	-	-	-	-	2	2	1
CO2	2	1	1	3	2	1	1	-	-	-	-	2	2	1
Average:	**2**	**1**	**1**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
CE24361	SURVEYING AND LEVELLING LABORATORY	PCC	0	0	3	1.5

Course Objectives:

- At the end of the course the student will possess knowledge about survey field techniques

LIST OF EXPERIMENTS:

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works–Foundation marking using tapes single Room and Double Room

Compass Survey

3. Compass Traversing–Measuring Bearings & arriving included angles

Levelling-Study of levels and levelling staff

4. Fly levelling using Dumpy level& Tilting level
5. Check levelling

Theodolite-Study of Theodolite

6. Measurements of horizontal angles by reiteration and repetition and vertical angles
7. Determination of elevation of an object using single plane method when baseis Accessible/inaccessible.

Tacheometry–Tangential system –Stadia system

8. Determination of Tacheometric Constants
9. Heights and distances by stadia Tacheometry
10. Heights and distances by Tangential Tacheometry

Total Station-Study of Total Station, Measuring Horizontal and vertical angles

11. Traverse using Total station and Area of Traverse
12. Determinationofdistanceanddifferenceinelevationbetweentwoinaccessiblepoints using Total station

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	impart knowledge on the usage of basic surveying instruments like chain/tape, compass and levelling instruments
CO2	Able to use levelling instrument for surveying operations
CO3	Able to use theodolite for various surveying operations
CO4	Able to carry out necessary surveys for social infrastructures
CO5	Able to prepare planimetric maps

Reference books/other materials/web resources:

1.	T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint, 2015.
2.	Dr.B.C.Punmia, AshokK.Jain and Arun KJain, Surveying Vol.I&II, Lakshmi Publications Pvt Ltd, New Delhi, 17thEdition, 2016.
3.	James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001
4.	Bannisterand S.Raymond, Surveying, Seventh Edition, Longman 2004 a. David Clark, Plane and Geodetic Surveying for Engineers, Volume I, Constable and Company Ltd, London, CBS,

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	6th Edition, 2004.
5.	David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, VolumeII, Constable and Company Ltd, London, CBS, 6thEdition, 2004.
6.	S.K.Roy,Fundamentals of Surveying,Second Edition,Prentice'HallofIndia 2004
7.	K.R.Arora,Surveying Vol.I&II,StandardBookhouse,EleventhEdition,2013.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	3	2	3	2	3	3	3	3	3	3	3
CO2	3	2	3	-	3	3	3	3	3	3	3	3	3	3
CO3	3	1	2	-	3	2	-	-	3	-	-	3	3	3
CO4	3	3	2	3	2	3	3	2	3	3	3	3	3	3
CO5	3	3	3	2	2	3	3	2	3	3	3	3	3	3
Average:	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

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Subject Code	Subject Name	Category	L	T	P	C
GE24903	PROFESSIONAL DEVELOPMENT	EEC	0	0	2	1

Course Objectives:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations

MS WORD: **10 Hours**

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: **10 Hours**

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

MS POWERPOINT: **10 Hours**

Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

Total Contact Hours : 30

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
CO2	Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
CO3	Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

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Subject Code:	Subject Name	Category	L	T	P	C
MA24404	PROBABILITY AND LINEAR PROGRAMMING PROBLEMS	HS	3	1	0	4

Course Objectives:

- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of Special distribution.
- To introduce the basic concepts of classifications of design of experiments.
- To apply quantitative techniques in modelling.
- To solving business related problems.

UNIT – I	**PROBABILITY AND RANDOM VARIABLES**	**9+3**
Axioms of Probability - Conditional Probability-Baye's Theorem- One dimensional Discrete and Continuous random variables -Moments - Moment generating functions.		
UNIT – II	**SPECIAL DISTRIBUTIONS**	**9+3**
Discrete distributions : Binomial, Poisson, Geometric – Continuous distributions: Uniform, Exponential and Normal distribution.		
UNIT – III	**STATISTICAL QUALITY CONTROL**	**9+3**
Control charts for Measurements ($\bar{x}$ and R Charts))- Control charts for Attributes (p, c, and np charts)- Tolerance limits- Acceptance Sampleng.		
UNIT – IV	**LINEAR PROGRAMMING PROBLEMS**	**9+3**
Linear Programming formulation, Solution by Graphical method - Simplex methods –Big-M method.		
UNIT – V	**TRANSPORTATION AND ASSIGNMENT PROBLEMS**	**9+3**
Transportation Models – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI. Assignment Problems– Balanced and Unbalanced Problems-Hungarian Method.		
		Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the basic concepts of Probability and Random variables and apply in Engineering applications.
CO2	Understand he fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
CO3	Apply the basic concepts of classifications of design of experiments in the field of Agriculture and statistical quality control.
CO4	Understand the Linear programming in product mix decisions.
CO5	Apply the Transportation and assignment in logistics and job allocation scenarios

Textbooks:

1.	Johnson. R.A., Miller. I.Rand Freund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia,9th Edition, 2016.
2.	JohnE.Freund,"MathematicalStatistics",PrenticeHall,5thEdition,1992.
3.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007
4.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018
5	N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.

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Reference books/other materials/web resources:	
1.	Gupta. S.C. and Kapoor. V. K., “Fundamentals of Mathematical Statistics”, Sultan Chand &Sons, New Delhi, 12th Edition, 2020
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Walpole.R.E.,Myers.R.H.,Myers.S.L.andYe.K.,"Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9thEdition, 2010.
4.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	1	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	2	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	2	-	-	-
CO5	3	3	3	2	2	-	-	-	-	-	2	-	-	-
Average:	3	2.8	2.6	2	1.6	-	-	-	-	-	1.6	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
AI24401	TRACTORS AND ENGINE SYSTEMS	PCC	3	0	0	3

Course Objectives:

- To introduce the students to the different systems and working principles of tractor, power tiller, makes of tractors and power tillers.

UNIT – I	**TRACTORS**	**9**

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

UNIT – II	**ENGINE SYSTEMS**	**9**

Valves-inletandoutletvalves–valvetimingdiagram.Aircleaner-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	**POWERTILLER , BULLDOZER AND TRACTOR TESTING**	**9**

Power tiller- special features -clutch- gearbox-steering and brake. Makes of tractors, power tillers and bulldozers. Bulldozer- salient features—turning mechanism, track mechanism, components—operations performed by bulldozers. Types of tests- test procedure - need for testing & evaluation of farm tractor -Test code for performance testing of tractors and power tillers.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Get an idea on various machinery available for farm mechanization
CO2	Calculate the valve timing of an IC engine and represent by a drawing
CO3	Gain knowledge on the transmission system of a tractor
CO4	Understand the hydraulic system in a tractor and estimate the traction
CO5	Gain knowledge on power tillers, bulldozers and different tractor testing procedures

Textbooks:

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

Reference books/other materials/webresources:

1. Barger, E.L., J.B.Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.
2. Domkundwar A.V.A course in internal combustion engines. DhanpatRai& Co.(P)Ltd., Educational and Technical Publishers, Delhi,1999.
3. Black, P.O.Diesel engine manual.Taraporevala Sons&Co.,Mumbai,1996.
4. Grouse,W.H. and Anglin, D.L. Automative mechanics. Macmillan McGraw- Hill, Singapore, Indian Standard Codes for Agricultural Implements Published by ISI, New Delhi, 1993.

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5.	JagadeeshwarSahay,Elements of Agricultural Engineering, Standard Publishers Co., New Delhi, 2010

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	1	2	3	-	-	2	-	-	-	3	3	3
CO2	2	3	3	2	3	-	-	2	-	-	-	3	3	2
CO3	2	3	3	3	3	-	-	1	-	-	-	3	3	2
CO4	3	3	3	2	3	-	-	2	-	-	-	3	3	2
CO5	2	3	3	3	3	-	-	2	-	1	2	3	3	2
Average:	2	3	3	2	3	-	-	2	-	-	2	3	3	2

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Subject Code	Subject Name	Category	L	T	P	C
AI24403	STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING	PCC	3	0	0	3

Course Objectives:

- To understand the stresses developed in bars, compound, bars, beams, shafts, cylinders and spheres.

UNIT – I	**STRESS, STRAIN AND DEFORMATION OF SOLIDS**	**9**
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars–Thermal stresses–Elastic constants–Volumetric strains-Thin shells -circumferential and longitudinal stresses in thin cylinders - deformation of thin cylinder – stresses in spherical shells – Deformation of spherical shells.		
UNIT – II	**ANALYSIS OF PLANE TRUSSES**	**9**
Determinate and indeterminate plane trusses–determination of member forces by method of joints, method of sections and method of tension coefficient.		
UNIT – III	**TRANSVERSE LOADING AND STRESSES IN BEAM**	**9**
Beams–types transverse loading on beams–Shear force and bending moment in beams–Cantilevers–Simply supported beams and over-hanging beams. Theory of simple bending–bending stress distribution – Shear stress distribution - Flitched beams – carriage springs.		
UNIT – IV	**TORSION**	**9**
Torsion formula - stresses and deformation in circular and hollows shafts–Stepped shafts–Deflection in shafts fixed at the both ends–Stresses in helical springs–Deflection of helical springs - carriage springs.		
UNIT – V	**DEFLECTION OF BEAMS**	**9**
Computation of slopes and deflections in determinate beams-Double Integration method–Macaulay‟s method – Area moment method – Conjugate beam method.		
	Total Contact Hours : 45	

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Find the stress distribution and strains in regular and composite structures subjected to axial loads.
CO2	Evaluate the stresses in plane trusses
CO3	Assess the shear force,bending moment and bending stresses in beams
CO4	Apply torsion equation in design of circular shafts and helical springs
CO5	Evaluate the slope and deflection of beams and buckling loads of columns under different boundary conditions

Textbooks:

1.	Bansal, R.K.,"Strength of Materials",Laxmi Publications(P)Ltd.,2007
2.	Jindal U.C.,"Strength o fMaterials",Asian Books Pvt.Ltd.,New Delhi,2007

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Reference books/other materials/web resources:	
1.	Egor.P.Popov“Engineering Mechanics of Solids”Prentice Hall of India,New Delhi,2001
2.	Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3.	Hibbeler,R.C.,"MechanicsofMaterials",PearsonEducation,LowPriceEdition, 2007
4.	Ferdinand P. Been,Russell Johnson, Jr. and JohnJ.Dewole"Mechanics of Materials", Tata McGraw Hill Publishing ,,co. Ltd., New Delhi, 2005.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	1	-	1	-	-	-	-	1	3	3	1
CO2	3	2	2	1	-	1	-	-	-	-	-	3	3	1
CO3	3	2	2	1	-	1	-	-	-	-	1	3	3	1
CO4	3	1	2	1	-	1	-	-	-	-	1	3	3	1
CO5	3	2	2	1	-	1	-	-	-	-	1	3	3	1
Average:	3	2	2	1	-	1	-	-	-	-	1	3	3	1

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Subject Code	Subject Name	Category	L	T	P	C
AI24404	HYDROLOGY AND WATER RESOURCES ENGINEERING	PCC	3	0	0	3

Course Objectives:

- To introduce to the students, the concepts of hydrological processes, hydrological extremes and groundwater.
- To prepare the students to quantify, regulate and manage water resources.

UNIT – I	**PRECIPITATION AND ABSTRACTIONS**	**9**

Hydrological cycle - Meteorological measurements—Types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen polygon and Iso-hyetal methods - Interception—Evaporation: Measurement, Evaporation suppression methods—Infiltration: Horton‟s equation-Double ring infiltrometer- Infiltration indices.

UNIT – II	**RUNOFF**	**9**

Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange's table and empirical methods-SCS-CN method—Stage discharge relationship-Flow measurements-Hydrograph—Unit Hydrograph—IUH.

UNIT – III	**HYDROLOGICAL EXTREMES**	**9**

Natural Disasters - Frequency analysis - Flood estimation - Flood management - Definitions of drought: Meteorological, Hydrological, Agricultural and Integrated - IMD method - NDVI analysis - Drought Prone Area Programme (DPAP).

UNIT – IV	**RESERVOIRS**	**9**

Classification of reservoirs- Site selection-General principles of design-Spillways-Elevation-Area-Capacity curve-Storage estimation-Sedimentation-Life of reservoirs—Rule curve.

UNIT – V	**GROUND WATER AND MANAGEMENT**	**9**

Origin - Classification and types - Properties of aquifers - Governing equations—Steady and unsteady flow- Artificial recharge-RWH in rural and urban areas.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Define the hydrological processes and their integrated behavior in catchments
CO2	Apply the knowledge of hydrological processes to address basin characteristics, runoff and hydrograph
CO3	Explain the concept of hydrological extremes and its management strategies
CO4	Describe the principles of storage reservoirs
CO5	Understand and apply the concepts of groundwater management

Textbooks:

1.	SubramanyaK,"Engineering Hydrology"-Tata McGraw Hill,2010
2.	Jayarami Reddy P,"Hydrology",Tata McGrawHill,2008.
3.	"Sedimentation Engineering", 2006, ASCE manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing.

Reference books/other materials/web resources:

1.	David Keith Todd."Ground water Hydrology",John Wiley & Sons,Inc.2007
2.	VenTe Chow, Maidment, D.R. and Mays, L.W."Applied Hydrology", McGraw Hill International Book Company, 1998.
3.	Raghunath.H.M.,"Hydrology",WileyEasternLtd.,1998.

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4.	Bhagu R. Chahar, Ground water Hydrology, McGraw Hill Education(India) Pvt Ltd,NewDelhi, 2017.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	2	1	2	2	-	2	2	-	2	2	2
CO2	2	3	2	2	1	2	2	-	3	2	-	2	2	3
CO3	2	2	2	1	-	2	2	-	2	2	2	2	2	2
CO4	2	2	1	1	1	3	2	2	2	2	-	2	2	3
CO5	2	2	2	2	1	3	2	2	3	2	2	2	2	3
Average:	2	2	1	2	1	2	2	1	2	2	1	2	2	3

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Subject Code	Subject Name	Category	L	T	P	C
ME24405	THEORY OF MACHINES	PCC	3	0	0	3

Course Objectives:

- Applying the basic components of mechanisms, analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and design cam mechanisms for specified output motions.
- Applying the basic concepts of toothed gearing and kinematics of gear trains
- Analyzing the effects of friction in machine elements
- Analyzing the force-motion relationship in components subjected to external forces and analyzing of standard mechanisms.
- Analyzing the undesirable effects of unbalances resulting from prescribed motions in mechanism and the effect of dynamics of undesirable vibrations.

UNIT – I	KINEMATICS OF MECHANISMS	9

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons– Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

UNIT – II	GEARS AND GEAR TRAINS	9

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

UNIT – III	FRICTION IN MACHINE ELEMENTS	9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes– Friction in vehicle propulsion and braking.

UNIT – IV	FORCE ANALYSIS	9

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members

UNIT – V	BALANCING AND VIBRATION	9

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation. (Gyroscopic principles)

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Discuss the basics of mechanism.
CO2	Solve problems on gears and gear trains.
CO3	Examine friction in machine elements.
CO4	Calculate static and dynamic forces of mechanisms.
CO5	Calculate the balancing masses and their locations of reciprocating and rotating masses. Computing the frequency of free vibration, forced vibration and damping coefficient.

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Textbooks:	
1.	Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.
2.	Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.

Reference books/other materials/web resources:	
1.	Amitabha Ghosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1988.
2.	Rao.J.S. and Dukkipati.R.V. "Mechanism and Machine Theory", New Age International Pvt. Ltd., 2006.
3.	Rattan, S.S, "Theory of Machines", McGraw-Hill Education Pvt. Ltd., 2014.
4.	Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGraw-Hill, 2009.
5.	Wilson and Sadler, Kinematics and Dynamics of Machinery, Pearson, 2008.

	CO-PO Mapping											CO-PSO Mapping		
PO& PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	-	2	-	-	1	-	-	-	3	-	1
CO2	3	2	2	-	2	-	-	1	-	-	-	3	-	1
CO3	3	2	2	-	2	-	-	1	-	-	-	3	-	1
CO4	3	2	2	-	2	-	-	1	-	-	-	3	-	1
CO5	3	2	2	-	2	-	-	1	-	-	-	3	-	1
Average:	3	2	2	-	2	-	-	1	-	-	-	3	-	1

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Subject Code	Subject Name	Category	L	T	P	C
GE24451	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	BSC	2	0	0	2

Course Objectives:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management

UNIT – I	**ENVIRONMENT AND BIODIVERSITY**	**6**
Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, 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.		
UNIT – II	**ENVIRONMENTAL POLLUTION**	**6**
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .		
UNIT – III	**RENEWABLE SOURCES OF ENERGY**	**6**
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.		
UNIT – IV	**SUSTAINABILITY AND MANAGEMENT**	**6**
Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.		
UNIT – V	**SUSTAINABILITY PRACTICES**	**6**
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-Carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization-Socio- economical and technological change.		
		Total Contact Hours : 30

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation
CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5	To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

Textbooks:	
1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016
3.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science',2ndedition, Pearson Education,2004.
4.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5.	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6.	Environment Impact Assessment Guidelines, Notification of Government of India,2006.
7.	Mackenthun, K.M.,Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

Reference books/other materials/web resources:	
1.	R.K.Trivedi,'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II,Enviro Media. 38 .edition 2010.
2.	Cunningham,W.P.Cooper,T.H.Gorhani,'Environmental Encyclopedia',Jaico Publ., House, Mumbai, 2001.
3.	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi,2007.
4.	Rajagopalan,R,'Environmental Studies-FromCrisistoCure',Oxford University Press, Third Edition, 2015.
5.	ErachBharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient BlackswanPvt. Ltd. 2013.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	-	-	-	2	3	-	-	-	-	-	-	-
CO2	3	2	-	-	-	3	3	-	-	-	-	-	-	-
CO3	3	-	1	-	-	2	2	-	-	-	-	-	-	-
CO4	3	2	1	1	-	2	2	-	-	-	-	-	-	-
CO5	3	2	1	-	-	2	2	-	-	-	-	-	-	-
Average:	2.8	1.8	1	1	-	2.2	2.4	-	-	-	-	-	-	-

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Subject Code	Subject Name	Category	L	T	P	C
	(ARMY WING) NCC Credit Course Level – II#	**NCC**	**3**	**0**	**0**	**3**

PERSONALITY DEVELOPMENT		**9**
PD3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD5	Public Speaking	3
LEADERSHIP		**7**
L2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA1	General Knowledge	4
ARMED FORCES		**6**
AF1	Armed Forces, Army, CAPF, Police	6
ADVENTURE		1
AD1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA1	History, Geography & Topography of Border/Coastal areas	2
	Total Contact Hours : 45	

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Subject Code	Subject Name	Category	L	T	P	C
	(NAVAL WING) NCC Credit Course Level - II#	**NCC**	**3**	**0**	**0**	**3**

PERSONALITY DEVELOPMENT		**9**
PD3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD5	Public Speaking	3
LEADERSHIP		**7**
L2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA1	General Knowledge	4
NAVAL ORIENTATION		**6**
AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3
ADVENTURE		1
AD1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA1	History, Geography & Topography of Border/Coastal areas	2
	Total Contact Hours : 45	

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Subject Code	Subject Name	Category	L	T	P	C
	(AIR FORCE WING) NCC Credit Course Level – II#	**NCC**	**2**	**0**	**0**	**2**

PERSONALITY DEVELOPMENT		**9**
PD3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD5	Public Speaking	3
LEADERSHIP		**7**
L2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA1	General Knowledge	4
GENERAL SERVICE KNOWLEDGE		**6**
GSK1	GSK 1 Armed Forces & IAF Capsule	2
GSK2	Modes of Entry in IAF, Civil Aviation	2
GSK3	Aircrafts - Types, Capabilities & Role	2
ADVENTURE		1
AD1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA1	History, Geography & Topography of Border/Coastal areas	2
		Total Contact Hours : 45

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Subject Code	Subject Name	Category	L	T	P	C
AI24411	TRACTOR AND FARM ENGINES LABORATORY	PCC	0	0	2	2

Course Objectives:

- To make the students conversant with the anatomy of farm tractor and farm engines
- To make them understand the working principle of IC engines, clutch, gear box, differential and final drive

EXPERIMENTS:

1. Identification and study of different components of diesel engine
2. Identification and study of different components of petrol engine
3. Method of working of diesel engine with the help of working models
4. Method of working of diesel engine with the help of working models
5. Dismantling and assembly of diesel engine
6. Dismantling and assembly of petrol engine
7. Study of clutch–components and method of working
8. Study of gearbox–components and method of working
9. Study of differential and final drive–components and method of working
10. Study of braking system and steering system–components and method of working
11. Study of hydraulic system and PTO system in a tractor
12. Study of electrical system, instruments in the dash board and controls components: dynamo, starting motor, battery, lights, horn, odometer, amperemeter, accelerator, brake, differential lock, PTO lever, hydraulic lever, draft and position control lever.

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the working of tractors, power tillers and their functions.
CO2	Identify and rectify problems in the functioning of tractors and power tillers.
CO3	Summarize the ergonomics of tractors and power tillers.

Reference books/other materials/web resources:

1. JagdishwarSahay. 2019. Elements of Agricultural Engineering. Standard Publishers Distributors, Dpelhi
2. Michael, A.M. and Ohja, T.P. 2018. Principles of Agricultural Engineering Volume I. Jain Brothers, Jodhpur.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	3	1	-	-	-	1	2	3	3	3
CO2	3	1	2	1	3	1	-	-	-	1	2	3	3	3
CO3	3	2	2	1	3	1	-	-	-	1	2	3	3	3
Average:	3	2	2	1	2	1	-	-	-	1	2	3	3	3

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24412	STRENGTH OF MATERIALS LABORATORY	PCC	0	0	4	2

Course Objectives:

- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally

EXPERIMENTS:

1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals(Rock well and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Find the stress distribution and strains in regular and composite structures subjected to axial loads.
CO2	Assess the shear force, bending moment and bending stresses in beams
CO3	Apply torsion equation in design of circular shafts and helical springs

Reference books/other materials/web resources:

1. Strength of Materials Laboratory Manual, Anna University, Chennai -600025
2. IS1786-2008(Fourth Revision, Reaffirmed2013),'High strength deformed bars and wires for concrete reinforcement—Specification', 2008.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	1	-	-	-	-	2	3	3	1
CO2	3	1	2	1	-	1	-	-	-	-	2	3	3	1
CO3	3	2	2	1	-	1	-	-	-	-	2	3	3	1
Average:	3	2	2	1	-	1	-	-	-	-	2	3	3	1

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24501	FARM EQUIPMENT AND MACHINERY	PCC	3	0	0	3

Course Objectives:

- To introduce the students to the working principles of farm equipment's, tillage implements
- To expose the students to farm mechanization benefits and constraints, identification of components of primary and secondary tillage implements

UNIT – I	**FARM MECHANIZATION**	**9**
Farm mechanisation — objectives. Tillage - objectives - methods — primary tillage implements - secondary tillage implements - animal drawn ploughs - construction. Types of farm implements — trailed, mounted . Field capacity - forces acting on tillage tool.		
UNIT – II	**PRIMARY AND SECONDARY TILLAGE IMPLEMENTS**	**9**
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. Disc harrows - Bund former - ridger — leveller. 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 conoweeder and rotary weeder — Engine operated and tractor weeders. Sprayers –types-classification – methods of atomization, 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 Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To understand the basics of mechanizing a farm
CO2	To understand the components of various tillage equipment.
CO3	To study about different sowing and fertilizing attachments and stand-alone units.
CO4	To study about weeder attachments and sprayers.
CO5	To study about combine harvester-thresher for various crops.

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

Reference books/other materials/web resources:

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.

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	3	-	-	-	1	-	2	3	3	1
CO2	2	3	3	2	3	-	-	-	1	-	2	3	3	1
CO3	2	3	3	2	3	-	2	-	1	-	2	3	3	1
CO4	2	3	3	2	3	-	2	-	1	-	2	3	3	1
CO5	2	3	3	2	3	-	2	-	1	-	2	3	3	1
Average:	**2**	**3**	**3**	**2**	**3**	**-**	**2**	**-**	**1**	**-**	**2**	**3**	**3**	**1**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24502	SOIL AND WATER CONSERVATION ENGINEERING	PEC	3	0	0	3

Course Objectives:

- Get a sound knowledge in the problems associated with soil erosion.
- Introduce the estimation of soil erosion.
- Impart knowledge in various practices to control erosion.
- Study about the water conservation principles and techniques.
- Get an idea about sedimentation and its control measures.

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**	**9**

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**	**9**

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 Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Gain fundamental knowledge on the concepts of erosion and sedimentation.
CO2	Gain knowledge about evolution of Universal Soil Loss Equation: and its applications.
CO3	Explain and design erosion control measures types and design specifications
CO4	Have sufficient knowledge on soil and water conservation measures.
CO5	Have sufficient knowledge on reservoir sedimentation and sediment control methods.

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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.

Reference books/other materials/web resources:	
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

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	2	2	2	2	1	3	2	2	2	2	1
CO2	2	2	3	2	2	1	2	2	3	2	2	2	2	1
CO3	2	3	3	2	2	3	1	1	1	2	2	2	2	1
CO4	3	3	3	3	2	1	1	1	2	2	2	2	2	1
CO5	3	3	3	3	2	1	2	2	3	2	2	2	2	1
Average:	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24511	FARM MACHINERY LABORATORY	PCC	0	0	4	2

Course Objectives:

- The students will be introduced to the practice of different farm machinery in the field on tillage, sowing, plant protection, harvesting and threshing; care and maintenance; lubrication; fits and tolerances and replacements; adjustments of farm machines; dismantling and reassembling of a disc harrow, seed-cum fertilizer drill and sprayer, engine pumps

EXPERIMENTS:

1. Identification of major systems of a tractor and general guidelines on preliminary check measures before starting a tractor - procedure for starting, running and stopping the tractor.
2. Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller.
3. Field operation and adjustments of ploughs
4. Field operation and adjustments of harrows
5. Field operation and adjustments of cultivators
6. Field operation of sowing and planting equipment and their adjustments
7. Field operation of plant protection equipment
8. Field operation on mowers and reapers
9. Field operation of combine and determination of field losses
10. Field operation of threshers and their performance evaluation
11. Studies on methods of repair, maintenance and off-season storage of farm equipment
12. Opening and reassembly of disc harrows, determination and adjustment of tilt and disc angles
13. Hitching of agricultural implements and trailers
14. Study and operation of bulldozer
15. Visit to agro-manufacturers

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To identify major systems in a tractor and general guidelines on preliminary check measures before starting a tractor.
CO2	To have knowledge of the field operations and management of tillage implements
CO3	To have knowledge of the field operations and management of seeder devices and plant protection equipment.
CO4	To have knowledge of the field operations and management of harvesters, threshers and combines.
CO5	To have knowledge of the field operations and management of heavy earth moving machinery.

Textbooks:

1.	Jain, S.C. and C.R. Rai. Farm Tractor Maintenance and Repair. Standard publishers and Distributors, New Delhi, 1999.
2.	Herbert L.Nichols Sr., Moving the Earth, D. Van Nostrand company Inc. Princeton, 1959.

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Reference books/other materials/web resources:	
1.	John A Havers and Frank W Stubbs, Hand book of Heavy Construction, McGraw ― Hill book Company, New York, 1971.
2.	Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	3	1	-	-	1	-	2	3	3	1
CO2	2	3	3	2	3	1	-	-	1	-	2	3	3	1
CO3	2	3	3	2	3	1	2	-	1	-	2	3	3	1
CO4	2	3	3	2	3	1	2	-	1	-	2	3	3	1
CO5	2	3	3	2	3	1	2	-	1	-	2	3	3	1
Average:	**2**	**3**	**3**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**2**	**3**	**3**	**1**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24512	ICT IN AGRICULTURAL ENGINEERING LABORATORY	PCC	0	0	4	2

Course Objectives:

- To gain practical knowledge on various technologies in information and communication for agriculture.

EXPERIMENTS:

1. Configuring timers for automatic switching "on and off" of irrigation systems
2. Experience with solenoid valves for pressurized irrigation
3. Using sensors for Agro meteorological measurements
4. Employing Printed Circuit Board (PCB) or Breadboard for controlling or triggering an agricultural system
5. Use of mobile apps for controlling or triggering an agricultural system
6. Construction of crop growth functions (best fit) for crop yields simulations
7. Image processing as tool for biotic and abiotic stress identification
8. Experience with existing open source crop simulation models
9. Exposing cloud resources for agricultural applications
10. Developing automated agro advisory systems

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Knowledge on meteorological measurements
CO2	Obtain knowledge on triggering an agricultural system
CO3	Knowledge on Image processing as tool for biotic and abiotic stress identification
CO4	Ability to conduct Spatial analysis of rainfall data and design water storage reservoirs

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	-	-	1	2	2	3	3	3
CO2	-	2	2	2	1	1	2	-	-	-	2	3	3	3
CO3	-	-	-	-	2	3	-	-	1	-	2	3	3	3
CO4	2	-	3	2	1	1	-	-	-	2	2	3	3	3
Average:	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**-**	**1**	**1**	**2**	**3**	**3**	**3**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24513	SUMMER TRAINING (2 WEEKS)	EEC	0	0	0	1

Course Objectives:

- To train the students in field work by attaching to any industry / organization so as to have a firsthand knowledge of practical problems in Agricultural Engineering
- To gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.

The students individually undertake training in reputed engineering companies / Govt organisations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

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Subject Code	Subject Name	Category	L	T	P	C
AI24601	POST-HARVEST TECHNOLOGY	PCC	3	0	0	3

Course Objectives:

- The students would be exposed to fundamental knowledge in engineering properties of agricultural materials, different Post Harvest operations and processing methods of harvested crops and storage of crops

UNIT – I	**FUNDAMENTALS OF POST HARVESTING**	**9**
Post harvest technology – 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**
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 – 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	**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 — millets processing		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the importance of post harvest processing and determine moisture content of products
CO2	Perform drying of agricultural products and analyze performance of dryers
CO3	Recognize the working principles of grain cleaning and grading devices and able to select suitable equipment for cereal grains, oilseeds, and pulses
CO4	Understand the operation of post harvest equipment like shellers, conveyors
CO5	Different Post Harvest operations and processing methods of harvested crops.

Textbooks:

1.	Chakraverty, A.Post harvest technology for Cereals, Pulses and oilseeds. Oxford & IBH publication Pvt Ltd, New Delhi, Third Edition, 2000.
2.	Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi, 1994.

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Reference books/other materials/web resources:	
1.	Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
2.	Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1	1	-	-	-	-	1	3	3	1
CO2	2	2	3	1	1	1	-	-	-	-	1	3	3	1
CO3	2	2	3	1	1	1	-	-	-	-	1	3	3	1
CO4	2	2	3	1	1	1	-	-	-	-	1	3	3	1
CO5	2	2	3	1	1	1	-	-	-	-	1	3	3	1
Average:	**2**	**2**	**3**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**3**	**3**	**1**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24602	IRRIGATION AND DRAINAGE ENGINEERING	PCC	3	0	0	3

Course Objectives:

- Inculcate water resources development and various parameters required for irrigation scheduling and its Requirement
- Understand different kinds of irrigation system and choose appropriate system for a given environment.
- Introduce different types of water control and diversion structures for planning the irrigation system.
- Understand canal, tank irrigation and command area development.
- Understand the basic concepts for planning, design and management of land drainage works in field areas

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	9

Methods of Irrigation — Surface and Subsurface methods — 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 - Excess irrigation and waterlogging problem - 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.

Total Contact Hours : 45

HoD/BOS Chairman **Principal**

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students will have knowledge and skills on Planning, design, operation and management of Water Resources and Irrigation Requirement.
CO2	The student will gain knowledge on different methods of irrigation including canal irrigation.
CO3	Obtain knowledge on different types Diversion and Impounding Structures
CO4	Understand the concept Canal Irrigation and Command Area Development
CO5	Understand the concept recycling of drainage water for irrigation.

Textbooks:	
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.
4.	Ritzema, H.P., "Drainage Principles and Applications", Publication No. 16, International Institute of Land Reclamation and Improvement, Netherlands, 1994.

Reference books/other materials/web resources:	
1.	Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
2.	Murthy, V.V.N. Land and water management, Kalyani publishing, New Delhi, 1998.
3.	Bhattacharya, A.K., and Michael, A.M., "Land Drainage — Principles, Methods and Applications", Konark Publishers Pvt. Ltd., New Delhi, 2003.
4.	Irrigation water Management, Training Manual No 6, Drainage of Irrigated Lands, Food and Agriculture Organisation, Rome 1996
5.	Kessler, J., "Drainage Principles and Applications", Vol. II and IV, International Institute of Land Reclamation and Improvement, Netherlands, 1979.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	2	2	2	2	1	2	2	2	2	2	1
CO2	2	2	3	2	2	1	2	2	2	2	2	2	2	1
CO3	2	2	2	2	2	3	1	1	2	2	2	2	2	1
CO4	3	3	2	3	2	1	1	1	2	2	2	2	2	1
CO5	3	3	3	3	2	1	2	2	3	2	2	2	2	1
Average:	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
	NCC CREDIT COURSE LEVEL 3# (ARMY WING) NCC CREDIT COURSE - III	**NCC**	**3**	**0**	**0**	**3**

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
ARMED FORCES		3
AF 2	Modes of Entry to Army, CAPF, Police	3
COMMUNICATION		**3**
C 1	Introduction to Communication & Latest Trends	3
INFANTRY		**3**
INF 1	Organisation of Infantry Battalion & its weapons	3
MILITARY HISTORY		**23**
MH 1	Biographies of Renowned Generals	4
MH 2	War Heroes - PVC Awardees	4
MH 3	Study of Battles - Indo Pak War 1965, 1971 & Kargil	9
MH4	War Movies	6
		Total Contact Hours : 45

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Subject Code	Subject Name	Category	L	T	P	C
	NCC CREDIT COURSE LEVEL 3# (NAVAL WING) NCC CREDIT COURSE - III	**NCC**	**3**	**0**	**0**	**3**

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
NAVAL ORIENTATION		**6**
NO 3	Modes of Entry - IN, ICG, Merchant Navy	3
AF 2	Naval Expeditions & Campaigns	3
NAVAL COMMUNICATION		**2**
NC 1	Introduction to Naval Communications	1
NC 2	Semaphore	1
NAVIGATION		**2**
N 1	Navigation of Ship - Basic Requirements	1
N 2	Chart Work	1
SEAMANSHIP		**15**
MH 1	Introduction to Anchor Work	2
MH 2	Rigging Capsule	6
MH 3	Boatwork - Parts of Boat	2
MH 4	Boat Pulling Instructions	2
MH 5	Whaler Sailing Instructions	3
FIRE FIGHTING FLOODING & DAMAGE CONTROL		**4**
FFDC 1	Fire Fighting	2
FFDC 2	Damage Control	2
SHIP MODELLING		**3**
SM	Ship Modelling Capsule	3
		Total Contact Hours : 45

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24611	CAD FOR AGRICULTURE MACHINERY LABORATORY	PCC	0	0	4	2

Course Objectives:

- To draft the agricultural engineering related machineries and structures manually and also by computer aided methods.

EXPERIMENTS:

1. Design and Drawing of Underground pipeline system
2. Design and Drawing of Check dam
3. Design and Drawing of Mould board plough
4. Design and Drawing of Disk plough
5. Design and Drawing of Post harvest technology units (threshers and winnowers)
6. Design and Drawing of Biogas plant.
7. Introduction & demonstration on 3D modeling softwares like Pro/E, Creo, Solid works, Solid Edge etc.

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the plan and layout of underground pipes, post harvesting units and check dams.
CO2	Design and draw the components using computer aided methods

Reference books/other materials/web resources:

1.	Michael, A.M. "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 1999.
2.	Rai, G.D. "Nonconventional Sources of Energy", Khanna publishers, New Delhi, 1995.
3.	Srivastava, A.C."Elements of Farm Machinery", Oxford and IBH Publications Co., New Delhi, 1990.
4.	Vijay Duggal. "A general guide to Computer Aided Design & Drafting, Mailmax Publications, 2000
5.	Tadeusz Stolarski et al. "Engineering Analysis with ANSYS Software", Butterworth Heinemann Publications, 2006
6.	Louis Gary Lamit, "Introduction to Pro/ENGINEER" SDC Publications, 2004.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	3	1	3	1	-	-	-	1	1	3	3	3
CO2	2	1	3	1	3	1	-	-	-	1	1	3	3	3
Average:	**2**	**1**	**3**	**1**	**3**	**1**	**-**	**-**	**-**	**1**	**1**	**3**	**3**	**3**

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Subject Code	Subject Name	Category	L	T	P	C
AI24612	POST - HARVESTING TECHNOLOGY LABORATORY	PCC	0	0	2	2

Course Objectives:

- After the end of this lab, students will be able to determine various engineering properties of grains, test and evaluate different post harvesting machineries.

EXPERIMENTS:

1. Determination of moisture content of grains by oven method and moisture meter.
2. Determination of porosity of grains.
3. Determination of coefficient of friction and angle of repose of grains.
4. Testing of paddy thresher & paddy winnower.
5. Testing of groundnut decorticator & maize sheller
6. Evaluation of thin layer drier
7. Evaluation of L.S.U. drier.
8. Determining the efficiency of bucket elevator and screw conveyor
9. Evaluation of shelling efficiency of rubber roll sheller
10. Determining the oil content of oil seeds.
11. Visit to modern rice mill
12. Visit to pulse milling industry

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Determine the different engineering properties of biological materials and their importance
CO2	Determine the efficiency of various post-harvest equipment

Textbooks:

1.	Chakraverty, A. Post harvest technology for Cereals, Pulses and Oilseeds. Oxford & IBH Publication Pvt Ltd, New Delhi, Third Edition, 2000.
2.	Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.

Reference books/other materials/web resources:

1.	Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
2.	Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.
3.	Mohsenin, N.N. Physical Properties of Plant and Animal Materials Gordon and Breach Publishers, Ludhiana, 1970.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	3	1	1	1	-	-	1	-	1	3	3	2
CO2	2	1	3	1	1	1	-	-	1	-	1	3	3	2
Average:	**2**	**1**	**3**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**1**	**3**	**3**	**2**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24613	IRRIGATION FIELD LABORATORY	PCC	0	0	2	2

Course Objectives:

- Students should be able to verify the principles studied in theory by performing the experiments in lab.

EXPERIMENTS:

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

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	On the completion of the course the student will have the knowledge on various meteorological instruments and understanding the concept of different irrigational systems in the laboratory tests.
CO2	The student will gain knowledge on infiltrometer
CO3	Obtain knowledge on Drip irrigation system with all accessories
CO4	Obtain knowledge on Sprinkler irrigation system with all accessories

Reference books/other materials/web resources:

1.	Michael, A.M., "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 1999.
2.	Asawa, G.L., "Irrigation Engineering", New Age International Private Limited, New Delhi, 1996.
3.	Laboratory Manual, Centre for Water Resources, Anna University, Chennai.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	-	-	1	2	2	3	3	2
CO2	-	2	2	2	1	1	2	-	-	-	2	3	3	2
CO3	-	-	-	-	2	3	-	-	1	-	2	3	3	2
CO4	2	-	3	-	1	-	-	-	-	2	2	3	3	2
Average:	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**-**	**1**	**1**	**2**	**3**	**3**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24701	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM	PCC	3	0	0	3

Course 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 concepts of GIS 9 Map and their influences
- To introduce the spatial data models, analysis and presentation technique
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources

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 – Expert systems

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 using image 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 Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the remote sensing principles and systems.
CO2	Gain sufficient knowledge on satellite data processing and available data products.
CO3	Know the concept of GIS and its tools.
CO4	Have knowledge on data input and analysis techniques.
CO5	Utilize these advanced techniques in addressing the real world problems.

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 Wiley and Sons, New York, 2000.

Reference books/other materials/web resources:	
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

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	-	1	1	1	1	2	3	2	2	2
CO2	3	2	3	2	1	-	1	-	1	2	3	2	2	2
CO3	3	3	2	-	1	-	-	2	2	3	3	2	2	2
CO4	2	3	1	-	-	-	1	-	1	2	2	2	2	2
CO5	2	3	2	3	2	3	1	2	1	2	1	2	2	2
Average:	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24702	RENEWABLE ENERGY IN AGRICULTURAL ENGINEERING	PCC	3	0	0	3

Course Objectives:

- To impart the fundamental knowledge on the importance of Bio resources, Bio energy and reactors.
- To study Slurry handling
- To study Bio reactors/ fermenters
- To study Alcohol and ethanol production and
- To study 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 Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students will be able to understand the concepts of bio energy sources and its applications.
CO2	Gain sufficient knowledge on Bioenergy.
CO3	Know the concept of Bioreactors and Fermentors and their working principles.
CO4	Have knowledge on production of alcohol.
CO5	Utilize these advanced techniques in conserving energy and protecting the environment.

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

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Reference books/other materials/web resources:	
1.	Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	-	1	1	1	1	2	3	2	2	2
CO2	3	2	3	2	1	-	1	-	1	2	3	2	2	2
CO3	3	3	2	-	1	-	-	2	2	3	3	2	2	2
CO4	2	3	1	-	-	-	1	-	1	2	2	2	2	2
CO5	2	3	2	3	2	3	1	2	1	2	2	2	2	2
Average:	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
GE24791	HUMAN VALUES AND ETHICS	HSMC	2	0	0	2

COURSE DESCRIPTION

- This course aims to provide a broad understanding about the modern values and ethical principles that have evolved and are enshrined in the Constitution of India with regard to the democratic, secular and scientific aspects. The course is designed for undergraduate students so that they could study, understand and apply these values in their day to day life.

Course Objectives:

- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To instill the scientific temper in the students' minds and develop their critical thinking.
- To promote sense of responsibility and understanding of the duties of citizen.

UNIT – I	**DEMOCRATIC VALUES**	**6**

Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance — World Democracies: French Revolution, American Independence, Indian Freedom Movement.
Reading Text: Excerpts from John Stuart Mills' *On Liberty*

UNIT – II	**SECULAR VALUES**	**6**

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.

Reading Text: Excerpt from *Secularism in India: Concept and Practice* by Ram Puniyani

UNIT – III	**SCIENTIFIC VALUES**	**6**

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach — Skepticism and Empiricism — Rationalism and Scientific Temper.

Reading Text: Excerpt from *The Scientific Temper* by Antony Michaelis R

UNIT – IV	**SOCIAL ETHICS**	**6**

Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.
Reading Text: Excerpt from *21 Lessons for the 21st Century* by Yuval Noah Harari

UNIT – V	**SCIENTIFIC ETHICS**	**6**

Transparency and Fairness in scientific pursuits — Scientific inventions for the betterment of society - Unfair application of scientific inventions — Role and Responsibility of Scientist in the modern society.

Reading Text: Excerpt from *American Prometheus: The Triumph and Tragedy of J.Robert Oppenheimer* by Kai Bird and Martin J. Sherwin.

Total Contact Hours : 30

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Identify the importance of democratic, secular and scientific values in harmonious functioning of social life
CO2	Practice democratic and scientific values in both their personal and professional life.
CO3	Find rational solutions to social problems.
CO4	Behave in an ethical manner in society
CO5	Practice critical thinking and the pursuit of truth.

Reference books/other materials/web resources:	
1.	The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.
2.	Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.
3.	The Oxford Handbook of Secularism, John R. Shook, Oxford University Press, 2017.
4.	The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5.	Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

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Subject Code	Subject Name	Category	L	T	P	C
AI24711	REMOTE SENSING AND GIS LABORATORY	PCC	0	0	4	2

Course Objectives:

- To introduce the principles and basic concepts of Remote Sensing and GIS through hands on training.

EXPERIMENTS:

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
14. GIS application in watershed analysis
15. GIS application in rainfall-runoff modelling
16. GIS application in soil erosion modelling

Total Contact Hours : 60

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Gain sufficient knowledge on satellite data processing and available data products.
CO2	Know the concept of GIS and its tools.
CO3	Have knowledge on data input and analysis techniques
CO4	Utilize these advanced techniques in addressing problems 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 Information Systems. Addison Wesley Longman, New York.

Reference books/other materials/web resources:

1.	Floyd F.Sabins. 2005. “Remote Sensing: Principles and Interpretation”, III edition. Freeman and Company New York.
2.	Jensen, J.R., 2004. “Introductory Digital Image Processing: A Remote Sensing Perspective”. Prentice — Hall. New Jerse

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2	2	-	-	1	2	2	2	2	2
CO2	-	2	2	2	1	1	2	-	-	-	2	2	2	2
CO3	-	-	-	-	2	3	-	-	1	-	2	2	2	2
CO4	2	-	3	2	1	1	-	-	-	2	2	2	2	2
Average:	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**-**	**1**	**1**	**2**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24712	RENEWABLE ENERGY IN AGRICULTURAL ENGINEERING LABORATORY	PCC	0	0	2	1

Course Objectives:

- To gain the practical knowledge on various renewable energy gadgets.
- To Know the concept of Automatic weather station
- To get knowledge on Testing of natural convection solar dryer

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.

Total Contact Hours : 30

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Be exposed to renewable energy sources and their applications.
CO2	Aim sufficient knowledge on Purification of biogas – CO2 and H2S removal
CO3	Know the concept of Automatic weather station
CO4	Have knowledge on Testing of natural convection solar dryer

Reference books/other materials/web resources:

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.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	-	-	1	2	2	2	2	2
CO2	-	2	2	2	1	1	2	-	-	-	2	2	2	2
CO3	-	-	-	-	2	3	-	-	1	-	2	2	2	2
CO4	2	-	3	2	1	1	-	-	-	2	2	2	2	2
Average:	1	1	2	2	2	2	1	-	1	1	2	2	2	2

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Subject Code	Subject Name	Category	L	T	P	C
AI24811	PROJECT WORK/INTERNSHIP	EEC	0	0	20	8

Course Objectives:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

Students in a group of 3 or 4 shall work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on three reviews by the review committee constituted by the Head of the Department. The project work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.

Total Contact Hours : 300

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Identify agricultural engineering problems reviewing available literature
CO2	Identify appropriate techniques to analyze complex agricultural engineering problems
CO3	Apply engineering and management principles through efficient handling of project, have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	3	3	3	3	-	-	-	2	2	2	2
CO2	3	3	1	3	3	3	3	-	-	-	2	2	2	2
CO3	2	2	2	-	3	3	3	2	2	2	2	2	2	2
Average:	**3**	**2**	**1**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
	VALUE ADDED COURSE	**EEC**	**0**	**0**	**0**	**2**

Course Objectives:

- Bridge the gap between Agricultural Engineering curriculum and current agri-industry, agritech, and farm mechanization requirements.
- Develop practical competencies using modern agricultural tools, sensors, software, and technologies.
- Enhance employability in sectors such as farm machinery, irrigation industries, precision agriculture, food processing, and agri-startup
- Improve understanding of advanced and emerging technologies in agriculture (IoT, drones, automation, energy-efficient systems).
- Promote strong industry interaction, field exposure, and experiential learning through real-time agricultural problem-solving.

STRATEGY

The Value Added Course is designed to enhance Agricultural Engineering students' technical competency, employability, and industry readiness by providing training beyond the curriculum.

Courses are chosen based on industry needs, emerging agricultural technologies, government missions (e.g., PMKSY, PMFBY, Digital Agriculture), and feedback from:

- Agricultural machinery manufacturers
- Irrigation and water resource companies
- Precision agriculture firms
- Agritech startups
- Alumni and industry experts

Each Value Added Course includes clearly defined objectives, outcomes, and practical components, ensuring hands-on skill development.

Content is delivered by qualified faculty members and industry professionals through:

- Demonstrations, Field applications, Software simulations, Lab experiments, Case studies

Assessment includes:

- Assignments, Field-based mini projects, Practical evaluations, Software/technology demonstration, Viva voce

The syllabus is periodically updated to align with industry standards, ICAR guidelines, and employability requirements.

Total Contact Hours : 30

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Demonstrate improved understanding of advanced agricultural tools, machinery systems, and precision technologies beyond the regular curriculum.
CO2	Apply modern software, sensors, and field instruments for agricultural engineering applications.
CO3	Exhibit enhanced employability skills suitable for farm machinery industries, irrigation companies, agritech startups, and food engineering sectors.
CO4	Adapt to emerging agricultural technologies such as drones, IoT-based soil sensors, smart irrigation controllers, and automation.
CO5	Apply real-time agricultural practices learned through industry interactions, field visits, and hands-on exposure to improve practical competency and industry readiness.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1:	3	2	2	1	1	-	-	-	-	1	2	3	2	3
CO2:	2	2	3	2	3	-	-	1	-	1	1	3	2	3
CO3:	3	3	2	2	2	-	-	-	-	1	1	2	3	2
CO4:	1	2	3	1	2	2	-	1	2	2	1	1	3	2
CO5:	2	1	2	2	3	-	2	-	-	1	3	3	2	3
Average:	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**3**

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PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL 1: FOOD PROCESSING

Subject Code	Subject Name	Category	L	T	P	C
AI24001	REFRIGERATION AND COLD STORAGE	PEC	3	0	0	3

Course Objectives:

- To interpret principles of operation of different Refrigeration & Air conditioning systems
- To understand the types of compressors and expansion devices and their applications
- To combine the parameters involved in design of the various air conditioning and cold storage systems

UNIT – I	**REFRIGERATION PRINCIPLES AND COMPONENTS**	**9**

Refrigeration principles - refrigeration effect coefficient of performance -units of refrigeration - Refrigeration components -compressor-classification-principle and working- condensers-types-construction, principle and working. Evaporators - types-principle and working. Expansion device types construction, principle and working. Refrigerants properties classification comparison and advantages chloroflouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants

UNIT – II	**VAPOUR COMPRESSION AND VAPOUR ABSORPTION CYCLE**	**9**

Simple vapour compression cycle - T-S diagram - p-h chart- vapour compression system-different types-vapour absorption cycle simple and practical vapour absorption system- advantages- ideal vapour absorption system- Electrolux refrigerator Lithium bromide refrigeration-construction and principles.

UNIT – III	**APPLIED PSYCHROMETRY**	**9**

Principle and properties of psychrometry, Representation of various psychometric processes on psychometric chart and their analysis, by-pass factor, sensible heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, apparatus dew point, ventilation and infiltration, energy efficiency ratio. Use of psychometric charts. Cooling and heating load calculations

UNIT – IV	**AIR CONDITIONING SYSTEM**	**9**

Air conditioning systems-equipment used-classification-comfort and Industrial air conditioning system- winter, summer and year- round air conditioning system- unitary and central air conditioning system- application of refrigeration and air conditioning-domestic refrigerator and freezer- ice manufacture

UNIT – V	**APPLICATIONS OF REFRIGERATION IN FOOD PROCESSING AND PRESERVATION**	**9**

Cooling and heating load estimation, cold storage design, types of cooling plants for cold storage. Insulation properties and types of insulation material. Cold storage for milk, meat, fruits, vegetables, poultry and marine products. Refrigerated Transport, Handling and Distribution, Cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display. Sensors for cold storage management.

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Select appropriate components of the refrigeration unit and analyze the effect of different refrigerants on environment
CO2	Differentiate various refrigeration cycles and its applicability
CO3	Apply knowledge of psychrometry for air conditioning & various food processing operations
CO4	Apply the knowledge of refrigeration and air conditioning in persevering foods using domestic and industrial refrigeration systems
CO5	Choose and design appropriate cold storage system for ensuring the product quality

Reference books/other materials/web resources:	
1.	C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2008
2.	Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice Hall of India, New Delhi, 2009
3.	Roy J. Dossat, Principles of Refrigeration, Pearson Education, New Delhi, 2007
4.	N. F Stoecker and Jones, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi, 2008
5.	Manohar Prasad, Refrigeration and Air Conditioning, Wiley Eastern Ltd., 2007
6.	J. B Hains, Automatic Control of Heating & Air conditioning, Tata McGraw Hill Publishing Company Private Limited, 2005

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1	1	1	-	-	-	1	2	2	2
CO2	3	1	2	1	1	1	1	-	-	-	1	2	2	2
CO3	3	2	2	1	1	1	1	-	-	-	1	2	2	2
CO4	3	1	2	1	1	1	1	-	-	1	1	2	2	2
CO5	3	2	2	1	2	1	1	-	-	1	1	2	2	2
Average:	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**-**	**1**	**1**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24002	FOOD AND DAIRY ENGINEERING	PEC	3	0	0	3

Course Objectives:

- To acquire better understanding of the food concentration and thermal processing of foods
- To know the physical and thermal properties of milk and different methods of milk processing and milk products
- To gain knowledge on the theory, methods, and equipment for the various unit operations of dairy industry

UNIT – I	**BASIC PROPERTIES AND THERMAL PROCESSING OF FOODS MATERIALS**	**9**

Constituents of food and their energy values – rheological properties of food materials- texture of food materials -viscometry - Concentrations of foods - freeze concentration - membrane concentration -Thermal processing of foods - product-time-temperature relationships - cooking, blanching pasteurization techniques- UHT Processing - sterilization of solid and liquid foods- batch and continuous sterilization equipment- interaction of heat energy on food components - kinetics of microbial destruction - Preservation by retort processing - principles and applications - microwave and radio frequency heating in food processing- Canning- Aseptic packaging.

UNIT – II	**DRYING AND DEHYDRATION**	**9**

Food spoilage - causes for spoilage -Moisture content - free moisture - bound and unbound moisture - equilibrium moisture content - Water activity - sorption behaviour of foods - types of dryers - drum, spray, Freeze drying, dryers-advantages and disadvantages - dehydration - methods of dehydration osmotic dehydration

UNIT – III	**MILK PROCESSING**	**9**

Physical, chemical, thermal and rheological properties of milk - storage tanks. Receiving handling and testing of milk - storage. Pasteurization - application- equipment - Low Temperature Long Time - High Temperature Short Time - Ultra High Temperature pasteurization, filling and packaging of milk and milk products

UNIT – IV	**DAIRY EQUIPMENT AND PRODUCTS**	**9**

Homogenisation - theory and working of homogenisers - high pressure homogenization of milk and other food suspensions - design criteria for homogenizing equipment- cream separation principles - types of separators. Clarifiers - butter churns - ghee manufacture - equipment - whey manufacture- techniques - equipment - ice cream freezers - condensed milk - milk powder manufacturing drying equipment- milk products - paneer - casein - probiotic dairy products - kefir- milk plant sanitation requirements - Cleaning in-place and its functions.

UNIT – V	**ADVANCED TECHNOLOGIES IN FOOD PROCESSING**	**9**

Non-thermal and other alternate thermal processing in Food processing - Nanotechnology: History- fundamental concepts - tools and techniques Nanomaterials - applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology.

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Explain physio-chemical properties of food material and select suitable thermal processing method for food products based on their properties
CO2	Compare food drying systems and assess their limitations in applying different food products
CO3	Explain physical, chemical and thermal properties of milk and compare milk processing techniques
CO4	Apply various milk processing equipment for processing and producing milk products and evaluate their performance
CO5	Assess the application and limitations of advanced food processing techniques

Reference books/other materials/web resources:	
1.	R. Paul Singh and Dennis R. Heldman. Introduction to Food Engineering. 5th edition Academic Press, USA. 2013.
2.	Heldman, Dennis R., Daryl B. Lund, and Cristina Sabliov, eds. Handbook of food engineering. CRC press, 2018.
3.	H.G.Kessler, Food Engineering and Dairy Technology, Freising, Germany, Verlag A.Kessler, 1981
4.	Sukumar De, Outlines of Dairy: Technology, Oxford University Press, 2001
5.	Minj, Jagrani, Aparna Sudhakaran, and Anuradha Kumari, eds. Dairy Processing: Advanced Research to Applications. Singapore: Springer, 2020.
6.	V. Chelladurai, and Digvir S. Jayas. Nanoscience and nanotechnology in foods and beverages. CRC Press, 2018.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	1	1	1	-	-	-	-	-	2	2	2
CO2	1	1	2	3	2	1	-	-	-	1	-	2	2	2
CO3	2	1	1	1	1	1	-	-	-	-	-	2	2	2
CO4	1	1	2	3	1	1	-	-	-	1	-	2	2	2
CO5	2	1	1	3	3	1	-	-	-	2	-	2	2	2
Average:	**2**	**1**	**1**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24003	PROCESS ENGINEERING OF FRUITS AND VEGETABLES	PEC	3	0	0	3

Course Objectives:

- Implement specific post harvest handling technique for storage and transport of fruits and vegetables
- Apply preservation techniques to produce value added fruits and vegetable products
- Learn the industrial scale processing and preservation methods to extend the shelf life of fruit and vegetable commodities

UNIT – I	**HARVESTING, HANDLING AND STORAGE OF FRUITS AND VEGETABLES**	**9**

Fruits and vegetables: classification, nutritional profile - Harvesting of fruits and vegetables - maturity indices - post harvest physiology - handling - pre-cooling and storage - Storage under ambient condition, low temperature storage - chilling, frozen storage- chilling injury, freeze burn. Controlled atmosphere storage, Modified atmosphere storage - concepts and methods - gas composition - Changes during storage

UNIT – II	**PRESERVATION OF FRUITS AND VEGETABLES BY VALUE ADDITION**	**9**

Methods of fruit and vegetable preservation - Processing using sugar- Preparation of jam, jelly, marmalade, squash, RTS, crush, nectar, cordial, fruit bar, preserves, candies and carbonated, fruit beverages. Processing using salt - Brining - Preparation of pickles, chutney and sauces, ketchup. Machinery involved in processing of fruits and vegetables products

UNIT – III	**PRESERVATION BY DRYING AND DEHYDRATION**	**9**

Drying and dehydration - Types of driers - Solar, cabinet, fluidized bed drier, spouted bed drier, heat pump drier, vacuum drier and freeze drier - Applications. Preparation of product. Changes during drying and dehydration. Problems related to storage of dried and dehydrated products.

UNIT – IV	**MINIMAL PROCESSING AND FERMENTATION**	**9**

Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables, Minimal Processing of Fruits and Vegetables. Preservation by fermentation - wine, vinegar, cider and sauerkraut.

UNIT – V	**CANNING AND BOTTLING**	**9**

Canning - principles, types of cans - preparation of canned products - packing of canned products - spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations. General considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Implement low temperature, modified atmosphere and controlled atmospheric storage methods for storage of fruits and vegetables
CO2	Produce value added products from fruits and vegetables by using suitable preservation method (sugar, salt or dehydration)
CO3	Produce dehydrated fruits and vegetables
CO4	Apply minimal processing and fermentation methods to produce value added products from fruits and vegetables
CO5	Plan to produce canned and bottled fruits and vegetables

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Textbooks:	
1.	Norman W. Desrosier, and James N. Desrosier. The Technology of Food Preservation 4th Edition, CBS Publisher & Distributions, New Delhi, 2004.

Reference books/other materials/web resources:	
1.	R.P. Srivastava and S. Kumar, Fruit and Vegetable Preservation: Principles and Practices, Third Edition, CBS Publishers & Distributors-New Delhi, 2002.
2.	A. Chakraverty, A.S. Mujumdar, G.S.Vijaya Raghavan and H.S. Ramaswamy, Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. CRC Press, USA, 2003.
3.	Girdhari Lal, G. S.Siddappa and G.L. Tandon, Preservation of Fruits and Vegetables, Indian Council of Agricultural Research, New Delhi, 2009.
4.	D.K. Salunkhe, and S.S. Kadam, Handbook of Fruit Science and Technology: Production, Composition and Processing, Marcel Dekker, New York, 1995.
5.	. K.Sharma, Stevan J.Mulvaney and Syed S.H. Rizvi, Food Process Engineering-Theory and Laboratory equipments, John Wiley & Sons, New York, 2000.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	1	2	1	2	1	1	1	1	2	2	2
CO2	2	2	1	2	1	1	1	1	2	2	2	1	1	1
CO3	1	1	1	1	1	2	1	1	1	1	1	1	2	2
CO4	2	2	2	3	1	1	1	2	1	1	1	1	1	1
CO5	2	1	1	2	3	1	2	1	2	1	3	1	1	1
Average:	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24004	STORAGE AND PACKAGING TECHNOLOGY	PEC	3	0	0	3

Course Objectives:

- To study about the different storage structures
- To learn about the different packaging materials and various methods of packaging to improve the shelf life of the products
- To understand the concepts of Controlled Atmosphere Storage and Modified Atmosphere Packaging

UNIT – I	STORAGE ENVIRONMENT AND STORAGE STRUCTURES	9

Storage losses in agricultural commodities. Physical properties of grain affecting storability- Factors of spoilage- fungi and mycotoxins- Treatments for enhancing shelf life- Fumigation Processes for bag storage piles. Rural storage structures- Bag Storage and its Design. Parameters and types of storage structure. Bulk Storage in silos and large Bins Construction of Silos, Problems of Silo storage, relative Costs of Silo and Bag Storage. Quality Changes and remedial measures of Grains during storages. Design considerations and heat load calculation of cold storage

UNIT – II	INTRODUCTION TO PACKAGING	9

Introduction Protection of Food products major role and functions of food packaging Effect of environmental factors, mechanical forces and biological factors on food quality and shelf life. Estimating the shelf life requirement accelerated storage studies. Tests on packaging materials Mechanical strength (Tension, notch and tearing strengths), Gas and water vapour transmission rates.

UNIT – III	CONTROLLED ATMOSPHERE STORAGE AND MODIFIED ATMOSPHERE PACKAGING	9

PACKAGING 9 Introduction and concept of CA Storage Equipment for creating, maintaining and measuring controlled atmosphere - Biochemical aspects of CA storage - Static & Dynamic CA, Fruit Ripening, Hypobaric and Hyperbaric Storage. Effects of concentrations of compositional gases on Fruits and vegetables. MAP-Film & Coating types, Permeability, Gas Flushing, Perforation, Absorbents, Humidity, Temperature, Chilling Injury, Shrink wrapping, Vacuum Packing, Modified Interactive Packaging, Minimal Processing, Equilibrium Modified Atmosphere Packaging, Effect of scavengers.

UNIT – IV	CANNING	9

Metal Cans and Glass Bottles as Packaging. Types of Metallic cans. Basics of Canning operations, Can closures. Glass jars and Bottles in food packaging, Design features and applications, Sterilization of bottles, advantages and problems, Bottle and jar closures, different types of caps and liners used. Plastics used and their Specific applications - Polyethylene (LDPE and HDPE),Cellulose, Polypropylene (PP), Polyesters, Polyvinylidene Chloride (PVDC Diofan, Ixan and Saran),Polyvinyl chloride, Copolymers their applications. Closing and sealing of Rigid plastic containers Seal types.

UNIT – V	FLEXIBLE FILMS PACKAGING	9

Formation of Films and pouches, Co-extruded films and Laminates applications. Filling and Sealing of pouches and flexible plastic containers, Pouch form fill seal machines: Rigid and Semi rigid plastic packaging. Fabrication methods Thermo forming, Blow moulding, Injection moulding, Extrusion Blow moulding applications. Laminated Paper board Cartons, Fibre Board and Corrugated Card Board packaging - applications. Nano packaging and smart packaging. Printing on packages, Bar codes, Nutrition labeling and legislative requirements. Sensors and IoT in Food packaging.

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Possess the knowledge on Storage environment and storage structures
CO2	The students will have a clear understanding of various methods of storage and different packaging techniques for food.
CO3	Determine the principles of Controlled Atmosphere Storage and Modified Atmosphere Packaging
CO4	Differentiate various canning systems and their application in food industry
CO5	Apply the knowledge to choose suitable flexible packaging film and the sealing technique for processed foods.

Textbooks:	
1.	Sahay, K.M. and K.K.Singh. 1996. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd., New Delhi.
2.	Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.
3.	Pandey, P.H.2002. Post harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.

Reference books/other materials/web resources:	
1.	Samuel Matz, The Chemistry and Technology of Cereals as Food and Feed, Chapman & Hall, 1992
2.	N.L.Kent and A.D.Evans, Technology of Cereals (4th Edition) Elsevier Science (Pergaman), Oxford, UK,1994
3.	Ruth H. Matthews: Pulses Ã¢?? Chemistry, Technology and Nutrition Mercel Dekker Inc., USA,1989
4.	Gordon L. Robertson, Food Packaging- Principles and Practice Marcel Dekker Inc, USA, 1993
5.	Donald Downing, Complete Course in Canning (3 Volumes) CTI Publications Inc, USA, 1996

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	1	1	1	2	1	1	1	1	1	1	2
CO2	1	1	2	3	2	1	1	1	2	1	2	1	1	1
CO3	2	1	1	1	1	1	1	2	1	1	1	2	1	1
CO4	1	1	2	3	1	1	1	1	1	1	1	1	2	1
CO5	2	1	1	3	3	1	2	1	2	1	3	1	1	2
Average:	**2**	**1**	**1**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

HoD/BOS Chairman **Principal**

Subject Code	Subject Name	Category	L	T	P	C
AI24005	FOOD PROCESS EQUIPMENT AND DESIGN	PEC	3	0	0	3

Course Objectives:

- Impart knowledge on basic principles of designing equipment for food processing
- Become familiar with design and manufacture of storage tanks, pulpers, heat exchangers, driers etc.
- Provide an idea about devising cold storage units, freezers etc.

UNIT – I	**PROCESS EQUIPMENT DESIGN**	**9**
Introduction on process equipment design, principles and selection of food processing equipment Application of design engineering for processing equipment.		
UNIT – II	**DESIGN PROCEDURE**	**9**
Design parameters and general design procedure, Material specification, Types of material for process equipment, Design codes, Pressure vessel design, Design of cleaners		
UNIT – III	**HEAT EXCHANGER**	**9**
Design of tubular heat exchanger, shell and tube heat exchanger and plate heat exchanger Problems on tubular heat exchanger, shell and tube type heat exchanger and plate heat exchanger		
UNIT – IV	**CONVEYING SYSTEM**	**9**
Design of belt conveyer, screw conveyer and bucket elevator, Design of dryers. Design of milling equipment.		
UNIT – V	**CAD**	**9**
Optimization of design with respect to process efficiency, energy and cost, Computer Aided Design		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Analyse the various process equipment design.
CO2	Understand the design procedure the development of vessels and cleaners.
CO3	Analyse the different types heat exchanger methods
CO4	Apply the different methods of conveying system
CO5	Optimize the variables using CAD for the process equipment design.

Textbooks:

1.	Rajput R K, 2008 Heat and Mass Transfer. S Chand Publishers
2.	Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
3.	Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
4.	Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi

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Reference books/other materials/web resources:	
1.	Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
2.	Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
3.	McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
4.	Singh, R. Paul. and Heldman, R.Dennis. 2004. Introduction to Food Engineering. 3rd Edition.Academic Press, London.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1	2	2	1	1	1	1	1	2	1
CO2	2	1	2	1	2	1	1	1	2	1	2	1	1	2
CO3	1	1	1	2	1	1	1	2	1	1	1	2	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO5	2	1	3	1	1	1	2	1	2	1	3	1	2	2
Average:	**1**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
AI24006	FOOD PLANT DESIGN AND MANAGEMENT	PEC	3	0	0	3

Course Objectives:

- State the different specifications and processes involved in the design and development of food processing plant
- Define the processes involved in layout design
- Evaluate the projects and cost estimation of designing food plant
- Outline the product cost and plant overheads
- Perform profitability analysis in food processing industry.

UNIT – I	**PLANT LAYOUT-INTRODUCTION**	**9**

Design considerations of processing agricultural and food products. Plant design concepts and general design considerations: Plant layout, plant location, location factors and their interaction with plant location, location theory models, and computer aided selection of the location. Human factors in design, selection of materials of construction and standard component, design standards and testing standards.

UNIT – II	**PROCESS ECONOMICS OF PLANT LAYOUT**	**9**

Feasibility analysis and preparation of feasibility report: plant size, factors affecting plant size and their interactions, estimation of break-even and economic plant size; Product and process design, process selection, process flow charts, Plant utilities, electricity, water, steam, air, raw material requirements and computer aided development of flow charts.

UNIT – III	**DEVELOPMENT AND PRESENTATION OF LAYOUT**	**9**

Hygienic design aspects and worker's safety, functional design of plant building and selection of building materials, estimation of capital investment, analysis of plant costs and profitability's, management techniques in plant design including applications of network analysis, preparation of project report and its appraisal.

UNIT – IV	**FOOD PROCESSING PLANT & EQUIPMENT LAYOUT**	**9**

Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages; milk and milk products; meat, poultry and fish processing industries. Equipment layout in Food Industries : Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.

UNIT – V	**PROJECT EVALUATION AND COST ESTIMATION**	**9**

Preparation of flow sheets for material movement and utility consumption in food plants; Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in project planning and monitoring; Cost estimation for a Food Plant; Scale-up. Case Study: Preparation of plant layout and cost estimation for a food processing plant

Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Design and construct the well-equipped food processing plant for effective processing
CO2	List the start – to – end facilities, infrastructure, utilities, investments along with the government regulations and specifications for plant layout
CO3	Evaluate and estimate the capital investments and methods of cost estimation of designing food plants
CO4	Assess the overall production cost, profitability and factors involved in the cost estimation of products manufactured
CO5	Analyze the problems involved in deciding the level of manufacture of a food product

Reference books/other materials/web resources:	
1.	Maroulis, Z.B. and Saravacos, G.D. . Food Process Design. Marcel Dekker Inc,. 2003.
2.	Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas,"Food Plant Design (Food Science and Technology)", CRC Press, 2005.
3.	Towler, G. and Sinnott, R.K. Chemical Engineering design principles, practice and Economics of Plant and Procese. 2nd Edition. Elsevier.2012.
4.	Theunis C. Robberts . Food plant engineering system. II Edition, CRC Press, Washington, 2013.
5.	M Moore, Mac Millan, Plant Layout & Design. Lames, New York, 1971.
6.	Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	3	1	1	2	2	-	-	1	1	1	1	1
CO2	1	1	3	2	1	2	2	-	-	3	1	3	3	3
CO3	1	1	3	2	1	2	2	-	-	3	1	3	3	3
CO4	2	1	3	2	1	2	2	-	-	3	1	3	3	3
CO5	1	1	3	3	1	2	2	-	-	3	1	3	3	3
Average:	**2**	**1**	**3**	**2**	**1**	**2**	**2**	**-**	**-**	**3**	**1**	**3**	**3**	**3**

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Subject Code	Subject Name	Category	L	T	P	C
AI24007	EMERGING TECHNOLOGIES IN FOOD PROCESSING	PEC	3	0	0	3

Course Objectives:

- Understand and apply the different emerging technologies in processing of foods
- Familiarize about the equipment used for the processing of foods by novel technologies
- Compare the application of alternate thermal and non-thermal processing techniques on foods

UNIT – I	**HIGH PRESSURE PROCESSING**	**9**
Principles - Mechanism and applications of high pressure processing to food systems - High pressure processing of salads, meats and sea foods, fruits and fruit products -Effect of high pressure on microorganisms, enzymes, textural and nutritional quality of foods - Other applications of high pressure processing - High Pressure Freezing: principles and equipment, types of high pressure freezing process, microbiological and enzymatic inactivation after high pressure freezing.		
UNIT – II	**PULSED ELECTRIC FIELDS PROCESSING**	**9**
Principles - Mechanism - PEF treatment systems - Main processing parameters PEF technology Equipment - Applications - Mechanisms of microbial and enzyme inactivation. PEF processing of solid foods, liquid foods and beverages. Food safety aspects of pulsed electric fields.		
UNIT – III	**FOOD IRRADIATION**	**9**
Introduction - Fundamentals of food Irradiation - Type and sources of radiation, dosimetry, mode of action of ionizing radiation - Direct and indirect effect, radiation effect on food constituents, Dose requirement for different products and regulations.		
UNIT – IV	**ALTERNATIVE NON THERMAL PROCESSING TECHNIQUES**	**9**
High intensity pulsed light technology:- principles of PLT technology - Technological aspects of PLT - Effects of PLT technology on microorganisms and food quality. Ultrasound Processing:Principle of ultrasound - Fundamentals - Ultrasound as a processing and food preservation tool - Effect of ultra sound on properties of foods - Applications of ultrasound in microbial inactivation, assisted drying, extraction, osmotic dehydration, detection of foreign bodies, filtration and freezing - challenges in ultrasound processing. Radio frequency electric fields: equipment, applications for heating and drying, effect of radio frequency electrical field on inactivation of microorganisms.		
UNIT – V	**ALTERNATIVE THERMAL PROCESSING TECHNIQUES**	**9**
Hurtle technology- Microwave heating and microwave drying: Microwaves - dielectric heating, dielectric properties of foods - thermal properties of foods - Recent developments in microwave heating - combined microwave-vacuum drying, microwave freeze-drying - applications. Case Study – development of a nonthermal processing technique for food and beverages.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the effect of high pressure processing on microbial inactivation of foods
CO2	Apply the principle of pulsed electric field and analyse the impact of pulsed electric field processing for both solid and liquid foods
CO3	Apply and assess the irradiation dosage requirement for foods
CO4	Apply non thermal technologies for inactivation of microorganisms and improve the food quality
CO5	Apply advanced thermal treatments for food processing and preservation

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Reference books/other materials/web resources:	
1.	Emerging Technologies for Food Processing. Da-Wen Sun (Ed), Academic Press, 2 Edition, 2014.
2.	Novel Food Processing Technologies. M. P. Cano, M. S. Tapia, and G. V. BarbosaCanovas, CRC Press, 1st Edition, 2004.
3.	Maria Laura Passos, Claudio P. Ribeiro, Innovation in Food Engineering: New Techniques and Products, CRC press, 2010.
4.	Howard Q. Zhang, Gustavo V. Barbosa-Canovas, V. M. Balasubramaniam, C. Patrick Dunne, Daniel F. Farkas, James T. C. Yuan, Nonthermal Processing Technologies for Food,2000
5.	Amit K. Jaiswal, Food Processing Technologies: Impact on Product Attributes. CRC Press, 2017

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	3	2	2	1	-	-	-	-	1	1	1
CO2	1	1	1	3	2	2	1	-	-	-	-	1	1	1
CO3	1	2	1	3	2	2	1	-	-	-	-	1	1	1
CO4	2	1	1	3	2	2	1	-	-	-	-	1	1	1
CO5	2	1	1	3	2	2	1	-	-	-	-	1	1	1
Average:	**2**	**2**	**1**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**

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VERTICAL 2- FARM MACHINERY AND ENERGY

Subject Code	Subject Name	Category	L	T	P	C
AI24008	FARM POWER AND MACHINERY MANAGEMENT	PEC	3	0	0	3

Course Objectives:

- To expose the student with the mechanization status in the country and management techniques for future requirements.

UNIT – I	**FARM MECHANIZATION**	**9**
The role of farm mechanization and its relationship to productivity, employment, social and Technological change.- Farm Power availability- Mechanization status in India–performance index of power source and farm machinery -Scheduling of farm operations		
UNIT – II	**COST ANALYSIS**	**9**
Farm records and inventory control - cost analysis of machinery: fixed cost and variable costs, effect of inflation on cost; Cost economics of tractor and farm machinery – land preparation, planting , intercultural, plant protection and harvesting machinery cost calculation		
UNIT – III	**MACHINERY SELECTION**	**9**
Selection of tractor and farm machinery – Matching implements for different hp- computation of hp requirement -optimum machinery and Replacement criteria; Break-even analysis, reliability and cash flow problems;		
UNIT – IV	**FARM MACHINERY OPERATION AND MANAGEMENT**	**9**
Operations and adjustments of Land preparation , planting, intercultural, plant protection and harvesting machinery – management of machinery .		
UNIT – V	**CUSTOM HIRING MODELS**	**9**
– Custom hiring project formulation – ownership vs custom hiring services- Economic viability of custom hiring service units – Replacement of farm machinery		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	have knowledge about the present status of farm mechanization
CO2	be able to optimally select machinery for varying uses.
CO3	be able to plan for mechanization of the farm.
CO4	be able to estimate the cost of machinery.
CO5	be able to create custom hiring centres

Textbooks:

1.	Donnell Hunt , Farm Power and Machinery Management
2.	Johl S S and Kapur T R 1989. Fundamentals of Farm Business Management, Kalyani Publishers , Ludhiana

Reference books/other materials/web resources:

1.	Mahajan M 2001. Industrial Engineering and Production Management Dhanpet Rai and Co (P) Ltd. New Delhi
2.	Sharma D N and S.Mukesh, 2013. Farm Power and Machinery Management, Jain Brothers, New Delhi.

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	1	3	2	2	1	3	3	3	3	1
CO2	3	1	2	2	3	3	2	2	1	3	3	3	3	1
CO3	3	1	3	2	3	3	2	2	1	3	3	3	3	1
CO4	3	2	2	3	3	3	2	2	1	3	3	3	3	1
CO5	3	3	3	3	3	3	2	2	1	3	3	3	3	1
Average:	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**3**	**3**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
AI24009	TESTING AND EVALUATION OF FARM MACHINERY AND EQUIPMENT	PEC	3	0	0	3

Course Objectives:

- Learn out testing of tractors and all other agricultural equipment and machinery

UNIT – I	**TESTING OF AGRICULTURAL TRACTORS**	**9**
Testing and evaluation system in India - Agricultural machinery situation -Mechanization policy – future prospects - standardization efforts - type of testing systems – General regulations - terminology- basic measurements, speed, fuel consumption, smoke density and power measurement - test items, specifications checking - PTO performance test- engine test, drawbar performance test - field test procedures -interpretation of results		
UNIT – II	**TESTING OF TILLAGE AND SOWING EQUIPMENT**	**9**
Testing of tillage machinery - laboratory test (hardness testing, chemical analysis) - field test (rate of work, quality of work, draft measurement, fuel consumption) - seed drill - laboratory test (seed drill calibration) - field checking and field tests		
UNIT – III	**TESTING OF INTERCULTURAL EQUIPMENT**	**9**
Testing and evaluation of weeders - types of tests for weeder - types of pesticide application equipment - terminology - types of tests for sprayers - testing methods - types of test for duster - testing methods		
UNIT – IV	**TESTING OF COMBINE HARVESTER**	**9**
Types of grain combines - combine systems - test items - procedure for laboratory testing - materials for field test - observations during field tests - sample analysis- data analysis - summary of performance parameters - analysis of field test data		
UNIT – V	**SAFETY TESTING OF AGRICULTURAL MACHINERY**	**9**
Types of agricultural machinery accidents - causes of agricultural machinery accidents - technical| measurements for ensuring safety - methods of safety testing- ROPS and FOPS -safety precautions		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the basics of testing procedures and standards of tractor testing
CO2	Understand the testing procedures and standards of tillage, sowing equipment
CO3	Understand the testing procedures and standards of intercultural equipment
CO4	Understand the testing procedures and standards of harvesting equipment
CO5	Understand the safety standards and testing procedures

Textbooks:

1.	Metha M.L., SR.Verma, K Mishra and VK Sharma. 1995. Testing and Evaluation of Agricultural Machinery, National Agricultural Technology Information Centre, Ludhiana
2.	Indian Standards Test Codes related to tractors, power tillers and agricultural implements

Reference books/other materials/web resources:

1.	Anonymous. 1983. RNAM Test Codes & Procedures for Farm Machinery. Technical Series 12.
2.	Nebraska Tractor Test Codes for Testing Tractors, Nebraska, USA.

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO83**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	-	1	1	1	3	-	2	3	2	2	2
CO2	3	1	2	-	1	1	1	3	-	2	3	2	2	2
CO3	3	1	2	-	1	1	1	3	-	2	3	2	2	2
CO4	3	1	2	-	1	1	1	3	-	2	3	2	2	2
CO5	-	-	2	-	1	1	1	3	-	2	-	2	2	2
Average:	**3**	**1**	**2**	**-**	**1**	**1**	**1**	**3**	**-**	**2**	**3**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24010	BIOCHEMICAL AND THERMOCHEMICAL CONVERSION OF BIOMASS	PEC	3	0	0	3

Course Objectives:

- To expose the students with different bio and thermal conversion of biomass.

UNIT – I	**BIOMASS CHARACTERIZATION**	**9**
Biomass – types – fuels from biomass. Terms and units used in biomass production. Biomass fuel characterization – physical, chemical and thermal – energy release. Supply chain – harvesting / collection – transportation and processing. Briquetting – types – pelletizing.		
UNIT – II	**BIOCHEMICAL CONVERSION**	**9**
Biochemical degradation – factors affecting biogas production - types of biogas plants – construction details – operation and maintenance – utilization of biogas - slurry handling, utilization and enrichment – high rate biomethanation process – landfills – bioethanol – feedstock – process – utilization - composting - methods – machinery.		
UNIT – III	**THERMO CHEMICAL CONVERSION BY COMBUSTION**	**9**
Thermochemical degradation. stoichiometric air requirement - Combustion process – chemistry of combustion - combustion zones - emissions. Cofiring of biomass. Incinerators - layout. Combustion of wastes and MSW. Wood burning stoves - types- operation.		
UNIT – IV	**THERMOCHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS**	**9**
Biomass gasification – chemistry of gasification – types of gasifier – Gas cleaning & conditioning - utilization of producer gas - emissions – commercial gasifies plants. Pyrolysis – product recovery – types - biochar – bio oil – operation – recovery.		
UNIT – V	**COGENERATION AND WASTE HEAT RECOVERY**	**9**
Cogeneration technologies – cycles – topping – bottoming – problems – applications – selection. Waste heat recovery - plate heat exchangers - waste heat boilers - heat pumps - thermic fluid heaters - selection of waste heat recovery.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Biomass identification and classes
CO2	Biomass characters and biochemical conversion.
CO3	Thermo chemical conversion techniques and cogeneration from waste
CO4	To know about application of biomass conversion
CO5	Analyse the energy generated from waste

Textbooks:

1.	Chawla, O.P.1986. "Advances in Biogas Technology". ICAR Publication, New Delhi.
2.	Rao. S and B.B. Parulekar. 2000. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi.
3.	Horlock JH, 1987. Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford Press.

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Reference books/other materials/web resources:	
1.	Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.
2.	Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. Technology and application of biogas. Jain Brothers, New Delhi.
3.	Mathur,A.N.and Rathore,N.S.1993.,Biogas production Management and Utilisation. Himanshu Publication. New Delhi.
4.	Chakraverty, A. 1993. Biotechnology and other alternate technologies for utilisation of biomass. Oxford and IBH Publishing Co., New Delhi.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	1	3	-	2	1	3	2	2	2	2
CO2	3	1	2	2	3	3	-	2	1	3	2	2	2	2
CO3	3	1	3	2	3	3	-	2	1	3	2	2	2	2
CO4	3	2	2	3	3	3	-	2	1	3	2	2	2	2
CO5	3	3	3	3	3	3	-	2	1	3	2	2	2	2
Average:	**3**	**2**	**2**	**2**	**3**	**3**	**-**	**2**	**1**	**3**	**2**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24011	WASTE AND BY PRODUCT UTILIZATION	PEC	3	0	0	3

Course Objectives:

- To expose the students with different byproducts of food industry and waste water management of any industry.

UNIT – I	**INTRODUCTION TO WASTE WATER TREATMENT**	**9**
Types and formation of by-products and waste; magnitude of Waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment.		
UNIT – II	**CHEMICAL PROPERTIES**	**9**
Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbigy of waste, other ingredients like insecticide, pesticides and fungicides residues.		
UNIT – III	**BY-PRODUCTS UTILIZATION**	**9**
Waste utilization in various industries, furnaces and boilers run on agricultural wastes and by products, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting.		
UNIT – IV	**PROCESSING TECHNIQUES**	**9**
Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary· treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, Tertiary treatments.		
UNIT – V	**ADVANCED WASTE WATER TREATMENT PROCESSES**	**9**
Sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Types of waste and influences
CO2	Waste water management from any food industry.
CO3	By product utilization from processing plants of cereals, pulses
CO4	Hands on training in wastewater treatment process
CO5	Advance procession techniques for waste water treatment

Textbooks:

1.	Huang, R.T. 1982. Compost Engineering: Principles and Practices.John Willey & Sons, New York.

Reference books/other materials/web resources:

1.	Standards, ASAE: Manure Production and Characteristics. ASAE, NewYork.
2.	USDA: Agricultural Waste Management Field Hand Book, New York, USA.

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	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	1	3	2	2	1	3	2	2	2	2
CO2	3	1	2	2	3	3	2	2	1	3	2	2	2	2
CO3	3	1	3	2	3	3	2	2	1	3	2	2	2	2
CO4	3	2	2	3	3	3	2	2	1	3	2	2	2	2
CO5	3	3	3	3	3	3	2	2	1	3	2	2	2	2
Average:	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**1**	**3**	**2**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24012	HUMAN ENGINEERING AND SAFETY IN FARM MACHINERY OPERATIONS	PEC	3	0	0	3

Course Objectives:

- To impart the fundamental knowledge to the student on the importance of human engineering and safety in the field of agriculture machinery.

UNIT – I	**ERGONOMICS**	**9**
Ergonomics- introduction- Role of ergonomics in Agriculture - Human metabolism- energy liberation in human body- Types of human metabolism- 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 dimensions- Cost benefit analysis - applications of anthropometric data. Anthropometric consideration in tool / equipment design.		
UNIT – V	**HUMAN SAFETY**	**9**
Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the importance of human factors and their application in system development.
CO2	Know the effect of visual, auditory and factual displays in human performance.
CO3	Understand the importance of optimum work-rest cycles in endurance.
CO4	Be able to ideally design the work space in accordance to anthropometry.
CO5	Have the general understanding safety features and regulation acts in farm machinery.

Textbooks:

1.	Ernest and Mc Cormick, E.L. (1970). Human factors in engineering and design. McGraw Hill Co., New York.
2.	Grandjean, E. (1988). Fitting the task to the man. Taylor and Francis, London.
3.	Liljedhal, J.B, Carleton, W.M, Smith, P.K and David, M. (1978). Tractors and power units. John Wiley and sons, New York.
4.	Murrel, K.H.F. (1978). Ergonomics, Man in his working environment. Chapman and Hall, London.

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Reference books/other materials/web resources:	
1.	Astrand, O.P and Rodhal, J. (1977). Work Physiology. Mc Graw hill Co. New York.
2.	https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/risk_management/ss_handbook/media/Chap17_1200.pdf
3.	http://www.derby.ac.uk/online/course/ergonomics-msc
4.	http://www.online.colostate.edu/certificates/ergonomics/
5.	http://www.cdc.gov/nchs/data/nhanes/nhanes3/cdrom/nchs/manuals/anthro.pdf

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	2	2	1	3	2	2	1	3	3	1	1	1
CO2	3	1	2	2	3	3	2	2	1	3	3	1	1	1
CO3	3	1	3	2	3	3	2	2	1	3	3	1	1	1
CO4	3	2	2	3	3	3	2	2	1	3	3	1	1	1
CO5	3	3	3	3	3	3	2	2	1	3	3	1	1	1
Average:	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**1**	**1**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
AI24013	PRECISION FARMING EQUIPMENT	PEC	3	0	0	3

Course Objectives:

- To learn about the fundamentals of precision farming principles and application of precision farming equipment

UNIT – I	**ROLE OF ELECTRONICS IN AGRICULTURAL ENGINEERING**	**9**
Role of electronics in agricultural engineering for precision agriculture. Basics of precision agriculture, tools for implementation of precision agriculture. Introduction of GIS/GPS positioning system for precision farming. Use of GIS and GPS in farm machinery and equipment.		
UNIT – II	**SENSORS, MICROCONTROLLER AND ACTUATOR FOR PRECISION AGRICULTURE**	**9**
Types of sensor- principle and concept of different sensor like ultrasonic, proximity, PIR, IR, radar, pressure, gas, temperature, moisture, strain /weight, colour sensor etc. used in agriculture. Microcontroller: Arduino, Raspberry Pi and PLC Actuator : DC Motor, Pump, linear Actuator etc. - Basic input circuits and signal conditioning systems – amplifiers and filters.		
UNIT – III	**PRECISION FARMING CONCEPTS AND PRECISION FARMING MACHINERY**	**9**
Precision farming concepts- Map based system- Real time system – Combination Map and real time system -components of PF – Site specific management- Constraints of PF- Precision tillage, planting, intercultural, plant protection and harvesting equipment, laser guided leveller, power sprayer, straw chopper cum spreader, straw bailer, combine harvester etc.		
UNIT – IV	**SITE-SPECIFIC MANAGEMENT SYSTEM**	**9**
Site-specific nutrient management- weeds management- Agro-chemicals and fertilizer management, data sources and decision making for site-specific management. Grain quality and yield. Yield monitoring and mapping, soil sampling and analysis.		
UNIT – V	**UNMANNED VEHICLES AND IOT IN AGRICULTURE**	**9**
UAV -Drones- Types - applications – rules and regulations – Autonomous ground vehicles – Robotics- platforms and unmanned agricultural vehicles- IoT - crop yield estimates- threat identification- crop insurance-pesticides spraying, environmental monitoring- protected cultivation- food quality monitoring etc,		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the role of electronics in precision farming
CO2	Analyse the principles and applications of sensors, micro controllers and actuators in precision farming equipment
CO3	Understand the precision farming concepts and machinery
CO4	Understand about site specific management system and unmanned vehicles & IoT applications
CO5	Analyse the application of sensors and electronics in farm machinery

Textbooks:

1.	Brase, T.A. 2006. Precision Agriculture. Thomson Delmar Learning, New York.
2.	Hermann, J.H. 2013. Precision in Crop Farming, Site Specific Concepts and Sensing Methods: Applications and Results. Springer, Netherlands.
3.	Krishna, K. R. 2016. Push Button Agriculture Robotics, Drones, Satellite-Guided Soil and Crop Management. Apple Academic Press
4.	Srivastava,A K., Carroll E.G., Roger P. R. and Dennis R.B.2006. Engineering Principles of Agricultural Machines. American Society of Agricultural and Biological Engineers, USA.
5.	Zhang, Q. 2015. Precision Agriculture Technology for Crop Farming. CRC Press, New York.
6.	Kepner, R.A., Bainer, R. and Berger, E.L. 1978. Principles of Farm Machinery.AVI Publ.

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7.	Sahay, K.M. and Singh, K.K. 1994. Unit Operation of Agricultural Processing. Vikas Publ. House.
8.	Michael, A.M. 2007. Irrigation: Theory and Practice. Vikash Publishing House Pvt. Ltd., New Delhi.
9.	Rai G.D. 1994. Non-conventional sources of energy. Khanna Publishers, Delhi

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1	3	2	2	1	3	3	2	2	2
CO2	3	2	2	1	3	3	2	2	1	3	3	2	2	2
CO3	3	2	3	1	3	3	2	2	1	3	3	2	2	2
CO4	3	2	2	1	3	3	2	2	1	3	3	2	2	2
CO5	3	3	3	1	3	3	2	2	1	3	3	2	2	2
Average:	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24014	SOLAR AND WIND ENERGY SYSTEM	PEC	3	0	0	3

Course Objectives:

- To learn about the fundamental aspects of solar energy availability, solar energy conversion technologies
- To understand about the fundamental aspects of wind energy availability and wind power generators
- To acquire the knowledge on the alternate sources of energy such as geothermal energy, wave energy, tidal energy, OTEC energy, fuel cells and energy storage

UNIT – I	**SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS**	**9**

Solar radiation availability - radiation measurement -transmittance - absorptance flat plate collectors - heat transfer correlations - collector efficiency - heat balance -absorber plate - types - selective surfaces. Solar driers types heat transfer performance of solar dryers agro industrial applications.

UNIT – II	**SOLAR CONCENTRATING COLLECTORS AND PV TECHNOLOGY**	**9**

Optically concentrating collectors- types reflectors - solar thermal power stations principle and applications - solar stills- types- solar pond performance- characteristics applications. Photovoltatics types characteristic- load estimation batteries invertors operation system controls. PV system installations standalone systems- PV powered water pumping system sizing and optimization hybrid system solar technologies in green buildings.

UNIT – III	**WIND MAPPING ANALYSIS AND CHARACTERISTICS OF WIND**	**9**

Nature of wind - wind structure and measurement - wind power laws - velocity and power duration curves- aero foil - tip speed ratio - torque and power characteristics power coefficients - Betz coefficient

UNIT – IV	**WIND MILL DESIGN AND APPLICATIONS**	**9**

Turbines- Wind mill - classification - power curve. Upwind and downwind systems - transmission rotors - pumps - generators - standalone system - grid system -batteries. Wind energy storage - wind farms - wheeling and banking - testing and certification procedures.

UNIT – V	**ALTERNATE ENERGY SOURCES**	**9**

Ocean energy - off shore and on shore ocean energy conversion technologies - OTEC principles - open and closed cycles. Tidal energy - high and low tides - tidal power - tidal energy conversion. Geothermal energy - resources - classification and types of geothermal power plants. Nuclear energy - reactions -fusion, fission, hybrid reactors. Fuel cell - principle and operation - classification and types. Energy storage- pumped hydro and underground pumped hydro - compressed air - battery - flywheel - thermal.

Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the basics of solar energy and solar thermal energy conversion technologies and compare direct mode and indirect mode solar dryers
CO2	Analyse the principles and applications of solar thermal power stations, solar pond, and solar stills
CO3	Understand the wind power laws and calculate the torque and power characteristics of wind energy
CO4	Design wind mills and test the units for certification
CO5	Understand the principles of geothermal energy, wave energy, tidal energy, OTEC energy, fuel cells and analyse their applications

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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.

Reference books/other materials/web resources:	
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.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1	3	2	2	1	3	3	2	2	2
CO2	3	2	2	1	3	3	2	2	1	3	3	2	2	2
CO3	3	2	3	1	3	3	2	2	1	3	3	2	2	2
CO4	3	2	2	1	3	3	2	2	1	3	3	2	2	2
CO5	3	3	3	1	3	3	2	2	1	3	3	2	2	2
Average:	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**2**	**2**

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VERTICAL III

(WATER MANAGEMENT AND PROTECTED CULTIVATION)

Subject Code	Subject Name	Category	L	T	P	C
AI24015	WATERSHED PLANNING AND MANAGEMENT	PEC	3	0	0	3

Course Objectives:

- To provide the technical know-how of analysing 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 - Watershed Based Land Use Planning-Watershed Characteristics: Classification and Measurement- priority watersheds - land resource regions in India- Importance of Watershed Properties for Watershed Management.		
UNIT – II	**WATERSHED PLANNING**	**9**
Importance of Watershed Planning - Utility of Hydrologic Data in Watershed Planning -Watershed Delineation - 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 Design of Water Harvesting Structures - 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 Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students will able to describe the watershed management concepts
CO2	The students will able to describe the components involved in watershed planning
CO3	The students will able to describe the methods of water harvesting structures
CO4	The students will able to design and construct the soil conservation structures
CO5	The students will able to prioritize and execute the watershed development programme

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Textbooks:	
1.	Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
2.	Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.

Reference books/other materials/web resources:	
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.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	2	1	2	1	2	2	2	2	2	2
CO2	3	2	3	2	3	1	3	1	3	3	2	2	2	2
CO3	3	2	3	2	2	1	2	2	2	2	3	2	2	2
CO4	3	2	2	1	2	2	3	1	2	2	2	2	2	2
CO5	2	2	1	2	3	3	3	2	1	1	2	2	2	2
Average:	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24016	GROUNDWATER AND WELL ENGINEERING	PEC	3	0	0	3

Course Objectives:

- To acquaint and equip the students with the techniques of groundwater development and management

UNIT – I	**GROUND WATER OCCURRENCE**	**9**
Occurrence of groundwater, temporal and spatial variability of groundwater, methods for groundwater exploration, determination of aquifer parameters, pumping tests, assessment of groundwater potential		
UNIT – II	**WELL CONSTRUCTION**	**9**
Groundwater structures, groundwater development and utilization, types of water wells, design and construction of water wells, drilling methods, well development, well maintenance and rehabilitation, groundwater monitoring, monitoring wells, design and construction of monitoring wells		
UNIT – III	**GROUNDWATER POLLUTION**	**9**
Groundwater development and quality considerations, groundwater contamination, sources and causes of groundwater pollution, contaminated systems and their rehabilitation, groundwater bioremediation, management of salt water ingress in inland and coastal aquifers.		
UNIT – IV	**GROUNDWATER MANAGEMENT**	**9**
Management of declining and rising water table, Natural and artificial groundwater recharge, Groundwater recharge basins and injection wells. Groundwater management in irrigation command, conjunctive water use, water lifting, different types of pumps, selection of pumps, pump characteristics curve, cost of groundwater pumping, comparative economics of surface and groundwater use for irrigation		
UNIT – V	**GROUNDWATER DEVELOPMENT POLICIES**	**9**
Major issues related to groundwater development and management in India, Legal aspects of groundwater exploitation, Diagnostic survey of sick wells/tube wells and their rehabilitation.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students will be able to describe the concepts of aquifer parameters
CO2	The students will be able to describe the components involved in Groundwater structures
CO3	The students will be able to describe the Groundwater development and quality considerations
CO4	The students will be able to describe the Management of declining and rising water table
CO5	The students will be able to prioritize and execute the Groundwater development programme

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Textbooks:	
1.	Walton, W.C. 1976. Groundwater Resource Evaluation. Mc Graw Hill. New York.
2.	Karanth, K.R. 1987. Groundwater Assessment, Development and Management. Tata- mcgraw Hill. New Delhi.
3.	Michael, A.M. and Khepar, S.D. 1989. Water Well and Pump Engineering. Tata-mcgraw Hill Publ. Co. New Delhi.

Reference books/other materials/web resources:	
1.	Giordano, M. and Villholth, K.G. 2007. The Agricultural Groundwater Revolution Volume 3.
2.	CABI Head Office, Nosworthy Way, Wallingford, Oxfordshire, OX10 8DE, UK Ghosh, N.C. and Sharma, K.D. 2006. Groundwater Modelling and Management.
3.	Madan Kumar Jha and Stefan Peiffer Applications of Remote Sensing and GIS Technologies in Groundwater Hydrology: Past, Present and Future.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2	1	3	1	2	2	2	2	2	2
CO2	3	2	2	2	3	1	3	1	3	3	2	2	2	2
CO3	2	2	2	2	2	1	2	2	2	2	3	2	2	2
CO4	2	3	2	1	2	2	3	1	1	2	2	2	2	2
CO5	2	1	1	2	3	3	3	2	1	1	2	1	1	1
Average:	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24017	DESIGN OF MICRO-IRRIGATION SYSTEM	PEC	3	0	0	3

Course Objectives:

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

UNIT – I	**MICRO IRRIGATION CONCEPT AND APPLICATIONS**	**9**
Micro irrigation -Merits, demerits, types and components of micro irrigation system- Present status, Scope and potential problem of micro irrigation - Micro-irrigation applications: Hills, arid lands, coastal and wastelands, Financial Assistance for Promotion of Micro Irrigation in India.		
UNIT – II	**DRIP IRRIGATION DESIGN**	**9**
Drip irrigation - Components- Dripper- types and equations governing flow through drippers- Wetting pattern- Chemigation application- Pump capacity -Installation- Operation and maintenance of Drip irrigation system. - Design of surface and sub-surface drip irrigation. .		
UNIT – III	**SPRINKLER IRRIGATION DESIGN**	**9**
Sprinkler irrigation- Components and accessories - Hydraulic design - Sprinkler selection and spacing- Capacity of sprinkler system - types - Sprinkler performance- Sprinkler discharge- Water distribution pattern- Droplet size, filtering unit, fertigation - System maintenance		
UNIT – IV	**ECONOMIC ANALYSIS**	**9**
Standardization and Quality Assurance of Micro Irrigation System Components. Terminologies in Economic Analysis, Optimal Flow Criterion for Economic Drip Irrigation Pipes Selection, Economic Viability of Micro Irrigation in Different Crops.		
UNIT – V	**AUTOMATION IN MICRO IRRIGATION**	**9**
Automation, Need for Automation of Irrigation, Merits and Demerits of Automation, Semiautomatic and Fully Automatic Systems of Automation, Components of Automation System, Types of Controls and Automation in Micro Irrigation		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Categorize the different types of pumps and water lifting devices based on the principle, components, and working efficiency
CO2	Explain the working principle of centrifugal pump as well as its characteristics with efficiencies and design the centrifugal pump including impeller design, casing and other parts of pumps .
CO3	Estimate water budgets and hydraulics used to develop irrigation schedules through micro irrigation based on crop geometry
CO4	Design drip and sprinkler irrigation system including, main line, sub main and laterals designs by consider pump capacity
CO5	Design green house irrigation system and advanced types of irrigation including lift irrigation and automation

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Textbooks:	
1.	Suresh, R., "Principles of Micro-Irrigation Engineering", Standard Publishers Distributors, New Delhi, 2010.
2.	Michael, A.M., "Irrigation Theory and Practice", Vikas Publishers, New Delhi, 2002.

Reference books/other materials/web resources:	
1.	Modi, P.N., and Seth, S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 1991.
2.	Jack Keller and Rond Belisher., "Sprinkler and Trickle Irrigation", Vannistrand Reinhold, New York, 1990.
3.	Sivanappan R.K., "Sprinkler Irrigation", Oxford and IBH Publishing Co., New Delhi, 1987.
4.	Keller.J and D. Karmeli, "Trickle Irrigation Design", Rainbird sprinkler Irrigation anufacturing Corporation, Glendora, California, USA.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	2	2	2	2	2	3	2	2	3	3	3
CO2	2	2	3	2	2	1	2	2	3	2	2	3	3	3
CO3	2	2	3	2	2	3	2	2	3	2	2	3	3	3
CO4	2	2	3	3	2	1	2	2	3	2	2	3	3	3
CO5	2	2	3	2	2	1	2	2	3	2	2	3	3	3
Average:	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**

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Subject Code	Subject Name	Category	L	T	P	C
AI24018	PROTECTED CULTIVATION	PEC	3	0	0	3

Course Objectives:

- To impart knowledge on the protected cultivation of vegetables, fruits and flower crops.
- To sensitize the students on hi-tech production technology of fruits and vegetables and flower crops.
- To learn and practices the various production practices of flower and other high value 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 in horticultural crops, role of commuters in developing comprehensive systems needed in site specific management (SSM), georeferencing and photometric correction. Sensors for information gathering, geostatistics, robotics in horticulture, postharvest process management (PPM), remote sensing, information and data management and crop growth models, GIS based modeling,VRT, robotics and drones in agriculture

UNIT – V	PRECISION FARMING FOR 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 Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students will be able to describe the different methods of protected cultivation practices available for vegetable crops and flowers
CO2	The students will be able to assess the technology available for vegetable crops
CO3	The students will be able to assess the technology available for flower crops
CO4	The students will be able to assess precision farming techniques using sensors and Geographic information systems for the crops
CO5	The students will be able to assess the technology available for horticulture crops

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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.

Reference books/other materials/web resources:	
1.	Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. Mapping out world: GIS lessons for Education, ESRI press, 2002
2.	David Reed, Water, media and nutrition for green house crops. Ball publishing USA, 1996
3.	Adams, C.R. K.M. Bandford and M.P. Early, Principles of Horticulture, CBS publishers and distributors, Darya ganj, New Delhi, 1996

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	2	1	2	1	2	2	2	1	1	1
CO2	3	2	3	2	3	1	3	1	3	3	2	1	1	1
CO3	3	2	3	2	2	1	2	2	2	2	3	2	2	2
CO4	3	3	2	1	2	2	3	1	1	2	2	1	1	1
CO5	2	1	1	2	3	3	3	2	1	1	2	2	2	2
Average:	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**1**	**1**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
AI24019	ON-FARM WATER MANAGEMENT	PEC	3	0	0	3

Course Objectives:

- Understand the fundamental design of irrigation channels and diversion structures.
- Study about command area development.
- Know about availability and utilization of water resources.
- Impart knowledge on water use efficiency.
- Get an idea about automation of irrigation systems and water policies.

UNIT – I	**DESIGN OF IRRIGATION CHANNELS**	**9**
Design of Erodible (earthen), Non-Erodible (lined) & Alluvial channels (pre-fabricated) - Kennedy's and Lacey's Theories; Materials for Lining watercourses and field channel; Water control and Diversion structure - Design - Land grading - Land Levelling 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 - Participatory irrigation management.		
UNIT – III	**CONJUNCTIVE USE OF SURFACE AND GROUNDWATER**	**9**
Availability of water - rainfall, canal supply and groundwater - conjunctive use - crop calendar 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 Appropriateness, Adequacy, Dependability, Equity, Reliability, Timeliness and efficiency - conjunctive use plan by optimization; Agricultural productivity indicators - Water use efficiency.		
UNIT – V	**DESIGN OF FARM DRAINAGE SYSTEM**	**9**
Agricultural drainage – types and Concept - Issues; Principles of flow through soils - Darcy's law - drainage coefficient -Infiltration theory; Surface drainage - methods - design - Random drainage - Herringbone - Grid iron types -Design of Open Drains. Steady State flow - Dupit'sForchimer 13assumptions -Hooghoudt's equation; Methods & Design - Mole drains - Drainage wells - Pipe materials -Problem soils - Leaching Requirements; Land reclamation - methods of Reclamation.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students will be able to design irrigation channels and diversion structures.
CO2	The students will be able to organize the different CADA programme and involved farmers to participate
CO3	The students will be able to inspect the conjunctive use of water resources by farmers
CO4	The students will be able to identify water balance between productivity and water use efficiency in agricultural land
CO5	The students will be able to design the surface and subsurface drainage systems.

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Textbooks:	
1.	Michael, A.M. 2006. “Irrigation Theory and practice”, Vikas publishing house, New Delhi
2.	Michael, A.M. and Ojha, T.P. “Principles of Agricultural Engineering -Vol II “,Jain Brothers, New Delhi,2002.

Reference books/other materials/web resources:	
1.	Israelson,“Irrigation principles and practices”, John Wiley & sons, New York, 2002.
2.	Modi, P.N., “Irrigation and water resources and water power engineering”, Standard Book House, New Delhi,2002.
3.	Suresh, R., “Land and water management principles”, Standard Publishers & Distributors,New Delhi,2008

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	2	3	2	3	2	2	2	3	1	1	1
CO2	3	2	2	2	3	2	3	1	3	1	2	1	1	1
CO3	2	2	1	3	3	3	2	2	2	2	3	2	2	2
CO4	3	3	2	2	2	1	3	3	1	2	2	1	1	1
CO5	2	1	3	2	3	3	3	2	1	3	3	2	2	2
Average:	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**1**	**1**	**1**

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Subject Code	Subject Name	Category	L	T	P	C
AI24020	IRRIGATION WATER QUALITY AND WASTE WATER MANAGEMENT	PEC	3	0	0	3

Course Objectives:

- To know the basics concepts of irrigation water quality
- To impart knowledge on water quality for irrigation purposes, besides relevant environmental problems and recycle and reuse concepts.
- To understand the importance of water quality for irrigation and major uses of water and the role environmental issues.

UNIT – I	**WATER QUALITY**	**9**
Physical and chemical properties of water – Suspended and dissolved solids – EC and pH – major ions –. Water quality investigation – Sampling design - Samplers and automatic samplers – Data collection platforms – Field kits – Water quality data storage, analysis and inference – Software packages		
UNIT – II	**IRRIGATION WATER QUALITY**	**9**
Water quality for irrigation – Salinity and permeability problem – Root zone salinity – Irrigation practices for poor quality water – Saline water irrigation – Future strategies		
UNIT – III	**WATER POLLUTION**	**9**
Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland.		
UNIT – IV	**RECYCLING AND REUSE OF WATER**	**9**
Multiple uses of water – Reuse of water in agriculture – Low cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation		
UNIT – V	**WATER QUALITY MANAGEMENT**	**9**
Principles of water quality – Water quality classification – Water quality standards - Water quality indices – TMDL Concepts – Water quality models		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students will be able to describe the parameters of water quality
CO2	The students will be able to describe the concepts of water quality for irrigation
CO3	The students will be able to describe the water pollution and quality considerations
CO4	The students will be able to describe the recycling and reuse of water
CO5	The students will be able to describe the management of water quality

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Textbooks:	
1.	George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, "Waste water Engineering: Treatment and Reuse", McGraw-Hill, 2002
2.	Vladimir Novonty, "Water Quality: Diffuse pollution and watershed Management", 2nd edition,John Wiley & Sons, 2003
3.	Mackenzie L Davis, David A Cornwell, "Introduction to Environmental Engineering", McGraw Hill 2006.
4.	Stum, M and Morgan, A., "Aquatic Chemistry", Plenum Publishing company, USA, 1985
5.	Lloyd, J.W. and Heathcote, J.A., "Natural inorganic chemistry" in relation to groundwater resources, Oxford University Press, Oxford, 1988

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	2	3	2	3	3	2	2	3	3	3	3
CO2	3	2	2	2	3	2	3	3	3	1	2	2	2	2
CO3	2	2	1	3	3	3	2	2	2	2	3	3	3	3
CO4	3	3	2	2	2	1	3	3	1	2	2	2	2	2
CO5	2	1	3	2	3	3	3	3	1	3	3	3	3	3
Average:	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**3**		**3**

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Subject Code	Subject Name	Category	L	T	P	C
AI24021	CLIMATE CHANGE AND ADAPTION	PEC	3	0	0	3

Course Objectives:

- To know the basics, importance of global warming
- To know the concept of mitigation measures against global warming
- To learn about the global warming and climate change.
-

UNIT – I	**EARTH'S CLIMATE SYSTEM**	**9**
Role of ozone in environment - ozone layer - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.		
UNIT – II	**ATMOSPHERE AND ITS COMPONENTS**	**9**
Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability - Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.		
UNIT – III	**IMPACTS OF CLIMATE CHANGE**	**9**
Causes of Climate change: Change of Temperature in the environment - Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.		
UNIT – IV	**CLIMATE CHANGES AND ITS CAUSES**	**9**
Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC– IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India.		
UNIT – V	**CLIMATE CHANGE AND MITIGATION MEASURES**	**9**
Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels– Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation fundingKey Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Demonstrate an understanding of how the threats and opportunities of predicted climate change will influence specific sectors at global and regional scale;
CO2	Identify the relationship between atmosphere and its components
CO3	Analyze the impacts of climate change on environment parameters
CO4	Evaluate the scientific insights underlying the assessment reports of the IPCC, with a focus on impacts, adaptation and mitigation
CO5	Critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts

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Textbooks:	
1.	Sangam Shrestha, Mukand S. Babel and Vishnu Prasad Pandey, 2014, Climate Change and Water Resources, CRC Press an imprint of the Taylor & Francis Group.
2.	Intergovernmental Panel on Climate Change: https://www.ipcc.ch/

Reference books/other materials/web resources:	
1.	Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
2.	Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3.	Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2	1	3	1	2	2	2	1	1	1
CO2	3	2	2	3	3	1	3	1	3	3	2	1	1	1
CO3	2	1	1	2	3	2	2	2	2	2	3	2	2	2
CO4	3	3	2	1	2	2	3	1	1	2	2	2	2	2
CO5	2	1	1	2	3	3	3	2	1	1	2	3	3	3
Average:	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**1**	**2**	**2**	**2**	**2**	**2**	**2**

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VERTICAL – 4

IT AND AGRICULTURAL BUSINESS MANAGEMENT

Subject Code	Subject Name	Category	L	T	P	C
AI24022	INTEGRATED FARMING SYSTEM	PEC	3	0	0	3

Course Objectives:

- This course will improve the student skills in the area of farming system research and optimization methodology to design individual integrated farming system in scientific manner.

UNIT – I	**INTRODUCTION OF FARMING SYSTEM**	**9**
Farming system – introduction – scope of farming system – importance – concept – principles of farming system - Types of farming systems – Advantages and limitations - suitability – factors affecting the farming system.		
UNIT – II	**INTEGRATED FARMING SYSTEM**	**9**
Integrated farming system-historical background - objectives and characteristics advantages of IFS – Components of IFS - Integrated Farming System in Wetland – IFS in garden land –- IFS in dryland and fallow land.		
UNIT – III	**LIVESTOCK PRODUCTION IN IFS**	**9**
IFS With Goats and Sheep – housing and feeding management – deworming – Young stock management - Dairy Farming in IFS - Fodder production in IFS - IFS With poultry rearing - Duck farming – Rabbit farming – Piggery.		
UNIT – IV	**IFS COMPONENTS**	**9**
Agroforestry – definition – types of agroforestry system – benefits of agroforestry system– Aquaculture – Fish cum agriculture and horticulture – Beekeeping – types and cast of bees – care and management in beekeeping – Sericulture - Mulberry cultivation – Silkworm rearing – Organic farming – Azolla – Small scale nursery.		
UNIT – V	**RESOURCE RECYCLING IN IFS**	**9**
Resource recycling in wetland IFS - Resource flow in crop + dairy + biogas + spawn + silviculture In IFS - Biogas production through IFS – Resource recycling in crop + goat IFS - Uses and features of biogas - Structure and function of Dheenabandhu Gas plant - Vermicompost - Preparation of vermicompost from farm residue – Mushroom production in IFS.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand practical knowledge on specialized in different farming system.
CO2	Apply the farm wastes with recycle use of different IFS components.
CO3	Analysis of comparative benefits of the different IFS components
CO4	Design a farming system model for wetland, garden land and dry land
CO5	Evaluate the extent of wetland, garden land and dry land Integrated Farming System.

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Textbooks:	
1.	Nanda, Sankarsana. Integrated farming system practices: challenges and opportunities. New India Publishing Agency, 2016.
2.	Ravikiran Vasant Mane, Integrated Farming System: A Strategy for Sustainable Farm Production & Livelihood Security, Scitus Academics, 2016

Reference books/other materials/web resources:	
1.	Zaman, Integrated Farming System and Agricultural, New India Publishing Agency, 2019
2.	Nanwal R. K. Farming System and Sustainable Agriculture, Kalyani Publishers, 2017

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	3	1	3	3	1	3	3	2	2	2	2
CO2	2	2	2	2	1	2	2	1	2	3	1	2	2	3
CO3	2	2	3	2	3	2	2	3	2	3	1	2	3	3
CO4	3	3	3	3	2	3	3	3	1	3	3	3	3	3
CO5	3	3	3	3	2	3	3	2	2	3	3	3	3	3
Average:	2	2	3	3	2	3	3	2	2	3	2	2	3	3

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Subject Code	Subject Name	Category	L	T	P	C
AI24023	AGRICULTURAL BUSINESS MANAGEMENT	PEC	3	0	0	3

Course Objectives:

- To introduce the importance of Agri-business management, its characteristics and Principles.
- To impart knowledge on the functional areas of Agri-business like Marketing management,Product pricing methods and Market potential assessment.

UNIT – I	**CONCEPTS OF AGRICULTURAL BUSINESS**	**9**
Agri-business - scope, characteristics, types. Management - importance, definition, management and administration, management thoughts, Small business - characteristics and stages of growth - Management functions - planning, organizing, leading.		
UNIT – II	**AGRI – BUSINESS ORGANIZATION**	**9**
Principles, forms of agri-business organizations, staffing, directing, supervision and motivation. Controlling - types, performance evaluation and control techniques. Management approaches - Profit Centered Approach, Management by objectives and Quality Circles. Strength, Weakness, Opportunities and Threat (SWOT) Analysis.		
UNIT – III	**AGRICULTURAL MARKETING**	**9**
Functional areas of Agri-business - Production and Operations management - functions, planning physical facilities and managing quality. Agro-inputs and products inventory management - raw material procurement, inventory types, and costs. Marketing management- Marketing environment, marketing mix - Agricultural input marketing firms.		
UNIT – IV	**AGRICULTURAL BUSINESS FINANCE**	**9**
Forms of agri-business organizations - Role of lead bank in agribusiness finance - Financial management. Acquiring capital- Budget analysis. Concepts and determinants- Business project scheduling of raw material procurement - production management - launching products (branding, placement) - Input marketing promotion activities.		
UNIT – V	**MARKET PROMOTION AND HUMAN RESOURCES**	**9**
Agricultural products - marketing promotion activities - product pricing methods. District Industries Centre - Consumer survey - Agricultural inputs retailing - Market potential assessment - types of distribution channels - Return on Investment - Personnel management. Recruitment, selection and training - Technology in Agri Business.		
		Total Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand the concepts and fundamentals of management with reference to agribusiness.
CO2	Gain knowledge about organization and functioning of different institutions involved in agriculture marketing
CO3	Understand the different concepts of inventory management of agricultural inputs
CO4	Expose students to various concepts of financing Agri Business
CO5	Have the knowledge of marketing agricultural products and the techniques involved

Textbooks:	
1.	1. Himanshu, "Agri Business Management – Problems and prospects", Ritu Publications, Jaipur, 2005.
2.	SmitaDiwase, "Indian Agriculture and Agribusiness Management", Krishi resource Management Network, Pune 2004.

Reference books/other materials/web resources:	
1.	Chandra Prasanna, "Projects: Preparation, Appraisal, Budgeting and Implementation", Tata McGraw Hill Publications, New Delhi, 2001.
2.	Kotler, P., "Marketing Management. Analysis, Planning and Control", Prentice Hall Inc., New York, 2001.
3.	Rao, V.S.P., and Narayana, P.S., "Principles and Practices of Management", Konark Publishing Private Limited, New Delhi, 2001.
4.	Tripathy, P.C., and Reddy, P.N., "Principles of Management", Tata McGraw Hill Publications, New Delhi, 2000.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	1	-	-	1	1	-	-	2	1	1	1
CO2	-	2	1	2	1	3	1	-	-	1	2	1	1	1
CO3	2	3	3	3	3	1	-	-	2	2	2	2	2	2
CO4	-	3	3	1	1	2	-	1	-	3	2	2	2	2
CO5	2	1	3	2	3	2	2	1	2	2	2	3	3	3
Average:	**2**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24024	SUSTAINABLE AGRICULTURE AND FOOD SECURITY	PEC	3	0	0	3

Course 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	**SUSTAINABILITY OF NATURAL RESOURCES**	**9**

Land Resources of India, Population and land, Land utilization, Net Area Sown, changes in cropping pattern, land degradation. 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 – II	**SUSTAINABLE AGRICULTURE**	**9**

Sustainable agriculture-definition. 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.

UNIT – III	**ORGANIC FARMING**	**9**

Natural farming principles – Sustainability in rain fed farming – organic farming – principles and practices. Organic farming-regulation and sustainability – The scale and productivity of organic sustainable systems.

UNIT – IV	**SUSTAINABLE FOOD PRODUCTION FOR 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 – Vertical farming – Controlled Environment Agriculture – Genetics diversity – GMO's. Sustainable food security indicators and index – Indicator of sustainability of food Security.

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 Contact Hours : 45

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Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand methods to sustain land resources.
CO2	Cognize approaches to sustain water resources and its utilization for agriculture and allied activities.
CO3	Design and develop new, improved and sustainable systems of agriculture and allied activities.
CO4	Understand new technologies for improving food security.
CO5	Comprehend policies to achieve sustainable farming and food security.

Textbooks:	
1.	M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., Singapore, 2010.
2.	B.K.Desai and Pujari, B.T. Sustainable Agriculture: A vision for future, New India Publishing Agency, New Delhi, 2007.

Reference books/other materials/web resources:	
1.	Swarna S.Vepaetal., 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.	Tanji, K. K., and Yaron, B. Management of water use in agriculture, Springer Verlag, Berlin, Germany, 1994.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	2	3	1	3	3	3	1	3	1	1	1
CO2	3	2	1	3	3	1	3	3	3	1	3	1	1	1
CO3	2	2	1	2	3	1	3	3	3	1	3	2	2	2
CO4	3	2	1	1	3	1	3	3	3	1	3	2	2	2
CO5	2	2	1	2	3	1	3	3	3	2	3	3	3	3
Average:	**2**	**2**	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24025	SYSTEMS ANALYSIS IN AGRICULTURAL ENGINEERING	PEC	3	0	0	3

Course Objectives:

- To introduce the students to the application of systems concept to irrigation planning and management.
- Optimization technique for modeling water resources systems, irrigation management and advanced optimization techniques to cover the socio-technical aspects will be taught.

UNIT – I	**SYSTEM CONCEPTS**	**9**
Definition, classification, and characteristics of systems – Scope and steps in systems engineering – Need for systems approach to water resources and irrigation.		
UNIT – II	**LINEAR PROGRAMMING**	**9**
Introduction to operations research – Linear programming, problem formulation, graphical solution, solution by simplex method – Sensitivity analysis, application to design and operation of reservoir, single and multipurpose development plans – Irrigation water allocation- Cropping pattern optimization.		
UNIT – III	**SIMULATION**	**9**
Basic principles and concepts – Random variate and random process – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic and stochastic simulation – Irrigation Scheduling.		
UNIT – IV	**DYNAMIC PROGRAMMING**	**9**
Bellman's optimality criteria, problem formulation and solutions – Application to design and operation of reservoirs, Single and multipurpose reservoir development plans – Applications in Irrigation management.		
UNIT – V	**OPTIMIZATION TECHNIQUES**	**9**
Integer and parametric linear programming – Applications to Irrigation water management- Goal programming models with applications.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Understand practical knowledge on specialized in different water resources and irrigation system.
CO2	Apply the Linear programming for crop planning and scheduling.
CO3	Apply the Dynamic Programming for reservoir release for irrigation management.
CO4	Design a reservoir irrigation system simulation model for efficient water management
CO5	To evaluate the application of optimization techniques used to address the socio-technical aspects irrigation water management.

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Textbooks:	
1.	Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
2.	Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.

Reference books/other materials/web resources:	
1.	Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi, 1997.
2.	Taha, H.A., "Operations Research", McMillan Publication Co., New York, 1995.
3.	Hiller, F.S., and Liebermann, G.J., "Operations Research", CBS Publications and Distributions, New Delhi, 1992.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	3	1	2	3	1	3	3	2	2	1	2
CO2	2	3	2	2	1	2	2	1	2	2	1	2	2	1
CO3	3	3	3	2	1	2	2	3	2	2	1	3	2	1
CO4	3	2	3	3	3	3	1	3	1	3	3	3	3	1
CO5	3	3	3	3	3	3	1	2	1	3	3	3	3	2
Average:	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**1**

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SUBJECT CODE	SUBJECT NAME	Category	L	T	P	C
AI24026	IT IN AGRICULTURAL SYSTEM	PEC	3	0	0	3

Course Objectives:

- To introduce the students to areas of agricultural systems in which IT and computers play amajor role.
- To also expose the students to IT applications in precision farming, environmental controlsystems, 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	**ENVIRONMENT CONTROL SYSTEMS**	**9**
Artificial light systems, management of crop growth in greenhouses, simulation of CO2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.		
UNIT – III	**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.		
UNIT – IV	**WEATHER PREDICTION MODELS**	**9**
Importance of climate variability and seasonal forecasting, Understanding and predicting world‟s climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.		
UNIT – V	**E-GOVERNANCE IN AGRICULTURAL SYSTEMS**	**9**
Expert systems, decision support systems, Agricultural and biological databases, e-commerce, e-business systems & applications, Technology enhanced learning systems and solutions, elearning, Rural development and information society.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	The students shall be able to understand the applications of IT in remote sensing applications such as Drones etc.
CO2	The students will be able to get a clear understanding of how a greenhouse can be automated and its advantages.
CO3	The students will be able to apply IT principles and concepts for management of field operations.
CO4	The students will get an understanding about weather models, their inputs and applications.
CO5	The students will get an understanding of how IT can be used for e-governance in agriculture.

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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.

Reference books/other materials/web resources:	
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.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	2	3	1	3	1	3	3	3	1	1	1
CO2	3	3	3	3	3	1	3	1	3	3	3	1	1	1
CO3	2	3	3	2	3	2	2	2	3	3	3	2	2	2
CO4	3	3	3	1	3	2	3	1	3	3	3	2	2	2
CO5	2	3	3	2	3	3	3	2	3	3	3	3	3	3
Average:	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**2**	**2**

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Subject Code	Subject Name	Category	L	T	P	C
AI24027	AUTOMATION IN AGRICULTURE	PEC	3	0	0	3

Course Objectives:

- To know the operation of various electronic circuits and its applications.
- To get adequate knowledge about various sensors and robots used in agricultural processes
- To learn automation techniques in agricultural system

UNIT – I	**INTRODUCTION**	**9**
Fundamental of electronics Passive devices -semiconductor devices - transistors - diode circuits - amplifier circuits. Integrated circuits and operational amplifier - logic gates - flip flop - counters digital to analog - analog to digital converters- microprocessor.		
UNIT – II	**PRECISION FARMING**	**9**
Precision farming -Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modelling.		
UNIT – III	**ROBOTICS IN AGRICULTURE**	**9**
Fundamental of Robotics - types – application. Agricultural robots - types- function - application. Future trends in automation in agriculture.		
UNIT – IV	**AUTOMATION USING IoT**	**9**
Use of different sensors - Temperature and humidity sensor - Soil Moisture Sensor - Water Level Depth Detector, Raspberry Pi Arduino UNO		
UNIT – V	**AUTOMATION OF AGRICULTURE OPERATION**	**9**
Automation of agricultural operations using IoT based systems - Smart Irrigation System- Automation in Greenhouse – Drones. Case Study- Automation of greenhouse/farm operations.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	Exemplify the working operations of electronic devices and processors
CO2	Interpret the necessity of sensor requirements for precision farming practices
CO3	Understand the basics of robotics and their applications in agriculture
CO4	Apply the IOT concepts in cropping practices
CO5	Interpolate the concept of automation in governing the agricultural systems

Textbooks:

1.	Zhang, Q. and Pierce, F.J. eds., 2013. Agricultural automation: fundamentals and practices. CRC Press.
2.	Choudhury, A., Biswas, A., Singh, T.P. and Ghosh, S.K. eds., 2022. Smart Agriculture Automation Using Advanced Technologies: Data Analytics and Machine Learning, Cloud Architecture, Automation and IoT.

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Reference books/other materials/web resources:	
1.	National Research Council, Precision Agriculture in the 21st Century, National Academies Press, Canada, 1997.
2.	Young, S.L. and Pierce, F.J. eds., 2013. Automation: The future of weed control in cropping systems. Springer Science & Business Media.
3.	Nof, S.Y. ed., 2009. Springer handbook of automation. Berlin, Heidelberg: Springer Berlin Heidelberg.
4.	Billingsley, J., 2019. Robotics and automation for improving agriculture. Burleigh Dodds Science Publishing Limited.
5.	McNulty, P. and Grace, P.M. eds., 2009. Agricultural Mechanization and Automation-Volume II (Vol. 2). EOLSS Publications.

	CO-PO Mapping											**CO-PSO Mapping**		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1	3	1	-	-	-	-	-	1	1	1
CO2	2	1	1	1	3	1	-	-	-	-	-	1	1	1
CO3	2	1	1	1	3	1	-	-	-	-	-	2	2	2
CO4	2	1	1	1	3	1	-	-	-	-	-	2	2	2
CO5	2	1	1	1	3	1	-	-	-	1	-	3	3	3
Average:	2	1	1	1	3	1	-	-	-	1	-	2	2	2

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Subject Code	Subject Name	Category	L	T	P	C
AI24028	LANDSCAPE ARCHITECTURE	PEC	3	0	0	3

Course Objectives:

- To understand the paradigms in landscape architecture in the post-industrial revolution era and to understand the multifaceted dimensions of landscape architecture such as ecology, environment and sustainability.
- To study the contemporary landscape and the manifestation in the western and Indian contexts.

UNIT – I	**BASICS OF LANDSCAPE ARCHITECTURE**	**9**
Site analysis, synthesis, suitability, landscape zoning and planning with landscape land uses for medium to large scale projects. Evolving an open space structure for the site and suggesting a suitable landscape treatment with respect to ecological, functional, cultural and visual contexts.		
UNIT – II	**LANDSCAPE FORMULATIONS**	**9**
Process for landscape project formulation and landscape design development based on synthesis. Examining how humans occupy exterior space and combines this information with the principles of design to create garden scale models.		
UNIT – III	**SITE MOBILIZATION**	**9**
Site mobilization; Sequence of site activity, site protection measures, site implementation checklist. Design and detailing of hard landscapes: Roads, paving, barriers, edge conditions - functions, types, criteria for selection, design aspects, details.		
UNIT – IV	**ILLUMINATION**	**9**
Outdoor lighting: Definition of technical terms, types of electrical lighting, types of fixtures, auxiliary fixtures. Principles of design for outdoor illumination, design and type of effects with electrical lighting. Safety precautions and drawbacks of electrical lighting, electrical accessories and their installation. Solar energy and lighting.		
UNIT – V	**IRRIGATION FEATURES**	**9**
Water features and Irrigation systems: Design of water features such as swimming pools, cascades, fountains etc., and their technical requirements. Consideration for design and detail of water bodies and natural ponds. Design of irrigation system – landscape area types, Course Overviews and design, water needs and sources, application, methods of installation. Control systems, scheduling and maintenance.		
		Total Contact Hours : 45

Course Outcomes:	Upon completion of the course students should be able to:
CO1	To equip the students to do landscape working drawings and preparation of bill of quantities and estimation.
CO2	To understand the design solutions for larger sites and express the same using models.
CO3	To understand the different concepts of landscape formulations.
CO4	To acquire the knowledge of illumination and lighting.
CO5	To obtain the knowledge on design of water bodies and irrigation systems.

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Textbooks:	
1.	Simonds. J. O. 1961. Landscape Architecture: The Shaping of Man's Natural Environment. F.W. Dodge Cooperation, London Harris.C.W. and Din, N.T. 1997. Time Saver Standards For Landscape Architecture. Mcgraw – Hill International Edition, Arch. Series.
2.	Starke .B. and Simonds, J. O. 2013. Landscape Architecture: A Manual of Site Planning and Design. 5th edition. McGraw-Hill Professional.

Reference books/other materials/web resources:	
1.	Shaheer, M., Dua, G.W. and Pal, A.2012. Landscape Architecture in India: A Reader. Indian Journal of Landscape Architecture.
2.	Reid, G. W. 1993. From Concept to Form: In Landscape Design. John Wiley & Sons.

	CO-PO Mapping											CO-PSO Mapping		
PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	1	3	2	1	1	3	1	2	2	3
CO2	2	3	3	3	2	3	1	1	1	2	2	3	2	2
CO3	2	2	2	2	1	2	1	1	1	2	1	2	2	1
CO4	2	3	2	2	3	3	1	1	2	3	1	3	2	3
CO5	2	3	3	3	1	2	2	1	3	3	3	3	2	1
Average:	**2**	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**2**	**3**	**2**	**3**	**2**	**3**

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