NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamil Nadu, India, Phone: 04294 – 225585

Curriculum and Syllabi

for

B. Tech. – Agricultural Engineering [R22]

[CHOICE BASED CREDIT SYSTEM]

[This Curriculum and Syllabi are applicable to Students admitted of (2022-2026) and (2023-2027) Batches only]

April 2025

INSTITUTE VISION AND MISSION

VISION	• To be an institute of excellence providing quality Engineering, Technology and Management education to meet the ever-changing needs of the society.
MISSION	• To provide quality education to produce ethical and competent professionals with social Responsibility • To excel in the thrust areas of Engineering, Technology and Entrepreneurship by solving real- world problems. • To create a learner centric environment and improve continually to meet the changing global needs.

B.Tech. – Agricultural Engineering

VISION	• To foster academic excellence by imparting knowledge in Agricultural Engineering to meet the ever-growing needs of the society.
MISSION	• To provide quality education to produce agricultural engineers with social responsibility. • To excel in the thrust areas of agricultural engineering to identify and solve the real-world problems. • To create a learner-centric environment by upgrading knowledge and skills to cater the needs and challenges of the society.
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	The graduates of Agricultural Engineering will be • **PEO1: Core Competency:** Successful professional with core competency and inter-disciplinary skills to satisfy the Industrial needs. • **PEO2: Research, Innovation and Life-long Learning:** Capable of identifying technological requirements for the society and providing innovative solutions to real time problems. • **PEO3: Ethics, Human values and Entrepreneurship**: Able to demonstrate ethical practices and managerial skills through continuous learning
PROGRAMME SPECIFIC OUTCOMES (PSO)	The students of Agricultural Engineering will be able to • **PSO1:** Design, analyze and apply the knowledge gained on agricultural machinery, tools, implements and production technologies to increase crop production, improve land use, soil nutrient and conserve resources like water, fertilizer and energy. • **PSO2:** Apply the comprehensive knowledge of engineering properties of agricultural products for upgrading the unit operation and developing innovative process, value-added products, and advanced engineering technologies to meet the challenges in agriculture.

PROGRAM OUTCOMES:

At the end of this programme, the students will be able to

a-l	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	**PO1**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b	Problem Analysis	**PO2**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c	Design and Development of Solutions	**PO3**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d	Investigation of Complex Problems	**PO4**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e	Modern Tool Usage	**PO5**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f	The Engineer and Society	**PO6**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g	Environment and Sustainability	**PO7**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h	Ethics	**PO8**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i	Individual and Team Work	**PO9**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j	Communication	**PO10**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k	Project Management and Finance	**PO11**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l	Lifelong Learning	**PO12**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Educational Objectives and the Programme Outcomes is given in the following table

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

Contribution **1: Reasonable** **2: Significant** **3: Strong**

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052
REGULATIONS – 2022 CHOICE BASED CREDIT SYSTEM

B. Tech. - AGRICULTURAL ENGINEERING

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1	22MAN01	Induction Programme	MC	-	0	0	0	0	0
THEORY									
2	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
3	22MYB01	Calculus and Linear Algebra*	BSC	-	4	3	1	0	4
4	22PYB02	Advanced Materials and Nano Technology	BSC	-	3	3	0	0	3
5	22AGC01	Basics of Engineering Mechanics	ESC	-	3	2	1	0	3
6	22MEC01	Engineering Graphics	ESC	-	4	2	0	2	3
7	22GYA01	தமிழர் மரபு / Heritage of Tamils*	HSMC	-	1	1	0	0	1
PRACTICAL									
8	22PYP01	Physics Laboratory*	BSC	-	2	0	0	2	1
9	22GEP01	Engineering Practices Laboratory	ESC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
10	22MAN02	Soft/Analytical Skills – I	MC	-	3	1	0	2	0
11	22MAN03	Yoga – I*	MC	-	1	0	0	1	0
				TOTAL	**29**	**14**	**2**	**13**	**20**

***Ratified by Eleventh Academic Council**

SEMESTER: II									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22EYA02	Professional Communication - II	HSMC	22EYA01	4	2	0	2	3
2	22MYB02	Partial Differential Equations and Transform Techniques*	BSC	-	4	3	1	0	4
3	22CYB05	Chemistry for Agricultural Engineers	BSC	-	3	3	0	0	3
4	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
5	22AGC02	Principles and Practices of Crop Production	PCC	-	3	3	0	0	3
6	22EEC04	Electrical Engineering*	PCC		3	3	0	0	3
7	22GYA02	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology*	HSMC		1	1	0	0	1
PRACTICAL									
8	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
9	22AGP01	Crop Production and Husbandry Laboratory	PCC	-	4	0	0	4	2
10	22CYP01	Chemistry Laboratory*	BSC	-	2	0	0	2	1
Mandatory Non-Credit Courses									
11	22MAN04	Soft/Analytical Skills – II	MC	22MAN02	3	1	0	2	0
12	22MAN05	Yoga – II*	MC	-	1	0	0	1	0
13	22MAN06	Environmental Science	MC	-	2	2	0	0	0
				TOTAL	**37**	**21**	**1**	**15**	**25**

***Ratified by Eleventh Academic Council**

SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4
2	22AGC03	Fundamentals of Soil Science	PCC	-	4	2	0	2	3
3	22AGC04	Strength of Materials for Agricultural Engineers	PCC	-	3	3	0	0	3
4	22AGC05	Basic workshop Technology	ESC	-	3	3	0	0	3
5	22AGC06	Thermodynamics for Agricultural Engineers	PCC	-	3	2	1	0	3
6	22AGC07	Farm Tractor Systems	PCC	-	3	3	0	0	3
PRACTICAL									
7	22AGP02	Workshop Technology Laboratory	ESC	-	4	0	0	4	2
8	22AGP03	Drawing of Farm Structures Laboratory	PCC	-	4	0	0	4	2
9	22AGP04	Farm Tractor and Engines Laboratory	PCC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
10	22MAN07#	Soft / Analytical Skills - III#	MC	-	3	1	0	2	0
	22MAN07R##	Soft / Analytical Skills - III##							
11	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
				TOTAL	**36**	**20**	**2**	**16**	**25**

 # Applicable for (2022 – 2026) Batch only

Applicable for (2023 – 2027) batch only

SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AGC08	Fluid Mechanics and Hydraulics	PCC	-	4	2	0	2	3
2	22AGC09	Heat and Mass Transfer for Agricultural Engineers	PCC	-	3	2	1	0	3
3	22AGC10	Crop Process Engineering	PCC	-	3	3	0	0	3
4	22AGC11	Irrigation and Drainage Engineering	PCC	-	3	3	0	0	3
5	22AGC12	Hydrology and Water Resources Engineering	PCC	-	3	3	0	0	3
6	22AGC13	Surveying and Levelling for Agricultural Engineers	PCC	-	4	2	0	2	3
PRACTICAL									
7	22AGP05	Crop Process Engineering Laboratory	PCC	-	4	0	0	4	2
8	22AGP06	Irrigation and Drainage Engineering Laboratory	PCC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
9	22MAN08 #	Soft/Analytical Skills – IV#	MC	-	3	1	0	2	0
	22MAN08R##	Soft/Analytical Skills – IV##							
10	22GED01	Personality and Character Development	MC	-	0	0	0	1	0
				TOTAL	**31**	**16**	**1**	**15**	**22**

 # Applicable for (2022 – 2026) Batch only

Applicable for (2023 – 2027) batch only

SEMESTER: V									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AGC14	Soil and Water Conservation Engineering	PCC	-	3	3	0	0	3
2	22AGC15	Unit Operations in Agricultural Processing	PCC	-	3	3	0	0	3
3	22AGC16	Farm Implements and Equipment (Theory + Lab)	PCC	-	5	3	0	2	4
4	E1	Elective(PEC)	PEC	-	3	3	0	0	3
5	E2	Elective(PEC)	PEC	-	3	3	0	0	3
6	E3	Elective(PEC/OEC)	PEC/OEC	-	3	3	0	0	3
PRACTICAL									
7	22AGP07	CAD for Agricultural Engineers	PCC	-	4	0	0	4	2
8	22AGP08	Unit Operations in Agricultural Processing Laboratory	PCC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
9	22MAN10R #	Communication and Quantitative Reasoning	MC	-	3	1	0	2	0
				TOTAL	**31**	**19**	**0**	**12**	**23**

 # Applicable for (2022 – 2026) Batch only

SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AGC17	Renewable energy Resources	PCC	-	3	3	0	0	3
2	22AGC18	Food and Dairy Engineering	PCC	-	3	3	0	0	3
3	EM1	Elective - Management	HSMC	-	3	3	0	0	3
4	E4	Elective(PEC)	PEC	-	3	3	0	0	3
5	E5	Elective(PEC/OEC)$	PEC/OEC	-	3	3	0	0	3
6	E6	Elective(PEC)	PEC	-	3	3	0	0	3
PRACTICAL									
7	22AGP09	Food and Dairy Engineering Laboratory	PCC	-	4	0	0	4	2
8	22AGP10	Rural Agro Industry Work Experiment	EEC	-	2	0	0	2	1
				TOTAL	**24**	**18**	**0**	**6**	**21**

$ Ratified by Thirteen Academic Council

SEMESTER: VII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
2	E7	Elective(PEC)	PEC	-	3	3	0	0	3
3	E8	Elective(PEC)	PEC	-	3	3	0	0	3
4	E9	Elective(OEC)	OEC	-	3	3	0	0	3
5	E10	Elective(OEC)	OEC	-	3	3	0	0	3
PRACTICAL									
6	22AGP11	Internship/ Inplant training (4 weeks)	EEC	-	0	0	0	0	2
				TOTAL	**14**	**14**	**0**	**0**	**16**

SEMESTER: VIII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICAL									
1	22AGD01	Project Work	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

HSM,BS, ES,EE and Mandatory Courses

(a) Humanities and Social Sciences including Management courses (HSMC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
2.	22GYA01	தமிழர் மரபு / Heritage of Tamils	HSMC	-	1	1	0	0	1
3.	22EYA02	Professional Communication - II	HSMC	22EYA01	4	2	0	2	3
4.	22GYA02	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HSMC	-	1	1	0	0	1
5.	EM1	Elective - Management	HSMC	-	3	3	0	0	3
6.	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2

(b) Basic Science Courses (BSC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22MYB01	Calculus and Linear Algebra	BSC	-	4	3	1	0	4
2.	22PYB02	Advanced Materials and Nano Technology	BSC	-	3	3	0	0	3
3.	22PYP01	Physics Laboratory	BSC	-	2	0	0	2	1
4.	22MYB02	Partial Differential Equations and Transform Techniques	BSC	-	4	3	1	0	4
5.	22CYB05	Chemistry for Agricultural Engineers	BSC	-	3	3	0	0	3
6.	22CYP01	Chemistry Laboratory	BSC	-	4	0	0	2	1
7.	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4

(c) Engineering Science Courses (ESC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22AGC01	Basics of Engineering Mechanics	ESC	-	3	2	1	0	3
2.	22MEC01	Engineering Graphics	ESC	-	4	2	0	2	3
3.	22GEP01	Engineering Practices Laboratory	ESC	-	4	0	0	4	2
4.	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
5.	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
6.	22AGC05	Basic workshop Technology	ESC	-	3	3	0	0	3
7.	22AGP02	Workshop Technology Laboratory	ESC	-	4	0	0	4	2

(d) Employability Enhancement Courses (EEC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22AGP10	Rural Agro Industry Work Experiment	EEC	-	2	0	0	2	1
2.	22AGP11	Internship/ Inplant training (4 weeks)	EEC	-	0	0	0	0	2
3.	22AGD01	Project Work	EEC	-	20	0	0	20	10

(e) Mandatory Non Credit Courses (MC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22MAN01	Induction Programme	MC	-	-	-	-	-	-
2.	22MAN02	Soft/Analytical Skills – I	MC	-	3	1	0	2	0
3.	22MAN03	Yoga – I	MC	-	1	0	0	1	0
4.	22MAN04	Soft/Analytical Skills – II	MC	22MAN02	3	1	0	2	0
5.	22MAN05	Yoga – II	MC	-	1	0	0	1	0

6.	22MAN06	Environmental Science	MC	-	2	2	0	0	0
7.	22MAN07/ 22MAN07R	Soft / Analytical Skills – III	MC	-	5	3	0	2	0
8.	22MAN08/ 22MAN08R	Soft/Analytical Skills – IV	MC	-	5	3	0	2	0
9.	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
10.	22MAN10R	Communication and Quantitative Reasoning	MC	-	3	1	0	2	0
11.	22GED01	Personality and Character Development	MC	-	0	0	0	1	0

Professional Core Courses (PCC)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1.	22AGC02	Principles and Practices of Crop Production	PCC	-	3	3	0	0	3
2.	22EEC04	Electrical Engineering	PCC		3	3	0	0	3
3.	22AGP01	Crop Production and Husbandry Laboratory	PCC	-	4	0	0	4	2
4.	22AGC03	Fundamentals of Soil Science	PCC	-	4	2	0	2	3
5.	22AGC04	Strength of Materials for Agricultural Engineers	PCC	-	3	3	0	0	3
6.	22AGC06	Thermodynamics for Agricultural Engineers	PCC	-	3	2	1	0	3
7.	22AGC07	Farm Tractor Systems	PCC	-	3	3	0	0	3
8.	22AGP03	Drawing of Farm Structures Laboratory	PCC	-	4	0	0	4	2
9.	22AGP04	Farm Tractor and Engines Laboratory	PCC	-	4	0	0	4	2
10.	22AGC08	Fluid Mechanics and Hydraulics	PCC	-	4	2	0	2	3
11.	22AGC09	Heat and Mass Transfer for Agricultural Engineers	PCC	-	3	2	1	0	3
12.	22AGC10	Crop Process Engineering	PCC	-	3	3	0	0	3
13.	22AGC11	Irrigation and Drainage Engineering	PCC	-	3	3	0	0	3
14.	22AGC12	Hydrology and Water Resources Engineering	PCC	-	3	3	0	0	3

15.	22AGC13	Surveying and Levelling for Agricultural Engineers	PCC	-	4	2	0	2	3
16.	22AGP05	Crop Process Engineering Laboratory	PCC	-	4	0	0	4	2
17.	22AGP06	Irrigation and Drainage Engineering Laboratory	PCC	-	4	0	0	4	2
18.	22AGC14	Soil and Water Conservation Engineering	PCC	-	3	3	0	0	3
19.	22AGC15	Unit Operations in Agricultural Processing	PCC	-	3	3	0	0	3
20.	22AGC16	Farm Implements and Equipment (Theory + Lab)	PCC	-	5	3	0	2	4
21.	22AGP07	CAD for Agricultural Engineers	PCC	-	4	0	0	4	2
22.	22AGP08	Unit Operations in Agricultural Processing Laboratory	PCC	-	4	0	0	4	2
23.	22AGC17	Renewable energy Resources	PCC	-	3	3	0	0	3
24.	22AGC18	Food and Dairy Engineering	PCC	-	3	3	0	0	3
25.	22AGP09	Food and Dairy Engineering Laboratory	PCC	-	4	0	0	4	2
Professional Elective Courses (PEC)									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
Vertical I: FARM MECHANIZATION									
1.	22AGX01	Testing and Management of Farm Machinery	PEC	-	3	3	0	0	3
2.	22AGX02	Plant Protection and Harvesting Machinery	PEC	-	3	3	0	0	3
3.	22AGX03	Human Engineering and Safety in Farm Machinery Operations	PEC	-	3	3	0	0	3
4.	22AGX04	Design of Agricultural Machinery	PEC	-	3	3	0	0	3
5.	22AGX05	Hydraulic Drives and Controls	PEC	-	3	3	0	0	3
6.	22AGX06	Precision Farming Equipment	PEC	-	3	3	0	0	3
7.	22AGX07	Theory of Machines	PEC	-	3	3	0	0	3
8.	22AGX08	Tractor and Automotive Engines	PEC	-	3	3	0	0	3

Vertical II: RENEWABLE ENERGY									
9.	22AGX11	Biochemical and Thermo chemical Conversion of biomass	PEC	-	3	3	0	0	3
10.	22AGX12	Waste and By-Product Utilization	PEC	-	3	3	0	0	3
11.	22AGX13	Solar Energy Engineering	PEC	-	3	3	0	0	3
12.	22AGX14	Wind Energy Engineering	PEC	-	3	3	0	0	3
13.	22AGX15	Alternate Energy Sources	PEC	-	3	3	0	0	3
14.	22AGX16	Energy Storage Systems	PEC	-	3	3	0	0	3
15.	22AGX17	Energy Auditing and Management	PEC	-	3	3	0	0	3
16.	22AGX18	Carbon Capture and Storage	PEC	-	3	3	0	0	3
Vertical III: WATER MANAGEMENT									
17.	22AGX21	Design of Micro Irrigation Systems	PEC	-	3	3	0	0	3
18.	22AGX22	Reservoir and Farm Pond Design	PEC	-	3	3	0	0	3
19.	22AGX23	Irrigation Water Quality and Waste Water Management	PEC	-	3	3	0	0	3
20.	22AGX24	Watershed Planning and Management	PEC	-	3	3	0	0	3
21.	22AGX25	Groundwater Wells and Pumps	PEC	-	3	3	0	0	3
22.	22AGX26	Water Harvesting	PEC	-	3	3	0	0	3
23.	22AGX27	On-Farm Water Management	PEC	-	3	3	0	0	3
24.	22AGX28	Building Materials, Estimation and Costing	PEC	-	3	3	0	0	3
Vertical IV: FOOD PROCESSING AND PRODUCT TECHNOLOGY									
25.	22AGX31	Emerging Technologies in Food Processing	PEC	-	3	3	0	0	3
26.	22AGX32	Storage and Packaging Technology	PEC	-	3	3	0	0	3
27.	22AGX33	Refrigeration and Cold Chain Management[$]	PEC	-	3	3	0	0	3

28.	22AGX34	Food Process Equipment and Design	PEC	-	3	3	0	0	3
29.	22AGX35	Processing of Fruits and Vegetables	PEC	-	3	3	0	0	3
30.	22AGX36	Food, Plant Design and Management	PEC	-	3	3	0	0	3
31.	22AGX37	Food Quality and Safety	PEC	-	3	3	0	0	3
32.	22AGX38	Dairy Technology	PEC	-	3	3	0	0	3
Vertical V: AGRI-BUSINESS MANAGEMENT AND ENTREPRUNERSHIP									
33.	22AGX41	Agricultural Business Management	PEC	-	3	3	0	0	3
34.	22AGX42	Entrepreneurship and Agribusiness Development	PEC	-	3	3	0	0	3
35.	22AGX43	Agricultural Marketing, Trade and Prices	PEC	-	3	3	0	0	3
36.	22AGX44	Extension Methods and Transfer of Technology	PEC	-	3	3	0	0	3
37.	22AGX45	Commercial Agriculture	PEC	-	3	3	0	0	3
38.	22AGX46	Agricultural Finance, Banking and Co-operation	PEC	-	3	3	0	0	3
39.	22AGX47	Ornamental and Landscape Gardening	PEC	-	3	3	0	0	3
40.	22AGX48	Seed Technology Applications	PEC	-	3	3	0	0	3
Vertical VI: SMART AGRICULTURAL SYSTEMS									
41.	22AGX51	Protected Cultivation	PEC	-	3	3	0	0	3
42.	22AGX52	Climate Change and Adaptation	PEC	-	3	3	0	0	3
43.	22AGX53	Remote Sensing and GIS for Agricultural Engineers	PEC	-	3	3	0	0	3
44.	22AGX54	Automation in Agriculture	PEC	-	3	3	0	0	3
45.	22AGX55	IT in Agriculture	PEC	-	3	3	0	0	3
46.	22AGX56	Instrumentation and Control Engineering	PEC	-	3	3	0	0	3
47.	22AGX57	IoT in Agriculture	PEC	-	3	3	0	0	3
48.	22AGX58	Artificial Intelligence and Machine Learning for Agriculture	PEC	-	3	3	0	0	3

EMI - Elective - Management Courses (HSMC)									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22GEA02	Principles of Management	HSMC	-	3	3	0	0	3
2.	22GEA03	Total Quality Management	HSMC	-	3	3	0	0	3
3.	22GEA04	Professional Ethics	HSMC	-	3	3	0	0	3
4.	22GEZ01	Entrepreneurship Development	HSMC	-	3	3	0	0	3
Open Elective Courses (OEC)									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22AGZ01	Fundamentals of Farm Machinery and Management	OEC	-	3	3	0	0	3
2.	22AGZ02	Plant Protection Equipments	OEC	-	3	3	0	0	3
3.	22AGZ03	Waste Water Management and Recycling	OEC	-	3	3	0	0	3
4.	22AGZ04	Baking and Confectionery Technology	OEC	-	3	3	0	0	3
Minor Degree Courses – Integrated Agricultural Systems: Technology and Management									
S.NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22AGM01	Production Technology of Field Crops	OEC	-	3	3	0	0	3
2.	22AGM02	Basic Horticulture	OEC	-	3	3	0	0	3
3.	22AGM03	Farm Mechanization	OEC	-	3	3	0	0	3
4.	22AGM04	Soil Conservation and Water Harvesting Technology	OEC	-	3	3	0	0	3
5.	22AGM05	Renewable Power Sources	OEC	-	3	3	0	0	3
6.	22AGM06	Environmental Pollution Management	OEC	-	3	3	0	0	3
7.	22AGM07	Principles of Food Science and Preservation	OEC	-	3	3	0	0	3

8.	22AGM08	Biomass Waste to Energy$	OEC	-	3	3	0	0	3

CREDIT DISTRIBUTION SUMMARY

Semester/ Category	HSMC	BSC	PCC	ESC	EEC	PEC	OEC	Total
I	4	8		8				20
II	4	8	8	5				25
III		4	16	5				25
IV			22					22
V			14			6	3	23
VI	3		8		1	6$	3	21
VII	2				2	6	6$	16
VIII					10			10
Total	13	20	68	18	13	18	12	162
%	**8.02%**	**12.35%**	**41.98%**	**11.11%**	**8.02%**	**11.11%**	**7.41%**	
AICTE Credits Recommended	16	23	59	29	15	12	9	163
	9.82%	**14.11%**	**36.20%**	**17.79%**	1	6$	3	**9.82%**

$ Ratified by Thirteen Academic Council

22MAN01 INDUCTION PROGRAMME *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	-	**-**	**-**	**-**

PRE REQUISITE : NIL

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:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"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

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.

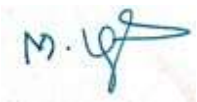
(ix) Department Specific Activities

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:

1.Guide to Induction program from AICTE



22EYA01 - PROFESSIONAL COMMUNICATION I (Common to All Branches)					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PRE - REQUISITE : NIL					
Course Objectives:	• To build essential English skills to address the challenges of communication • To enhance communication employing LSRW skills				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Communicate effectively in various work environments.	R	20%
CO2	Involve indiverse discourse forms utilizing LSRW Skills.	U	20%
CO3	Participate actively in communication activities that enhance the creative skill.	U	20%
CO4	Associate with the target audience and contexts using varied types of communication.	Ap	20%
CO5	Convey the ideas distinctly both in verbal and non-verbal communication in work culture.	U	20%

UNIT I –INTRODUCTORY SKILLS	(6+6)
Grammar – Parts of Speech – Verb (Auxiliaries – Primary & Modal, Main Verb) -**Listening** – Listening to Short Conversations or Monologues - Listening to Experiences – Listening to Descriptions- **Speaking** – Introducing Oneself – Exchanging Personal information - Talking about food and culture - **Reading**– Reading for Interrogation – Reading Newspaper, Advertisements and Interpreting - **Writing** - Seeking Permission for Industrial Visit & In-plant Training	
UNIT II – LANGUAGE ACUMEN	(6+6)
Grammar – Word Formation – Tenses (Present Tense) – Synonyms & Antonyms - **Listening** – Listening to Announcements – Listening to Interviews - Listening and Note-taking - **Speaking** – Talking about Holidays & Vacations – Narrating Unforgettable Anecdotes - **Reading** – Skimming – Scanning (Short Texts and Longer Passages) – Critical Reading - **Writing** – Instruction – Process Description	
UNIT III – COMMUNICATION ROOTERS	(6+6)
Grammar– Cause and Effect – Tenses (Past Tense) – Discourse Markers - **Listening** – Listening to Telephonic Conversations – Listening to Podcasts - **Speaking** – Talking about neoteric Technologies – Eliciting information to fill a form - **Reading** –Book Reading(Motivational) - Practicing Speed Reading (reading newspaper reports & biographies) - **Writing** – Checklist – Circular, Agenda & Minutes of the Meeting	

UNIT IV - DISCOURSE FORTE	(6+6)
Grammar – Tenses (Future Tense) –Yes/No & WH type questions – Negatives - **Listening** – Listening to TED/ Ink talks -**Speaking** – Participating in Short Conversations - **Reading** – Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - **Writing** - E-Mail Writing	
UNIT V - LINGUISTIC COMPETENCIES	(6+6)
Grammar – Articles – Homophones & Homonyms – Single line Definition – Phrasal Verb - **Listening** – Intensive listening to fill in the gapped text - **Speaking** –Expressing opinions through Situations & Role play - **Reading** – Cloze Texts - **Writing** – Paragraph Writing	
LIST OF SKILLS ASSESSED IN THE LABORATORY **1. Grammar** **2. Listening Skills** **3. Speaking Skills** **4. Reading Skills** **5. Writing Skills**	
TOTAL (L:30 , P:30) = 60 PERIODS	

TEXT BOOKS:

1. Shoba K N., Deepa Mary Francis. *English for Engineers and Technologists.* Volume 1, 3rd Edition, Orient Black Swan Pvt. Ltd, Telangana, 2022.

REFERENCES:

1. Koneru, Aruna. *English Language Skills.* Tata McGraw Hill Education (India) Private Limited, Chennai, 2006.
2. Hewings, M. *Advanced English Grammar.* Cambridge University Press, Chennai, 2000.
3. Jack C Richards, Jonathan Hull and Susan Proctor. *Interchange*. Cambridge University Press, New Delhi, 2015 (Reprint 2021).

WEB REFERENCE:

1. https://youtu.be/f0uqUzEf3A8?si=vyzu5KGIfbu35_IQ

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				
CO (W.A)									**2**	**3**				

22MYB01-CALCULUS AND LINEAR ALGEBRA (Common to All Branches)				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PRE - REQUISITE : NIL

Course Objectives:	• To understand the mathematical concepts of matrices and analytical geometry in real time problems. • To formulate differential and integral equations to model physical, biological, and engineering systems

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of matrix theory for find solutions to complex problems efficiently.	Ap	20%
CO2	Analyze the geometric configurations and relationships by using Analytical geometry.	An	20%
CO3	Interpret the partial derivatives which involve heat conduction problems modeled by the heat equation.	Ap	20%
CO4	Apply the differential and integral techniques to solve the differential equations and multiple integrals in heat conduction, fluid mechanics and potential theory.	Ap	40%
CO5	Demonstrate the importance of matrix theory, analytical geometry and integral methods using programming tools.	Ap	Internal Assessment

UNIT I –MATRICES	**(9+3)**
Characteristic Equation-Eigen values and Eigen vectors of a matrix- Cayley Hamilton Theorem(excluding proof)and its applications-Quadratic Form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II – ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+3)**
Equation of plane–Angle between two planes–Equation of straight lines-Coplanar lines–Equation of sphere –Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+3)**
Curvature–Curvature in Cartesian co-ordinates-Centre and Radius of curvature-Circle of curvature-Evolutes and Involutes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(9+3)**
Partial derivatives-Euler's theorem on homogeneous function-Jacobian-Maxima and Minima of functions of Two variables-Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V - MULTIPLE INTEGRALS	**(9+3)**
Double integration in Cartesian Co-ordinates-Change of order of integration-Area as double integral-Triple Integration in Cartesian Co-ordinates-Volume as triple integrals.	
TOTAL(L:45+T:15) :60PERIODS	

LIST OF PROGRAMS USING MATLAB(Assignment/OnlineTest):

1. Introduction to MATLAB
2. Matrix operations–Addition,Multiplication,Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

11. Grewal,B.S.,"Higher Engineering Mathematics", Khanna publications,42ndEdition,2012.
12. ErwinKreyszig,"Advanced Engineering mathematics",JohnWiley&sons,9th Edition,2013.
13. Veerarajan,T.,"Engineering Mathematics of semesterI&II",TataMcGrawHill,3rdEdition,2016.

REFERENCES:

14. Bali,N.P.,ManishGoyal,"A Textbook of Engineering Mathematics-Sem-II",Laxmi Publications,6thEdition,2014.
15. Kandasamy,P.,Thilagavathy,K.,Gunavathy,K.,"Engineering Mathematics for first year",Scand&Co Ltd,9th Revised Edition,2013.
16. GlynJames,"Advanced Engineering Mathematics",Wiley India,7thEdition,2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		2												
3		2												
4	3													
5	3				2				3			2		
CO (W.A)	3	2			2				3			2		

22PYB02 - ADVANCED MATERIALS AND NANO TECHNOLOGY (Common to CIVIL, CHEM & AGRI)				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE: Nil

Course Objectives:	• To gain adequate information about the properties of matter and nano materials. • To expose the concepts of Photonics, fiber optics and Advanced new engineering materials.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Correlate the stress and strain ratio to apply the elasticity for spring materials.	An	20%
CO2	Discriminate the thermal conductivity of the medium to employing in instrument applications.	An	20%
CO3	Articulate the role of nanotechnology in environmental sustainability for the field of agriculture.	Ap	20%
CO4	Operate the optical fibers in sensor devices.	Ap	20%
CO5	Appraise the classification of composites in the applications of aerospace components, automotive parts, and sports equipment.	Ev	20%

UNIT I -PROPERTIES OF MATTER	(9)
Elasticity – Hooke's law Stress-strain diagram and its uses – factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple – torsion pendulum: theory and experiment - bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I-shaped girders - stress due to bending in beams.	
UNIT II -THERMAL PHYSICS	(9)
Mode of heat transfer-thermal conductivity-Newton 's law of cooling –thermal conduction through compound media (bodies in series and parallel) – Thermal conductivity of a good conductor – Forbe's method - Thermal conductivity of bad conductor – Lee's disc – Hazards– Cyclone and flood hazards – Fire hazards and fire protection, fire – proofing of materials, fire safety regulations and firefighting equipment. Prevention and safety measures.	
UNIT III -SYNTHESIS AND PROPERTIES OF NANOSTRUCTURES	(9)
Introduction to Nanoscience – Types of nanostructure and properties of Nanomaterials – Synthesis and preparation of Nanomaterials – Nanosensors – Biosensors – Nanoscience and Environment.	
UNIT IV -PHOTONICS AND FIBER OPTICS	(9)
Photonics: Population of energy levels – Einstein's A and B coefficients derivation – Resonant cavity – Types of lasers – solid state laser (Neodymium) – gas laser (CO_2) Applications of lasers in science – Engineering – Medicine.	

Fibre optics: Principle, numerical aperture and acceptance angle - Types of optical fibres (Material, refractive index and mode) -Losses in optical fibre - Fibre optic communication Fibre optic sensors (pressure and displacement).

UNIT V -ADVANCED NEW ENGINEERING MATERIALS	(9)

Ceramics - Types and applications - Composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics - Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications - Shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy and application - Bio material - applications.

TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:

2. Dattuprasad, Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2019.
3. V.Rajendran, — Engineering Physics, Tata McGraw-Hill. New Delhi.2017.
4. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2018.

REFERENCES:

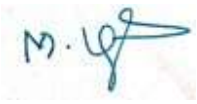
1. Subrahmanyam N, Brijlal, "A Text Book of Optics" S.Chand& Co. Ltd, New Delhi, 2017.
2. Kongbamchandramanisingh, "Basic Physics", PHI, 2018.
3. M.N.Avathanalu, P.G.Kshirsagar "A text book of engineering physics" S.Chand&company Ltd, 2017.

WEB LINKS:

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf.
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
3. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
4. https://zenodo.org/record/243407#.ZEgPZXZBzIU
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												
2	3	2												
3	3						2							
4	3		2											
5	3					2	2					2		
CO (WA)	**3**	**2**	**2**			**2**	**2**					**2**		



22AGC01 - BASICS OF ENGINEERING MECHANICS				
	L	T	P	C
	2	1	0	3
PRE - REQUISITE : NIL				
Course Objectives:	• To analyze the behaviour of the particle and rigid body under the action of forces • To gain knowledge related to friction and its applications • To study the geometric properties of the different plane areas • To acquire knowledge on the behavior of the body in motion under the action of forces			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the forces and support reactions of particles and rigid bodies in equilibrium.	An	20%
CO2	Solve the problems involving dry friction under equilibrium conditions	An	20%
CO3	Determine the centroid, centre of gravity and moment of inertia of various plane and composite areas	An	20%
CO4	Analyze the problems involving dynamics of particle	An	20%
CO5	Demonstrate the concept of forces and their effects in practical applications	Ap	20%

UNIT I – STATICS OF PARTICLE	(9)
Units and dimensions - fundamental principles - laws of mechanics, lami's theorem, parallelogram and triangular law of forces, principle of transmissibility – System of forces- coplanar and concurrent forces - resultant force - statics of particles in two dimension - free body diagram - equilibrium of particles in two dimensions -problems	
UNIT II - STATICS OF RIGID BODY	(9)
Rigid body - Statics of rigid body in two dimensions - moment of a force about a point and about an axis - Varignon's theorem - Resultant of parallel and nonconcurrent forces - moments and couple - equilibrium of rigid bodies in two dimensions - requirements of stable equilibrium- types of supports and their reactions	
UNIT III - FRICTION	(9)
Frictional force - Laws of Coulomb friction - Limiting friction - co-efficient of friction and angle of friction - Impending motion - angle of repose - cone of friction - simple contact friction - ladder friction - belt friction - transmission of power through belts - problems involving the equilibrium of a rigid bodies with frictional forces	

UNIT IV- PROPERTIES OF SECTIONS	(9)
Centroid and Centre of Gravity - first and second moment of area - centroid of plan and composite plane Areas - moment of Inertia of plane and composite plane areas - Radius of gyration-parallel axis theorem - perpendicular axis theorem - polar moment of inertia - Problems	
UNIT V - DYNAMICS OF PARTICLES	(9)
Kinematics - Displacements, velocity and acceleration, their relationship - linear motion with uniform and variable acceleration - curvilinear motion and projectile motion - Kinetics of particles - Newton's law, D'Alembert's Principle - work energy equation - impulse momentum equation - problems	
TOTAL (L:30 +T15) = 45 PERIODS	

TEXT BOOKS:

1. Vela Murali, "Engineering Mechanics", Oxford University Press, 2010.
2. Ferdinand, P., Beer and Russell Johnson, E., "Vector Mechanics for Engineers: Statics and Dynamics" Tata McGraw Hill International Edition, 9thEdition, 2010.

REFERENCES:

1. Irving H. Shames, "Engineering Mechanics: Statics and Dynamics", Prentice Hall of India Private limited, 2003.
2. Russell C. Hibbeler, "Engineering Mechanics: Statics and Dynamics", 12th Edition Prentice Hall, 2009.
3. Anthony M. Bedford and Wallace Fowler, "Engineering Mechanics: Statics and Dynamics", 5th Edition, Prentice Hall, 2007.
4. Palanichamy, M. S and Nagan, S., "Engineering Mechanics - Statics and Dynamics", Tata McGraw-Hill, 3rd Edition, New Delhi, 2005.
5. Meriam, J. L. and Kraige, L. G., "Engineering Mechanics: Statics and Dynamics", Wiley Publishers, 6th Edition, 2006.
6. Rajasekaran, S. and Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 3rd Edition, New Delhi, 2005.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3											3	
3		2	2										2	
4	2	2											2	
5			2									3		2
CO (W.A)	**2.5**	**2.33**	**2**									**3**	**2.33**	**2**

22MEC01 - ENGINEERING GRAPHICS *(Common to AGRI, CIVIL, CHEMICAL and EEE Branches)*				
	L	**T**	**P**	**C**
	2	**0**	**2**	**3**

PRE - REQUISITE : Nil

Course Objectives:	• To Construct various plane curves • To Construct the concept of projection of points, lines and plane • To Develop the projection of solids • To Solve problems in sectioning of solids and developing the surfaces • To Apply the concepts of orthographic and isometric

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of engineering drawing standards to drawn 2D Engineering drawings.	Ap	40%
CO2	Apply the knowledge of engineering drawing standards to solve the given 2D problem using first angle of projection.	Ap	20%
CO3	Apply the knowledge of engineering drawing standards solve the 3D problem using first angle of projection	Ap	20%
CO4	Analyze the given problem to create 3D drawing	An	20%
CO5	Engage independent study as a member of team and make effective oral presentation on engineering graphics	U	Internal Assessment

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 - scales.	
UNIT I - PLANE CURVES	**(6+6)**
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 - theory of projection - principle of multi-view orthographic projection - profile plane and side views - multiple views - representation of three dimensional objects - layout of views.	
UNIT II - PROJECTION OF POINTS, LINES AND PLANES	**(6+6)**
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 - projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.	
UNIT III - PROJECTION OF SOLIDS	**(6+6)**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to anyone of the principal plane and parallel to another by rotating object method.	

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	(6+6)
Sectioning of solids (prism, cube, pyramid, cylinder and cone) 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 cylinder and cone.	
UNIT V - ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	**(6+6)**
Principles of isometric projection - isometric scale - isometric projections of lines, plane figures, simple solids and truncated solids - prisms, pyramids, cylinders, cones – free hand sketching of orthographic views from isometric views of objects.	
TOTAL (L:30+P:30) : 60 PERIODS	

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. K.R.Gopalakrishna, "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.
3. K. V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
4. 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.
5. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3		3								2	3	
2	3	3		3								2	3	
3	3	3		3								2	3	
4	3	3		3								2	3	
5	3			3					2			3	3	
CO (W.A)	3	3		3					2			2	3	

22PYP01 - PHYSICS LABORATORY (Common to All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

PRE - REQUISITE : 22CHC09

Course Objectives:	• To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory. • To introduce different experiments to test basics of physics concepts applied in optics and electronics

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Examine the effects of material type and loading conditions on the results of the non-uniform bending experiment.	An
CO2	Utilize principles of light interaction to determine the particle size of materials using laser diffraction techniques.	Ap
CO3	Evaluate the accuracy of the wavelength of different colors with the accepted values in the literature	Ev
CO4	Measure the effectiveness of the solar cell based on its V-I characteristics.	Ev
CO5	Analyze the principles underlying the Air wedge method for the determination of the thickness of a thin wire,	An

LIST OF EXPERIMENTS:

1. Determination of Young's modulus by non-uniform bending method
2. Determination of (a) wavelength and (b) particle size using Laser.
3. Determination of thermal conductivity of a bad conductor – Lee 's Disc method.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of band gap of a semiconductor.
6. Determination of thickness of a thin wire – Air wedge method.
7. Determination of V-I characteristics of solar cell.

TOTAL (P:30) = 30 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3												
2	3											2		
3	3	3												
4	3											2		
5	3	3												
CO (weighted average)	**3**	**3**										**2**		

22GEP01 - ENGINEERING PRACTICES LABORATORY *(Common to AGRI, BME, CHEM, CIVIL, ECE, EEE and MECH Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**
PRE - REQUISITE : NIL				

Course Objective:	• To provide hands on training on various basic engineering practices in civil engineering • To provide hands on training on welding in mechanical engineering • To provide hands on training on various basic engineering practices in mechanical engineering • To understand the basic working principle of electric components • To understand the basic working principle of electronic components

The Student will be able to	**Course Outcomes**	**Cognitive Level**
CO1	Design new layouts of civil work for residential and industrial buildings.	Ap
CO2	Apply the concepts of welding in repairing works and making various components	Ap
CO3	Design new components using machining processes in real life and industries	Ap
CO4	Apply the skills of basic electrical engineering for wiring in different areas and Measure various electrical quantities	Ap
CO5	Apply electronic principles to measure various parameters of a signal.	Ap

GROUP-A (MECHANICAL AND CIVIL ENGINEERING)	
I - CIVIL ENGINEERING PRACTICE	**(15)**
Buildings: a. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects	
Plumbing: a. Study of tools and operations b. Hands-on-exercise: External thread cutting and joining of pipes	
Carpentry: a. Study of tools and operations b. Hands-on-exercise: "L" joint and "T" joint	
II - MECHANICAL ENGINEERING PRACTICE	**(15)**
Welding: a. Study of arc welding, gas welding tools and equipments b. Arc welding- Butt joints, Lap joints and Tee joints c. Practicing gas welding	

Basic Machining: a. Study of lathe and drilling machine b. Facing and turning c. Drilling and Tapping
Sheet Metal Work: a. Study of tools and operations b. Rectangular tray c. Cone
GROUP - B (ELECTRICAL AND ELECTRONICS)
I - ELECTRICAL ENGINEERING PRACTICE **(15)**
a. Residential house wiring using Switches ,fuse, indicator, lamp b. Fluorescent lamp wiring c. Stair Case Wiring d. Measurement of electrical quantities – Voltage, current ,power in R Circuit e. Study of Electrical apparatus-Iron box & water heater f. Study of Electrical Measuring instruments- Megger
II - ELECTRONICS ENGINEERING PRACTICE **(15)**
a. Study of Electronic components and various use of multi meter. b. Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO. c. Study of logic gates AND, OR, XOR and NOT. d. Study of Clock Signal. e. Soldering practice -Components Devices and Circuits - Using general purpose PCB. f. Study of Half Wave Rectifier (HWR) and Full Wave Rectifier (FWR). g. Study of Telephone, FM Radio and Cell Phone.
TOTAL(P:60)=60PERIODS

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				2							3		
2		3			3									
3			2		3							3		
4	3				3									
5	3				3									
CO (W.A)	**3**	**3**	**2**		**2.8**							**3**		

22MAN02 - SOFT/ANALYTICAL SKILLS – I (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**
PRE - REQUISITE : NIL				
Course Objectives:	• To understand the basic concepts of grammar and apply them in a structured Manner • To solve mathematical problems and thereby reducing the time taken for performing job functions			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment Test**
CO1	Recognize and apply fundamental grammatical rules in both written and spoken contexts.	U	40%
CO2	Solve real-time problems for performing job functions easily.	Ap	30%
CO3	Enhance their aptitude round clearing ability in interview process.	An	30%

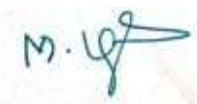
UNIT I – VERBAL ABILITY	(5+10)
Tenses - One Word Substitution- Articles - Preposition - Conjunction	
UNIT II – BASIC APTITUDE	(5+10)
Percentage - Ratio and Proportion - Blood Relations - Analogy	
UNIT III – LOGICAL REASONING	(5+10)
Probability - Profit and Loss - Syllogism - Statement Assumptions.	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
2. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN03 YOGA – I (For Common To All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**I**	**0**
PRE - REQUISITE : NIL				

Course Objectives:	• To make students in understanding the importance of yoga in shaping mental and physical wellness. • To provide awareness about the significance of leading a peaceful life by following yoga exercises and principles. • To develop mental wellbeing through meditation and breathing exercises. • To strengthen the body through physical exercises. • To inculcate the knowledge about different types of Asanas and their benefits

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Understand the importance of yoga for physical and mental goodness.	U	Internal Assessment
CO2	Perform the yoga exercises for hand, leg, eye and sun salutation etc.	Ap	
CO3	Learn and practice meditation techniques for keeping good mental health	Ap	
CO4	Develop their body by performing yoga exercises.	Ap	
CO5	Demonstrate different types of yoga Asanas for improving their personal fitness.	Ap	

UNIT I – INTRODUCTION TO YOGA	(3)
Meaning and Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra.	
UNIT II - YOGA AND LIFE STYLE	(3)
Asanas as Preventive measures – Hypertension:Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana – Obesity: Procedure, Beneits and contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana – Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana - Diabetes: Procedure, Benefits and contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana – Asthema: Procedure, Benfits and contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.	

UNIT III – MIND EXERCISES	(3)
Naadi sudhi – Thanduvada sudhi – Breathing meditation – Silent meditation – Relax meditation.	
UNIT IV – PHYSICAL EXERCISES (PART– I)	(3)
Hand Exercises – Leg Exercises – Eye Exercises – Sun Salutation.	
UNIT V – ASANAS (PART-I)	(3)
Asanas –Tadasana – Yegapadhasana – Chakrasana – Udkaddasana – Thirikosana – Thandasana – Paschimottanasana.	
TOTAL (P:15) : 15 PERIODS	

TEXT BOOKS/REFERENCES:
1. Light On Yoga by B.K.S. Iyengar.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1								3	2			3		
2								3	2			3		
3								3	2			3		
4								3	2			3		
5								3	2			3		
CO (W.A)								3	2			3		

22EYA02- PROFESSIONAL COMMUNICATION- II (Common to All Branches)				
	L	**T**	**P**	**C**
	2	**0**	**2**	**3**

PRE - REQUISITE : 22EYA01

Course Objectives:	• To enhance the students with necessary English language skills • To enable students to communicate effectively in an academic setting

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Frame sentences both in written and spoken forms with accuracy and fluency.	R	20%
CO2	Use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.	U	20%
CO3	Gain essential competency to express one's thoughts orally and in writing in a meaningful way.	U	20%
CO4	Attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.	Ap	20%
CO5	Perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation.	U	20%

UNIT I - LANGUAGE RUDIMENTS	(6+6)
Grammar – Active and Passive Voice – Impersonal Passive Voice – Numerical Expressions - Listening – Listening for Specific Information and Match / Choose / Fill in the texts - Speaking – Describing a Person - Making Plans -Reading – Intensive Reading -Writing – Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	(6+6)
Grammar – Reported Speech – Infinitive and Gerund - Listening – Listening to Iconic Speeches and making notes - Listening news / documentaries - Speaking –Talking over Phone – Narrating Incidents - Reading – Extensive Reading (Motivational Books) - Writing – Recommendation	
UNIT III - TECHNICAL CORRESPONDENCE	(6+6)
Grammar – If Conditionals – Blended Words - Listening – Listening to business conversation on audio and video of Short Films, News, Biographies - Speaking – Synchronous communication and Asynchronous communication - Opportunities and threats in using digital platform- Reading - Finding key information in a given text - Writing –Netiquettes- Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	(6+6)
Grammar – Concord – Compound Words - Listening – Listening to Roles and Responsibilities in Corporate - Listening to technical videos - Speaking – Introduction to Technical Presentation - Story Telling - Reading – Reading and Understanding Technical Articles - Writing – Report Writing (Accident, Survey and feasibility)	

UNIT V - LANGUAGE BOOSTERS	(6+6)
Grammar - Idiomatic Expressions – Relative Clauses – Confusable words - Listening – Listening to different kinds of Interviews - Listening to Group Discussion - Speaking – Group Discussion - Reading – Reading and Interpreting Visual Materials - Writing – Analytical Paragraph Writing	
LIST OF SKILLS ASSESSED IN THE LABORATORY **1. Grammar** **2. Listening Skills** **3. Speaking Skills** **4. Reading Skills** **5. Writing Skills**	
TOTAL (L:30 , P:30) = 60 PERIODS	

TEXT BOOKS:

5. Sudharshana, N.P and Saveetha.C. *English for Technical Communication*. Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

1. Rizvi, M Ashraf. *Effective Technical Communication.* Second Edition, McGraw Hill Education India PvtLtd, 2017.
2. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds. *A Student's Introduction to English Grammar.* Second Edition, Cambridge University Press, New Delhi, 2022.

WEB REFERENCE:

1. http://youtu.be/URtdGiutVew

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2									2	3				
3									2	3				
4									2	3				
5									2	3				
CO (W.A)									**2**	**3**				

22MYB02 – PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES *(Common to AGRI,CIVIL,CHEMICAL, MECH Branches)*				
	L	**T**	**P**	**C**
	3	**I**	**0**	**4**
PRE - REQUISITE : NIL				
Course Objectives:	• To make the conversant with concepts of Laplace transforms, Fourier series, Fourier Transforms to represent periodical physical problems in engineering analysis. • To provide adequate knowledge in partial differential equation and to analyze the boundary value problems.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the various techniques of Fourier series to obtain solution for different functions.	Ap	20%
CO2	Interpret the methods of partial differential equations in fluid mechanics and water resource management.	Ap	20%
CO3	Solve the initial and boundary value problems by using Fourier series.	Ap	20%
CO4	Analyze the concepts of Transform Techniques to solve the problems in stability analysis, Structural Analysis, control system design and analysis.	An	40%
CO5	Demonstrate the importance of Transform Techniques and partial differential equations in engineering using modern tools.	Ap	Internal Assessment

UNIT I – FOURIER SERIES	**(9+3)**
Dirichlet's condition – Fourier series: Half range sine series – Half range cosine series – Parseval's identity for half range series – Root mean square value of a function – Harmonic analysis.	
UNIT II –PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Formulation of partial differential equations by eliminating arbitrary constants and functions – Solution of standard types first order partial differential equations of the type f(p,q)=0,Clairaut's form – Lagrange's linear equations –Linear partial differential equation of second and higher order with constant coefficient of homogeneous types.	
UNIT III –APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Classification of second order quasi linear partial differential equations – Solution of one dimensional wave equation (Zero and non-zero velocity) – One dimensional heat equation (Temperature reduced to zero and non zero boundary conditions) – Steady state solution of two dimensional heat equation(Finite and infinite plate).	
UNIT IV –-FOURIER TRANSFORM	**(9+3)**
Fourier integral theorem(Statement only) – Fourier transform pair - Sine and Cosine transforms – Properties -Transforms of simple functions – Convolution theorem – Parseval's identity(Excluding proof).	

UNIT V –LAPLACE TRANSFORM	(9+3)
Condition for existence - Transforms of Elementary functions –Basic Properties- First & Second Shifting Theorems(Statement only) - Initial and Final value Theorems. Inverse Laplace transforms -Convolution theorem (Excluding proof)- Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Veerarajan.T,"Engineering Mathematics (for semester III), 3rd ed., Tata McGraw Hill, New Delhi.
2. Kandasamy.P, Thilagavathy.K, and Gunavathy.K., "Engineering Mathematics; Volume III", S.Chand&Coltd., 2008.
3. GrewalB.S,"Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.

REFERENCES:

1. Goyal Manish and Bali.N.P,"A Text book of Engineering mathematics", 6th ed.,Laxmi Publication (P) Ltd,New Delhi, 2012.
2. Kreyszig, Erwin,"Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.

Singaravelu.A,"Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamilnadu.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2	3													
3	3													
4	3													
5	3				2				3			3		
CO (W.A)	3	2			2				3			3		

22CYB05 CHEMISTRY FOR AGRICULTURAL ENGINEERS (For AGRI Branch Only)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE - REQUISITE : NIL

Course Objectives:	• To make the students conversant with water treatment, boiler feed water techniques, nature of bonding, engineering materials and corrosive nature of metals. • To impart knowledge to the students on the basic concepts of nanochemistry and fundamentals of soil science and endow skills on weathering

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO2	Categorize the properties of lubricants and refractories for various applications.	Ap	20%
CO3	Explore the type of corrosion and its control measures.	An	20%
CO4	Implement the basic concepts of soil and identify the effects of fertilizers and pesticides in modern agriculture.	Ap	20%
CO5	Illustrate the concepts of nanoscience and its various applications.	Ap	20%

UNIT I – WATER TECHNOLOGY	(9)
Hardness – types – estimation by EDTA method. Water quality parameter – BOD and COD - Domestic water treatment – disinfection methods (chlorination, ozonation and UV treatment) – Boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) – Internal conditioning (carbonate, phosphate and calgon) – External conditioning – demineralization process – desalination – reverse osmosis method.	
UNIT II – CHEMICAL BONDING AND ENGINEERING MATERIALS	(9)
Chemical bond – Types of bonds - Covalent bond – Hydrogen fluoride, Methane (overview only) - Ionic bond – Sodium Chloride, Magnesium Oxide (overview only) - Coordinate bond – Hydrogen Peroxide, Ozone (overview only) - Hydrogen Bond – Types of hydrogen bond (overview only). Engineering Materials : Synthesis of Abrasives – Properties of Refractories – Lubricants.	
UNIT III – SCIENCE OF CORRISION	(9)
Corrosion – types - chemical corrosion - pilling bedworth rule - electrochemical corrosion – mechanism - galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors.	

UNIT IV – BASICS OF SOIL	(9)
Soil – Pedological and edaphological concepts – Earth – Interior and Exterior of earth -Composition of earth's crust – Rocks and minerals – types – Weathering of rocks and minerals – physical weathering - chemical weathering – biological weathering -- Fundamental soil forming process – Humification – Eluviation – Illuviation – Horizonation and specific soil forming process – Calcification – Decalcification – Fertilizers and pesticides – Effects of using fertilizers and pesticides in modern agriculture.	
UNIT – V – NANOCHEMISTRY	(9)
Introduction - Types of nanomaterials - Properties and uses of – nanoparticle - nanocluster- nanorod, nanowire and nanotube. - Synthesis of nanomaterials - sol-gel – solvothermal - laser ablation - chemical vapour deposition - electrochemical deposition and electro spinning - Applications of nanomaterials.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Ravikrishnan, A., "Engineering Chemistry I & Engineering Chemistry II , Sri Krishna Hitech Publishing chem., Co. Pvt. Ltd., 13th ed., Chennai , 2020.
2. Dilip kumar Das, "Introductory soil science", Kalyani publishers, 2018.

REFERENCES:

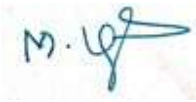
1. Jain, P.C. and Monica Jain, "Engineering Chemistry", Vol I &II, Dhanpat Rai Pub, Co., New Delhi 15th ed., 2018.
2. "Fundamentals of Soil Science", ISSS Publication, New Delhi, 2019.

WEB LINK:

1. https://www.sciencedirect.com/book/9781856177054/water-technology\
2. https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/Chemical_Compounds/Introduction_to_Chemical_Bonding
3. https://www.sciencedirect.com/topics/materials-science/corrosion
4. https://www.soils.org/about-soils/basics/
5. https://www.sciencedirect.com/topics/chemistry/nanochemistry

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2												
2		2					2							
3		2					2		2					
4			2				2							
5						2						2		
CO (W.A)	**3**	**2**	**2**			**2**	**2**		**2**			**2**		



22CSC01 - PROBLEM SOLVING AND C PROGRAMMING *(Common to All Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PRE - REQUISITE : NIL					
Course Objective:	To equip students with the essential skills and knowledge to solve computational problems using the C programming language.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply basic syntax and semantics of C language to write clear and structured code.	Ap	20%
CO2	Make use of both conditional statements and iterative control structures for developing applications.	Ap	20%
CO3	Apply knowledge of arrays and strings to solve computational problems.	Ap	20%
CO4	Identify modular solutions that integrate problem-solving techniques to solve complex computational problems.	An	20%
CO5	Analyze the performance implications using pointers and to manage file operations efficiently.	An	20%

UNIT I -PROBLEM SOLVING AND C PROGRAMMING BASICS	**(9)**
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms **Basics of C Programming** : Introduction to C - Structure of C program - Programming Rules – Compilation – Errors - C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initialization - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	**(9)**
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	**(9)**
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	**(9)**
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	
UNIT V - POINTERS AND FILE MANAGEMENT	**(9)**
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation	
	TOTAL (L:45) :45 PERIODS

TEXT BOOKS:

1. Ashok N. Kamthane, "Programming in C", 2nd Edition, Pearson Education, 2013.
2. Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.

REFERENCES:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st Edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th Edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645
3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
4. ReemaThareja., "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.
5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2	3		3										2	
3	3				3							3		
4		3			3							3		
5		3										3		2
CO (W.A)	**3**	**3**	**3**		**3**							**3**	**2**	**2**

22AGC02 - PRINCIPLES AND PRACTICES OF CROP PRODUCTION				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE: NIL				
Course Objective:	• To develop students' ability to critically evaluate and implement effective crop production and protection strategies, fostering a sustainable and productive agricultural environment.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Articulate advanced tillage and crop establishment methods, including modern concepts of tillage and sowing techniques, to improve soil fertility and crop establishment in diverse farming scenarios.	Ap	20%
CO2	Analyze crop production and protection strategies, including the use of fertilizers, irrigation, and integrated pest management, to enhance the efficiency and sustainability of agricultural practices across different crop types and farming systems.	An	20%
CO3	Evaluate the effectiveness of sustainable agricultural practices, such as organic farming, integrated farming systems, and dry farming, in enhancing soil health and crop yield under varying climatic and edaphic conditions.	An	20%
CO4	Apply integrated crop management techniques, including soil preparation, seed selection, and pest and disease management, across various cropping systems to optimize productivity and sustainability.	Ap	40%
CO5	Summarize a report as a team member on the techniques and constraints, observed in crop production and management practices by gaining an field level exposure.	An	Internal Assessment

UNIT I – HISTORY OF AGRICUTLURE AND AGRONOMY	**(9)**
Agriculture – Definition – Importance and scope – Branches of agriculture – Evolution of man and agriculture – History of agricultural development in the world and India – ITK – National and International Agricultural Research Institutes in India and Tamil Nadu. Agronomy – Definition – Importance, meaning and scope – Agro–climatic zones of India and Tamil Nādu – crops and classification – season – Units and measurements.	
UNIT II – FIELD PREPARATION AND CROP ESTABLISHMENT	**(9)**
Tillage – Definition – Types – Objectives – Modern concepts of tillage - Main field preparation – seeds – seed rate – sowing methods – crop establishment methods – plating geometry and factors affecting crop production – climatic – edaphic – biotic – physiographic and socio-economic factors – after cultivation – Thinning – Gap filing – Earthing up – detrashing – nipping – Pruning and Mulching.	
UNIT III – CROP MANAGEMENT TECHNIQUES	**(9)**
Weeds – Definition – types – weed control methods – physical cultural – mechanical – chemical – biological controls. Irrigation – methods. Pest and disease and their management. Manures and fertilizers-organic–inorganic –Time and methods of application – Integrated management practices- (IWM, INM, IPM)	

UNIT IV – CROPPING SYSTEMS	(9)
Cropping systems – Definition – Principles – Concepts – classification cropping systems of India and Tamil Nadu – cropping patterns – suitable Agriculture – integrated farming systems – organic agriculture – Dry farming.	
UNIT V – PACKAGE OF PRACTICES FOR AGRI. AND HORTI. CROPS	**(9)**
Cultivation practices for cereals (Rice, maize) – millets (Cumbu, Ragi, sorghum) – minor millets, pulses (Black gram, green gram, Red gram) – Oil seeds (Groundnut and sesame) – Fiber (Cotton) – Sugar crop (sugarcane). Cultivation practices for Horticulture crops – Vegetables. Fruits and flowers.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Yellamanda Reddy, T., Sankara Reddy, G. H., "Principles of Agronomy", Kalyani Publishers, New Delhi, 2016.
2. Chidda SIngh, Prem Singh and Rajtir Sing, "Modern techniques of raising field crops". Oxford & AMP; IBH Publishing Co. Pvt. Ltd., 2nd Edition, New Delhi, 2018.

REFERENCES:

1. Hand book of Agriculture, ICAR publications, New Delhi, 2016.
2. Rajendra Prasad, "Text book of field crop production", Directorate of Information and Publication, Krishi Anusandhan bavan, Pusa, New Delhi. 2015.
3. "Crop production guide", Directorate of Agriculture and Tamil Nadu Agricultural University, Coimbatore, 2020.
4. Palaniyappan, S. P. and Sivaraman, K. "Cropping systems in the tropics principles and management", New Age International Publishers, Revised 2nd Edition, New Delhi, 2006.
5. Kumar. N., "Introduction to Horticulture", Rajalakshmi publications, 7th Edition, Nagercoil, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					3								3	
2		3					3						3	
3				3			3						3	3
4													3	3
5									3	3				3
CO (W.A)		3		3	3		3		3	3			3	3

22EEC04- ELECTRICAL ENGINEERING *(For AGRI Branch only)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE - REQUISITE : NIL

Course Objective:	• To impart knowledge on the concepts of measuring instruments, Electrical wiring, machines, Drives with protection • To understand the concept of sensor and Transducer

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply instrumentation principles to predict the various measuring instruments, sensor and transducers.	Ap	25%
CO2	Analyze the protection circuits that used for electrical wiring and electrical fencing.	An	25%
CO3	Investigate the ideas about the earthing and measurement of earth resistance.	An	25%
CO4	Illustrate the operation and types of electrical machines including instruments, motors and drives	Ap	25`%
CO5	Achieve as an independent learner in a team to build an authentic applications of electrical engineering paradigm and make an effective oral presentation.	C	Internal Assessment (Seminar)

UNIT I - MEASURING INSTRUMENTS	**(9)**
Instruments: Introduction, Classification – Indicating Instruments: Operating Principles, Moving Iron, Moving Coil – Induction type Energy meter - Measurement of Earth resistance: Fall of potential method and Earth tester.	
UNIT II - ELECTRICAL WIRING AND FENCING	**(9)**
Electric Wiring: Types of wires, Wiring materials, Casing and Capping wiring, Cleat wiring, Batten Wiring and Conduit Wiring - Electric Fencing: working principle, Earth Return System, Fence Return System, Bi-Polar Fencing System, Energisers.	
UNIT III – PROTECTION	
Introduction to Fuses - Circuit Breaker: Operation - Types: MCB, MCCB, ELCB - Earthing: Types – Pipe and Plate Earthing, System and Equipment's Earthing.	**(9)**
UNIT IV - ELECTRICAL MACHINES AND DRIVES	
Single Phase Induction Motor: Constructional details, Starting methods - Applications - Electric drives: Introduction, Classifications, General electric drive system (Block diagram Approach only)	**(9)**

UNIT V SENSORS AND TRANSDUCERS	
Sensors: Introduction, Position sensor, Velocity sensor, Proximity sensor, Hall effect sensor Thermistor and Thermocouple - Transducer: Principle of operation, Resistive potentiometer, LVDT, Piezo electric, capacitive.	**(9)**
	TOTAL = 45 PERIODS

TEXT BOOKS:

1. Kothari, D. P. and Nagarath, I. J., "Basic Electrical Engineering", McGraw Hill Education (India) Private Limited, 4th Edition, Third Reprint, 2019.
2. Muthusubramaian, R., Salivahanan, S. and Muraleedharan, K.A., "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill publishers, 2nd ed., New Delhi, 2012.

REFERENCES:

1. Bhattacharya, S. K., "Basic Electrical and Electronics Engineering", Pearson India, Second Edition, New Delhi, 2017.
2 Sawhney, A. K., "A Course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai & Sons, 29th Edition, New Delhi, 2021.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3											2	
3		3											2	
4	3												2	
5									3	3	3	3		
CO (W.A)	**3**	**3**							**3**	**3**	**3**	**3**	**2**	

22CSP01 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY *(Common to All Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE - REQUISITE : NIL

Course Objective:	To develop programs to solve basic problems by understanding basic concepts in C language

Course Outcomes The student will be able to		**Cognitive Level**
CO1	Formulate the algorithms for simple problems	Ap
CO2	Apply the concept of pointers of different types	Ap
CO3	Apply and manipulate data with arrays, strings and structures	Ap
CO4	Apply the concept of functions and dynamic memory allocation	Ap
CO5	Analyse and correct logical errors encountered during execution	An

C-Programming:

1. Draw the flowchart for the following using Raptor tool.
    a) Simple interest calculation
    b) Greatest among three numbers
    c) Find the sum of digits of a number
2. Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential and Selection structures)
3. Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures)
4. Programs for demonstrating one-dimensional and two-dimensional numeric array
5. Programs to demonstrate modular programming concepts using functions
6. Programs to implement various character and string operations with and without built-in library functions.
7. Programs to demonstrate the use of pointers
8. Programs to illustrate the use of user-defined data types
9. Programs to implement various file management.
10. Program Using Dynamic memory allocation functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:
Hardware: • LAN System with 33 nodes (OR) Standalone PCs – 33 Nos. • Printers – 3 Nos. **Software:** • RAPTOR Tool • Compiler – C
TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												2	
3	3												2	
4	3												2	
5		3			2							2	3	
CO (W.A)	3	3			2							2	2.4	

22AGP01 - CROP PRODUCTION AND HUSBANDRY LABORATORY				
	L	T	P	C
	0	0	4	2

PRE - REQUISITE: NIL

Course Objective:	• To equip students with practical skills in agricultural practices and post-harvest processes, thereby enabling them to apply and analyze modern farming techniques for improved crop production and sustainable agriculture.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Acquire practical skills in handling primary and secondary tillage implements, and meteorological instruments applying their understanding of equipment function and safety procedures.	Ap	20%
CO2	Identify various types of seeds, fertilizers, manures, and green leaf manures, and analyze their suitability for different crops.	An	20%
CO3	Calculate the manure and fertilizer requirements for different crops and apply the appropriate methods for their application, analyzing the impact on crop growth and soil health.	An	20%
CO4	Apply different methods of land configuration and seed treatments, sowing methods and analyze the effectiveness of various post harvest techniques.	Ap	20%
CO5	Analyze the effectiveness of different weeding practices, and proficiently use weeding tools and implements.	An	20%

LIST OF EXPERIMENTS

1. Identification of seeds, seed rates, manures, fertilizers, green and green leaf manures.
2. Identification of tools and implements.
3. Acquiring skill in handling primary and secondary tillage implements.
4. Practicing different methods of land configuration.
5. Practicing different methods of seed treatments and sowing methods.
6. Practicing various inter-cultural operations.
7. Working out manures and fertilizers requirements of crop and practicing methods of application.
8. Identification of Weeds, weeding practices and handling of weeding tools and implements.
9. Practicing various Harvest – Post harvest techniques in field crop.
10. Study on Meteorological Instruments and visit to AWS.

TOTAL (P: 60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3				3								3	
2							3					2	3	
3				3								2	3	3
4	3		3									2	3	3
5					3									3
CO (W.A)	**3**		**3**	**3**	**3**		**3**					**2**	**3**	**3**

22CYP01 CHEMISTRY LABORATORY (Common to AGRI, BME, CHEM, CIVIL, ECE, EEE and MECH Branches)				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

PRE - REQUISITE : NIL

Course Objective:	• To determine the copper in brass in the given solution and explain the origin of hardness, alkalinity, chloride and dissolved oxygen in water. • To perform a potentiometric, conductometric titration and pH of an acidic solution of known Normality.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Predict the various water quality parameters by volumetric analysis.	An
CO2	Evaluate the amount of copper in the given solution by titration method.	E
CO3	Analyze the conductance and emf of the different solutions.	An
CO4	Analyze and gain experimental skill about potential of hydrogen ion.	An
CO5	Examine the pH of various acidic, basic and neutral solutions.	An

LIST OF EXPERIMENTS :

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of chloride content of water sample by Argentometric method.
4. Determination of DO content of water sample by Winkler's method.
5. Estimation of copper in brass by EDTA.
6. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Determination of strength of given hydrochloric acid using pH meter.

Total (30 P) = 30 periods

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1					3									
2							2							
3							2							
4					3									
5							2							
CO (W.A)					**3**		**2**							

22MAN04 - SOFT/ANALYTICAL SKILLS – II (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE - REQUISITE : NIL

Course Objective:	• To acquire satisfactory competency in verbal reasoning. • To develop skill to meet the competitive examinations for better job opportunity.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment test**
CO1	Enhance vocabulary which in turn will help in developing language competency.	U	40%
CO2	Solve the problems easily by using Short-cut method with time management.	Ap	30%
CO3	Analyze the problems logically and approach the problems in a different manner.	An	30%

UNIT I - VERBAL COMPETENCY	(5+10)
Voice - Modal Verbs - Synonyms & Antonyms - Confusable Words	
UNIT II - NUMERICAL REPRESENTATION	(5+10)
Average - Data Interpretation - Simple Interest and Compound Interest - Venn Diagram.	
UNIT III - RESOLUTION TENDENCY	(5+10)
Time and Work - Pipes and Cistern - Number Series and Odd man Out - Cube Problems	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

3. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
4. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				

22MAN05 - YOGA – II (For Common To All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**I**	**0**
PRE - REQUISITE : NIL				

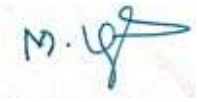
Course Objective:	• To strengthen the body through physical exercises. • To understand the importance of value system and ethics. • To know the life philosophy of yogis and maharishis. • To understand the nature laws, cause and effect theory. • To inculcate knowledge about different types of Asanas and their benefits.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Perform physical exercises like spine exercises, massage and acupressure.	Ap	Internal Assessment
CO2	Learn the human values, ethics, time management and the importance of introspection.	U	
CO3	Analyze various life philosophies of yogi's and rishi's.	An	
CO4	Understand life lessons and nature laws.	U	
CO5	Demonstrate different types of yoga Asanas and improve their personal fitness.	Ap	

UNIT I – PHYSICAL EXCERCISES (PART-II)	(3)
Breathing Exercises – Kapalapathi – Maharasanam (Spine Exerices) – Massage and Acupressure.	
UNIT II – HUMAN VALUE	(3)
Divine power – Life force (Bio magnetism) – Importance of Introspection – Time management – Punctuality – self confidence – mind control.	
UNIT III – PHILOSOPHY OF LIFE	(3)
Basic needs for life – Hunger and thirst – climatic/weather changes – Body wastes – pressure of excretory organs – safety measures – protection from natural disaster – protection from enmity – protection from accidents – ethics – morality – duty – charity – Wisdom of perfection stages – faith – understanding – realization.	
UNIT IV – NATURE'S LAW OF CAUSE AND EFFECT	(3)
Food transformation into seven minerals – Natural actions – pattern – precision – regularity – Required skills – planned work – awareness – introspection.	
UNIT V – ASANAS (PART-II)	(3)
Ustrasana – Vakrasana –Komugasana – Padmasana – Vajrasana – Sukhasana – Yogamudra – mahamudra.	
TOTAL (P:15) : 15 PERIODS	

TEXT BOOKS/REFERENCES:
1. Light On Yoga by B.K.S. Iyengar.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1								3	2			3		
2								3	2			3		
3								3	2			3		
4								3	2			3		
5								3	2			3		
CO (W.A)								3	2			3		



22MAN06 ENVIRONMENTAL SCIENCE (Common to AGRI (2nd semester) and MECH (4th semester) Branches)				
	L	**T**	**P**	**C**
	2	**0**	**0**	**0**
PRE - REQUISITE : NIL				
Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity	Ap	Internal Assessment
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	
CO3	Produce the renewable and non-renewable resources and preserve them for future generations.	Ap	
CO4	Organize the different goals of sustainable development and apply them for societal development.	Ap	
CO5	Evaluate the recycling of battery, cell phone , laptop and PCB	E	

UNIT I - ENVIRONMENT AND BIODIVERSITY	(6)
Environment - scope and importance - Eco-system: Structure and function of an ecosystem- types of biodiversity - genetic - species and ecosystem diversity – values of biodiversity - hot-spots of biodiversity – conservation of biodiversity: In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	(6)
Pollution – Causes - Effects and Preventive measures of Water, Air and noise pollution - Solid waste management: methods of disposal of solid waste - Environmental protection act: Air act – Water act.	
UNIT III - RENEWABLE SOURCES OF ENERGY	(6)
Energy management and conservation - New Energy Sources: Different types of new energy sources – Solar energy – wind energy - Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion.	
UNIT IV – SUSTAINABILITY AND MANAGEMENT	(6)
Development – Factors affecting development – advantages – disadvantages – GDP - Sustainability- needs – concept - concept of carbon credit – carbon footprint – Environmental management.	

UNIT V – BATTERIES AND RECYCLING OF E-WASTE	(6)
Battery lifecycle - Mobile battery life cycle – Laptop battery life cycle – battery maintenance – benefits of recycling battery – E-waste – sources of e-waste - recycling of computing devices - mobile phones - PCB .	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOKS:

1. Ravikrishan, A., "Envrionmental Science and Engineering", Sri Krishna Hitech Publishing Co. Pvt. Ltd., 15thEdition, Chennai, 2023.
2. Anubha Kaushik and Kaushik's, C. P., "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.

REFERENCES:

1. Rajagopalan, R., "Environmental Studies-From Crisis to Cure", Oxford University Press, Third Edition, 2015.
2. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Orient Blackswan Pvt. Ltd. 2013.

WEB LINK:

1. http://www.jnkvv.org/PDF/080420202015128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/
4. https://www.researchgate.net/publication/326090368_E-_Waste_and_Its_Management
5. https://www.ewaste1.com/how-to-reduce-e-waste/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2							2						
4							3		2					
5						3						2		
CO (W.A)	2	2	2			3	3	2	2			2		

22GYA01 HERITAGE OF TAMILS *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

UNIT I - LANGUAGE AND LITERATURE	**(3)**
Language Families in India - Dravidian Languages – Tamil as aClassical 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 (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization 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.

22GYA01 தமிழர் மரபு (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	1	0	0	1
முன் தேவை: இல்லை				

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 – தமிழ்க 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 2 மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்கலை:	**(3)**
நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள்– தேர் செய்யும் கலை– சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	
அலகு 3 நாட்டுப்பறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**(3)**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டாம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	
அலகு 4 தமிழர்களின் திணைக் கோட்பாடுகள்:	**(3)**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளின் சோழர்களின் வெற்றி.	
அலகு 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**(3)**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் –இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ் புத்தக்களின் அச்சு வரலாறு.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization 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.

22GYA02 TAMILS AND TECHNOLOGY *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

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 n 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 – Sorkuvai Project.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
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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.

22GYA02 தமிழரும் தொழில்நுட்பமும் (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	I	0	0	I
முன் தேவை: இல்லை				

அலகு 1 நெசவு மற்றும் பானைத் தொழில்நுட்பம்:	(3)
சங்ககாலத்தில் நெசவுத்தொழில் – பானைத் தொழிலநுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.	
அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:	**(3)**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுக்கல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ–சாரோசெனிக் கட்டிடக் கலை.	
அலகு 3 உற்பத்தி தொழில் நுட்பம்:	**(3)**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எக்கு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	
அலகு 4 வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்:	**(3)**
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.	
அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:	**(3)**
அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் –கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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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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12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22MYB03 – STATISTICS AND NUMERICAL METHODS *(Common to AGRI, AI&DS,CSE,IT,IOT,CS(Cyber security)CIVIL,CHEMICAL,EEE,MECH Branches)*				
	L	**T**	**P**	**C**
	3	**I**	**0**	**4**

PRE - REQUISITE : NIL

Course Objective:	• To understand the concept of testing of hypothesis for small and large samples and design of experiments. • To provide adequate knowledge in numerical techniques to solving ordinary differential equations and numerical integration which plays an important role in engineering and technology disciplines.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret the principles and techniques in experimental design to solve the variance	Ap	20%
CO2	Apply the fundamental numerical techniques used to solve various types of mathematical problems on solution of equations, interpolation and numerical integration.	Ap	40%
CO3	Determine the statistics based on the data and related to the testing of hypothesis.	An	20%
CO4	Solve the real-world problems using numerical methods for IVPs, demonstrating their applicability and limitations.	Ap	20%
CO5	Demonstrate the importance of interpolation and approximation techniques to solve real-world problems in various disciplines of Engineering using modern tools.	Ap	Internal Assessment

UNIT I - TESTING OF HYPOTHESIS	**(9+3)**
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z ,t - distribution, F – distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	**(9+3)**
Analysis of variance- Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE 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 – Iterative methods of Gauss Jacobi and Gauss Seidel Methods– Eigenvalues of a matrix by Power method .	
UNIT IV - INTERPOLATION AND APPROXIMATION	**(9+3)**
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules - Romberg's Methods.	

UNITV - NUMERICAL DIFFERENTIATION AND INTEGRATION	(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 (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

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.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

REFERENCES:

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.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												3	
3		3			3									
4	3													
5	3				3				3			3		
CO (W.A)	3	3			3				3			3	3	

22AGC03 - FUNDAMENTALS OF SOIL SCIENCE				
	L	T	P	C
	2	0	2	3

PRE - REQUISITE : NIL

Course Objective:	• To equip students with the knowledge and skills to analyze soil properties, nutrient dynamics, and management practices in agriculture, enabling them to make informed decisions for sustainable soil use and productivity

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Articulate principles of soil water dynamics and their implications for irrigation, drainage, and water conservation strategies in agricultural practices.	Ap	20%
CO2	Analyze the role of soil organic matter, soil organisms, and nutrient cycling processes in soil fertility and sustainability.	An	20%
CO3	Apply knowledge of soil physical and chemical properties to analyze and classify soils, and make informed decisions in soil management practices.	Ap	40%
CO4	Evaluate different types of fertilizers and composting techniques to optimize nutrient management and enhance soil health in agricultural systems.	An	20%
CO5	Summarize a report as a team member on the techniques and constraints, observed in soil fertility management.	An	Internal Assessment

UNIT I – PHYSICAL PROPERTIES	**(8)**
Soil physical properties and their significance – Soil texture and textural classes – soil structure and classification – soil consistence. Bulk density, particle density and porosity – soil color- significance – causes and measurement. Soil temperature – Soil air – soil water – Measurements – Soil water potentials – Soil moisture constants – Movements of soil water – saturated and unsaturated flow – infiltration, hydraulic conductivity, percolation, permeability and drainage.	
UNIT II –CHEMICAL PROPERTIES	**(7)**
Soil colloids – properties, types and significance – layer silicate clays – their genesis and sources of charges – Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange – significance. Soil reaction, Buffering capacity and EC	
UNIT III – ORGANIC MATTER AND HUMUS	**(5)**
Soil organic matter – Composition – decomposition and mineralization, C: N ratio, carbon cycle – Fractions of Soil organic matter – Humus formation. Soil organisms – Beneficial and Harmful effects – Soil enzymes.	
UNIT IV – CLASSIFICATION OF FERTILIZERS AND ITS REQUIREMENT	**(5)**
Fertilizers – Definition and classification – Primary, Secondary and micronutrients. Calculating fertilizer requirements – simple fertilizer – Complex fertilizers – mixed fertilizers – water soluble fertilizers, liquid fertilizers.	
UNIT V – COMPOSTING TECHNOLOGY	**(5)**
Composting techniques – Aerobic and anaerobic – Enriched FYM and Vermi-compost. Composting of organic waste – Sugarcane trash and coir waste	

LIST OF EXPERIMENTS

1. Soil sample collection
2. Visit to soils of different terrains and study of Soil profiles.
3. Determination of bulk density, particle density and porosity – cylinder, wax coating and core methods.
4. Soil textural analysis – feel method, International pipette method.
5. Determination of soil color and temperature.
6. Determination of soil moisture
7. Determination of Infiltration rate
8. Determination of Hydraulic conductivity.
9. Determination of soil pH and EC
10. Estimation of Soil organic carbon.

TOTAL (L:30+P:30) : 60 PERIODS

TEXT BOOKS:

1. Brady, N. C. and Raymond, C. Weil, "The Nature and properties of Soils", Pearson Education, Inc. publishing as prentice Hall, 14th Edition, 2013.
2. Dilip Kumar Das, "Introductory Soil Science", Kalyani Publishers, New Delhi, 2004.
3. Schgal, J., "Pedology concepts and application", Kalyani Publishers, New Delhi, 2005.
4. "Fundamentals of Soil Science", ISS Publication, New Delhi, 2009.

REFERENCES:

1. Fanning, D. S. and Fanning, C. B., "Soil: Morphology, Genesis and classification", John Wiley and sons, Newyork, 1989.
2. Garrison Sposito, "The Chemistry of soils", Amazon Publishers, India, 2008.
3. Ghildyal, B. P. and Tripathi, R. P., "Soil physics", New Age International Publications, 2001.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2				3			2						3	
3		3												
4				3			2						3	
5									3	3				
CO (W.A)	**3**	**3**		**3**			**2**		**3**	**3**			**2.7**	

22AGC04 - STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand the stresses developed in bars, compounds bars, beams, columns, shafts, and connections. • To develop skills to select appropriate structural members based on calculated stresses and safety factors to ensure structural integrity and reliability. • To gain knowledge of material properties relevant to strength of materials and factors affecting material behavior under load.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate stresses and strains, centroids and centre of gravity in structural elements subjected to axial, bending, torsional, and combined loading conditions.	Ap	20%
CO2	Analyze the stress-strain distributions, shear force and bending moment diagrams for given / derived data.	An	20%
CO3	Analyze the mechanisms and criteria for failure of materials and structures and beams, including concepts like yield strength, bending moment, ultimate strength, and factors of safety.	An	20%
CO4	Apply principles of mechanics, such as equilibrium, compatibility of deformations in beams, and stress-strain relationships, to solve engineering problems related to structural design and analysis.	Ap	20%
CO5	Analyse practical engineering components based on the principles of solid mechanics while working in a team and communicate the same through effective presentations.	Ap	20%

UNIT I – BASICS OF STRESSES AND STRAINS	(9)
Simple Stresses and Strains Hookes Law Modulus of Elasticity Principle of Superposition bars of varying sections thermal stresses and strains Elastic Constants – Poisson's Ratio - Bulk Modulus - Shear Modulus - interrelationships - Strain Energy and Impact Loading - Proof Resilience - Modulus of Resilience	
UNIT II – CENTRE OF GRAVITY AND MOMENT OF INERTIA	(9)
Centroid and Centre of Gravity -geometrical considerations - method of moments - Plane (laminae) sections - symmetrical sections - unsymmetrical sections -Moment of Inertia - Routh rule - method of integration - Theorem of Parallel axes - Theorem of Perpendicular axes - geometric sections - solid and hollow sections	

UNIT III – ANALYSIS OF FRAMED STRUCTURES (TRUSSES)	(9)
Structures built of Frames - Types of Frames - Perfect and imperfect frames - deficient and redundant frames - Loads and stresses - Method of Joints - Method of sections - Graphical method – Bow notations - - cantilever trusses - freely supported trusses - King Post and Queen Post Trusses	
UNIT IV – SHEAR FORCE, BENDING MOMENT AND DEFLECTION (BEAMS)	(9)
Beams – Types - Uniformly distributed load and gradually varying load -Shear Force and Bending Moment distributions - Theory of Simple Bending - Bending stress - modulus of section - deflection in beams and cantilevers - Double integration method	
UNIT V – COLUMNS, SHELLS AND SHAFTS	(9)
Columns and struts - Slenderness ratio - Buckling and crushing - Euler Column theory - applications - Rankine formula-Johnson formula - Indian Standards - Shells -Cylindrical and spherical shells- thin and thick shells - Shafts - torsion in circular shafts - Polar Moment of Inertia - strain energy due to torsion.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Punmia, B. C., Jain, A. K. and Jain, A. K., 2002, "Strength of Materials", Firewall Media.
3. Ramamrutham, S., 2008, "Strength of Materials", Dhanpat Rai Publishing Co., 16th edition, India

REFERENCES:

1. Rajput, R. K. "Strength of Materials" (Mechanics of Solids), S. Chand & Company Ltd., 4th edition India, 2010.
2. Khurmi, R. S. Strength of Materials (Mechanics of Solids), S. Chand & Company Ltd., 24th Edition, India, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3		3												
4	3												3	
5	2				2				2	2			3	
CO (W.A)	2.8	3			2				2	2			3	

22AGC05 - BASIC WORKSHOP TECHNOLOGY				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE - REQUISITE : NIL

Course Objective:	• To apply safety practices and procedures in a workshop environment. • To equip with problem-solving and troubleshooting skills and develop professionalism in maintaining optimal performance

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Demonstrate safe work habits that reflect concern and care for self, others and the environment.	Ap	20%
CO2	Assemble the machine basic parts from different materials	Ap	20%
CO3	Analyze the process of manufacturing	An	40%
CO4	Demonstrate the ability to break down manufacturing processes for analyzing the machinery.	Ap	20%
CO5	Analyze technical problems and obtain solution for the same.	An	Internal Assessment

UNIT I – WELDING	(9)
Introduction to welding, types of welding, Oxyacetylene gas welding, types of flames, welding techniques and equipment. Principle of arc welding, equipment and tools.	
UNIT II – LATHE AND DRILLING	(9)
Constructional details of center lathe, Main accessories and attachments. Main operations and tools used on center lathes. Types of shapers, Constructional details of standard shaper. Work holding devices, shaper tools and main operations. Types of drilling machines. Constructional details of pillar types and radial drilling machines. Work holding and tool holding devices. Main operations. Twist drills, drill angles and sizes.	
UNIT III – CASTING AND GRINDING	(9)
Patterns - mould making - core - moulding sand - melting equipment - melting and pouring - gating system - cooling and solidification - casting - preparation, design - sand, shell mould, ceramic, vacuum, investment, die, centrifugal, continuous casting processes - casting defects, inspection and testing - Grinding - types of grinding -grinding wheel designation and selection - honing, lapping, super finishing, polishing, burnishing and buffing	
UNIT IV – METAL FORMING PROCESSES	(9)
Cold and hot working - rolling - forging - extrusion - drawing - metal stamping and forming - bending, deep drawing, stretch forming, metal spinning, shear and flow forming, blanking, piercing, embossing and coining, roll forming - forming defects - shot peening - types of dies, presses - comparison of forming processes	

UNIT V – NON - TRADITIONAL MACHINING	(9)
Classification of Non-traditional Machining processes - Principle of operations - Process characteristics - applications - Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Chemical machining, Electro chemical machining, Electro chemical grinding, Laser beam machining, Electron beam machining	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Rajput, R. K., "A Textbook of Manufacturing Technology", Laxmi Publications (P) Ltd., 2nd ed., 2016.
4. Richard R. Kibbe, John E. Neely, Roland O. Meyer and Warren T. White, "Machine Tool Practices", Prentice Hall of India, 10th Revised edition, New Delhi, 2014.

REFERENCES:

1. Hajra Choudhury, S. K., Hajra Choundhury, A. K. and Nirjhar Roy, "Elements of Workshop Technology", Media Promoters & Publishers Pvt. Ltd., Vol. I, II, 2017.
2. Jain, R. K. and Gupta, S. C., "Production Technology", Khanna Publishers, New Delhi, 2014.
3. Sharma, P. C., "A Textbook of Production Technology", S. Chand Publications, 2014.

Serope Kalpakjian, Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, 4th ed., 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1							2		2					
2	3			3									3	
3		2									3		3	
4		2		3							3			
5		2	3											
CO (W.A)	**3**	**2**	**3**	**3**			**2**		**2**		**3**		**3**	

22AGC06 - THERMODYNAMICS FOR AGRICULTURAL ENGINEERS (Use of Steam Tables and Psychrometric Chart permitted)				
	L	**T**	**P**	**C**
	2	**1**	**0**	**3**
PRE - REQUISITE : NIL				

Course Objectives:	• To study the fundamentals of thermodynamics and zeroth law • To study the thermodynamic properties of pure substances and its phase change processes • To learn about gas power cycles, properties of gas mixtures and steam boiler.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the basic concepts of thermodynamics involving heat and work interactions to determine thermodynamic condition	Ap	20%
CO2	Analyze and quantify the energy interaction in thermodynamics cycle by energy conservation principle	An	20%
CO3	derive the performance of thermal systems undergoing a thermodynamic process or cycle	Ap	20%
CO4	Infer the thermodynamics cycle and processes using second law and entropy constraints and apply the knowledge of thermodynamics process.	An	20%
CO5	Engage in independent study to learn applications based on different types of boilers	Ap	20%

UNIT I – BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS	**(6+3)**
Thermodynamic, Thermodynamic Systems and Surroundings, Different Approaches in The Study of Thermodynamics-Property, Thermodynamic Equilibrium, State, Process, Cyclic Process, Quasi-Static Process and Non Quasi-Static Process- Working Fluid, Gas, Vapour and Gas Laws-Temperature, Equality of Temperature, The Zeroth Law of Thermodynamics and Temperature Scale-Work & Heat - First law of thermodynamics - Applied to closed and open systems-isolated systems. Internal energy. Specific heat at constant volume (Cv) and Specific heat at constant pressure (Cp). Enthalpy-Limitations of Laws of thermodynamics.	
UNIT II –SECOND LAW OF THERMODYNAMICS	**(6+3)**
Second law of thermodynamics - Kelvin Planck and Clausius statements. Reversibility and Irreversibility. Clausius inequality. Entropy concept-a point function or a property of a system efficiency, Principle of increase of entropy - Change of entropy during thermodynamic processes. Carnot theorem- absolute entropy- availability. CARNOT CYCLE Coefficient of Performance of heat pumps and refrigerator.	
UNIT III - PROPERTIES OF PURE SUBSTANCES	**(6+3)**
Thermodynamic properties of pure substances in solid, liquid and vapour phases, Pressure-Volume (P-V), Pressure - Temperature (P-T), Temperature - Volume (T-V), Temperature - Entropy (T-S), Enthalpy - Entropy (H-S), Pressure-Volume-Temperature (P-V-T) diagrams, Triple Point And Critical Point. Thermodynamic properties of steam - Calculations of work done and heat transfer in non-flow and flow process	

UNIT IV - AIR STANDARD CYCLES AND PSYCHROMETRY	(6+3)
Air standard cycles - Otto, Diesel and Dual, Calculation of mean effective pressure and Air standard efficiency. Rankine cycle concept of ideal- Psychrometric chart	
UNIT V - STEAM BOILERS	**(9)**
Steam Boilers/Generators, Classification of Boilers - Lancashire Boiler - Cochran Boiler, Locomotive Boiler and Babcock-Wilcox Boiler - Boiler Mountings - Boiler Accessories. (Theory only)	
TOTAL (L:30 +T:15): 45 PERIODS	

TEXT BOOKS:

1. Rajput, R. K., "A Text Book of Engineering Thermodynamics", Laxmi publication Pvt. Ltd., New Delhi, 2015.
2. Cengel Y. and Boles, "Thermodynamics - An Engineering Approach", Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2019 .

REFERENCES:

1. Ballaney, P. L., "Thermal Engineering (Engineering Thermodynamics & Energy Conversion Techniques)".
2. Arora, C. P., "Thermodynamics", Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2010.
3. Rayner Joel, "Basic Engineering Thermodynamics", Pearson Publications,2019
4. Khurmi, S., "Text book of thermodynamics and Heat transfer", S. Chand Publications, New Delhi, 2017.
5. Merle C. Potter, Craig W. Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2020.
6. Khurmi, R. S., "Steam table with Psychometric chart", S. Chand Publications, New Delhi, 2008.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3												
3	3		3										2	
4		3	3											
5	3								2			1	1	
CO (W.A)	3	3	3						2			1	1.67	

22AGC07 – FARM TRACTOR SYSTEMS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To enable the students for acquiring knowledge pertaining to systems like transmission system, steering and brake system, power outlets like P.T.O.& draw-bar, stability testing of tractor and ergonomics with a view of current trades.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the working of valves, cleaners and electrical systems	Ap	20%
CO2	Inspect the working of transmission and hydraulic systems	An	20%
CO3	Break down the components of brake and safety systems	An	20%
CO4	Examine the tractor performance based on the safety standards	An	20%
CO5	Organize the applications of IC engines based on the principle and operation	An	20%

UNIT I – TRACTORS	**(9)**
Classification of tractors – Tractor engines – Principles of operation of IC 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 – inlet and outlet valves – valve timing diagram. Air cleaner – exhaust – silencer – Cooling systems – lubricating systems – fuel system – properties of fuels – governor – electrical system – engine trouble shooting	
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 – wheel ballasting – 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 – tractor safety.	

UNIT V – POWER TILLER AND TRACTOR TESTING	(9)
Power tiller – special features – clutch – gear box – steering and brake – Makes of tractors and power tillers – Need – Advancements from BS IV to VI - Types of tests – test procedure – need for testing & evaluation of farm tractor –Test code for performance testing of tractors and power tillers	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Jain, S. C. and Rai, C. R., "Farm tractor maintenance and repair" Standard publishers and distributors, 3rd Edition, New Delhi, 2016.
2. Jagdishwar Sahay, "Elements of Agricultural Engineering", Standard Publishers and Distributors Pvt Ltd, 2020

REFERENCES:

1. Barger, E. L., Liljedahl, J. B. and McKibben, E. C., "Tractors and their Power Units" Wiley Eastern Pvt. Ltd., New Delhi, 1997.
2. Indian Standard Codes for Agril. Implements. Published by ISI, New Delhi.
3. http://ecoursesonline.iasri.res.in/course/view.php?id=39

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2				2			2				2	2	
2				3										
3		3												
4		3											2	
5	2													
CO (W.A)	2	3		3	2			2				2	2	

22AGP02 - WORKSHOP TECHNOLOGY LABORATORY				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**
PRE - REQUISITE : NIL				
Course Objective:	• To develop hands-on skills in using various workshop tools and equipments. • To apply safety practices and procedures while working in a workshop environment. • To gain proficiency in handling different types of materials • To apply learned skills and knowledge in executing workshop projects. • To foster a mindset of continuous learning and improvement in workshop techniques.			

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Ability to safely and effectively operate workshop tools and equipment.	Ap
CO2	Execution of basic and advanced manufacturing processes	An
CO3	Proficiency in using hand tools and machinery	Ap
CO4	Ability to analyze and solve technical problems encountered in workshop tasks.	An
CO5	Development of innovative solutions for manufacturing challenges.	C

LIST OF EXPERIMENTS :

1. Fabrication of a structure using welded joints (based on AWS Standards)
2. Preparation of metal joints using gas welding
3. Experiment in facing, plain turning
4. Experiment in Taper Turning, Thread Cutting, Knurling
5. Experiment in Eccentric Turning and Groove cutting
6. Experiment in Drilling, Reaming and Tapping
7. Abrasive machining of cylindrical shaft using cylindrical Grinding machine
8. Finishing of flat metal surface using Surface Grinding machine
9. Preparation of sand Mould using solid and split pattern
10. Experiment in bending and forming of sheet metal

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1												1	
2	1				1							1	1	
3	1													
4		2		2										
5			3			1								
CO (W.A)	**1**	**2**	**3**	**2**	**1**	**1**						**1**	**1**	

22AGP03 - DRAWING OF FARM STRUCTURES LABORATORY				
	L	T	P	C
	0	0	4	2

PRE - REQUISITE : NIL

Course Objective:	• To acquire know on farmstead, machine shed and workshop • To acquire knowledge on diary and poultry house • To understand the importance of ventilation system for dairy and poultry house • To study the different silo and storage structures • To understand the importance of fencing and sanitary structure

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Design a farm layout that maximizes efficiency in crop rotation and livestock management, showing interconnected structures and pathways	Ap
CO2	Design a layout for a small farm, considering factors like terrain, climate, and operational efficiency	Ap
CO3	Analyze the effectiveness of farm structures in different contexts	An
CO4	Generate innovative farm structure designs integrating new technologies or sustainable practices	C
CO5	Design a layout for a small farm, considering factors like terrain, climate, and operational efficiency.	Ap

LIST OF EXPERIMENTS :

1. Planning and Layout of farmstead
2. Design of stall bam
3. Design of loose housing and milk parlors
4. Design of poultry house
5. Design of a sheep / goat house
6. Design of ventilation system for dairy and poultry house
7. Design of silos – over ground and underground and hay storages
8. Design of farm fencing system
9. Design of machinery and equipment shed and workshops
10. Design of septic tank and sanitary structures

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						1	1							
2												2		
3					3									
4			3									2		
5				3									3	
CO (W.A)			3	3	3	1	1					2	3	

22AGP04 - FARM TRACTOR AND ENGINES LABORATORY				
	L	T	P	C
	0	0	4	2
PRE - REQUISITE : 22CHC09				

Course Objective:	• To experiment the working of valves, engine system components, steering, brake, clutch systems and drive. • To enhance practical knowledge by visiting Institute offering modern state-of-art technology.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Illustrate the working of valves and components of farm engines	Ap
CO2	Inspect the working of cooling, lubrication, air cleaner, gear and clutch system	An
CO3	Break down the components of petrol and diesel engine	An
CO4	Examine the components of differential and final drive, braking and steering system, tyres, rims and ballasting	An
CO5	Investigate the modern tools in department of Agricultural Engineering through participative learning	An

List of Experiments

1. Identification and study of different components of Farm engine
2. Study of valve timing diagram and reconditioning the actuation of valve timing.
3. Identification and study of different components of tractor engine – Cooling system, lubrication and air cleaner system.
4. Dismantling and assembly of diesel engine
5. Dismantling and assembly of petrol engine
6. Mantling and dismantling of tractor engine gear box.
7. Study of clutch system – methods and its working.
8. Study of differential and final drive– components and method of working.
9. Study of braking system and steering system – components and method of working.
10. Study of tyres, rims and ballasting methods of a tractor
11. Visit to department of Agricultural Engineering, Chennai

TOTAL (L:0, P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2				3	3									
3		3												
4				3	3									
5		3				2		2				2	3	
CO (W.A)	**3**	**3**		**3**	**3**	**2**		**2**				**2**	**3**	

22MAN07 - SOFT / ANALYTICAL SKILLS – III (Common to All Branches)				
Applicable for (2022 – 2026) Batch only	**L**	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE - REQUISITE : NIL

Course Objective:	• Improving overall language proficiency for personal or professional reasons • To develop problem solving skills across all levels

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment Test**
CO1	Write grammatically correct and coherent sentences.	U	40%
CO2	Develop problem solving skills across all levels.	Ap	30%
CO3	Solve reasoning problems with ease.	An	30%

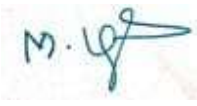
UNIT I - VERBAL COMPETENCY	(5+10)
Sentence Selection - Paragraph Formation - Sentence Correction - Spellings	
UNIT II - APTITUDE	(5+10)
Clocks - Calendar- Age Problems - Problem on Trains - Problems on Numbers - Partnerships	
UNIT III - LOGICAL & REASONING	(5+10)
Coding & Decoding - Logical Equivalent - Venn Diagram Problem	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
2. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN07R - SOFT/ANALYTICAL SKILLS – III (Common to All Branches)				
Applicable for (2023 – 2027) Batch only	**L**	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE - REQUISITE : Nil

Course Objective:	• To improve language proficiency for personal or professional reasons • To enhance students' mathematical problem-solving and critical thinking skills

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Demonstrate effective communication skills by listening actively, speaking clearly, reading critically, and writing coherently in contexts.	U	40%
CO2	Develop proficiency in applying mathematical concepts of time, speed, distance, and financial calculations involving simple and compound interest.	Ap	30%
CO3	Analyse logical reasoning skills through various forms of statements.	An	30%

UNIT I – VERBAL ABILITY	**(5+10)**
Grammar - Concord - Relative Clause - **Listening** - IELTS Listening (Advanced) and Gap Filling - **Speaking** - Introducing Others - Formal Conversations - **Reading** - Reading Comprehension - **Writing** - Hints Development.	
UNIT II – APTITUDE	**(5+10)**
Simple and Compound Interest - Time, Speed and Distance - Problems on Trains - Boats and Streams - Chain Rule - Time and Work - Pipe and Cisterns.	
UNIT III - REASONING	**(5+10)**
Seating Arrangements - Syllogism - Statement and Conclusion - Statement and Assumption - Statement and Course of Action.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication.* Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative* Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. *How to Prepare for Quantitative Aptitude for the CAT*. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				

22MAN09 - INDIAN CONSTITUTION (Common to All Branches)				
	L	**T**	**P**	**C**
	I	**0**	**0**	**0**

PRE - REQUISITE : NIL

Course Objective:	• To educate students to learn about the Constitutional Law of India. • To motivate students to understand the role of Union Government. • To make students to understand about State Government. • To understand about District Administration, Municipal Corporation and Zila Panchayat. • To encourage students to Understand about the election commission.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Gain Knowledge about the Constitutional Law of India.	U	Internal Assessment
CO2	Know the Union Government and role of President and Prime Minister.	R	
CO3	Gain knowledge about State Government and role of Governor, Chief Minister.	U	
CO4	Understand the District Administration, Municipal Corporation and Zila Panchayat.	U	
CO5	Understand the role and function of election commission.	U	

UNIT I - THE CONSTITUTION INTRODUCTION	(3)
The History of the Making of the Indian Constitution - Preamble and the Basic Structure, and its interpretation - Fundamental Rights and Duties and their interpretation - State Policy Principles.	
UNIT II - UNION GOVERNMENT	(3)
Structure of the Indian Union - President - Role and Power - Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha	
UNIT III - STATE GOVERNMENT	(3)
Governor - Role and Power - Chief Minister and Council of Ministers - State Secretariat	
UNIT IV - LOCAL ADMINISTRATION	(3)
District Administration - Municipal Corporation - Zila Panchayat	
UNIT V - ELECTION COMMISSION	(3)
Role and Functioning - Chief Election Commissioner - State Election Commission	
TOTAL (L:15) : 15 PERIODS	

TEXT BOOKS:

1. Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, New Delhi, 2008.
2. B.L. Fadia, "The Constitution of India", Sahitya Bhawan; New edition (2017).
3. DD Basu, "Introduction to the Constitution of India", Lexis Nexis; Twenty-Third 2018 edition.

REFERENCES:

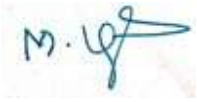
1. Steve Blank and Bob Dorf, "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K & S Ranch ISBN – 978-0984999392
2. Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" , Penguin UK ISBN - 978-0670921607
3. Adrian J. Slywotzky with Karl Weber, "Demand: Creating What People Love Before They Know They Want It", Headline Book Publishing ISBN - 978-0755388974
4. Clayton M. Christensen, "The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business", Harvard business ISBN: 978-142219602.

REFERENCES: Web link

1. https://www.fundable.com/learn/resources/guides/startup
2. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/
3. https://www.finder.com/small-business-finance-tips
4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						3		3		2		3		
2						3		3		2		3		
3						3		3		2		3		
4						3		3		2		3		
5						3		3		2		3		
CO (W.A)						3		3		2		3		



22AGC08 - FLUID MECHANICS AND HYDRAULICS				
	L	T	P	C
	2	0	2	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand fundamental concepts of fluid mechanics, fluid properties, fluid statics, and dynamics and their influence on fluid motion • Capability to analyze different types of fluid flow, including laminar and turbulent flow, flow through pipes, channels, and around immersed bodies. • To understand the principles of hydraulic machines and acquire knowledge on model and dimensional analysis			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the equations of motion and energy equations to identify the flow characteristics and to estimate the fluid flow.	Ap	20%
CO2	Analyse the losses in pipes and discharge through pipe network.	An	20%
CO3	Apply fluid mechanics principles to solve engineering problems related to fluid flow in pipes, open channels, hydraulic machines	Ap	20%
CO4	Calculate the engineering problems using analytical and Non-dimensional techniques	An	20%
CO5	Demonstrate the Fluid Mechanics principles in practical applications.	Ap	20%

UNIT I : BASIC CONCEPTS AND PROPERTIES	**(6)**
Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity - Fluid statics: concept of fluid static pressure, absolute and gauge pressures -Pascal's law -hydrostatic law - pressure measurements using simple manometers and mechanical gauges	
UNIT II - FLOW MEASUREMENTS	**(6)**
Euler's equation of motion - Bernoulli's equation - applications - Venturimeter - orifice meter, Pitot tube- Flow through pipes - laminar and turbulent flow in pipes - Major losses ,Darcy Weisbach equation for friction head loss -minor losses in pipes	
UNIT III - OPEN CHANNEL FLOW	**(6)**
Types of flow in channel - Most economical section of channel - rectangular -trapezoidal. Flow measurement in channels – weirs and notches - rectangular, triangular	
UNIT IV DIMENSIONAL AND MODEL ANALYSIS	**(6)**
Dimensions -derived quantities - dimensional homogeneity - methods of dimensional analyses - Rayleigh"s and Buckingham's method - similitude - dimensionless numbers.	

UNIT V - PUMPS	(6)
Types of pumps - Centrifugal pumps - components- working - specific speed - characteristics curves. Submersible pumps - Jet pump- reciprocating pump	

List of Experiments:

1. Verification of Bernoulli's theorem
2. Determination of Co-efficient of discharge of Venturimeter/ orifice meter
3. Determination of co-efficient of velocity of given Flow through Pitot tube
4. Determination of Co-efficient of discharge of V-notch/ Rectangular Notch
5. To determine the major and minor head loss coefficient for different pipe fittings.
6. Conduct a test on Centrifugal pump/reciprocating pump
7. Conduct a test and on Submersible pump

TOTAL (L:30 +P:30): 60 PERIODS

TEXT BOOKS:

1. Bansal, R. K., "A text book of Fluid Mechanics and Hydraulic Machinery", Laxmi publications (P) Ltd., New Delhi, 2002.
2. Yunus A. Cengel, John M. Cimbala, "Fluid Mechanics-Fundamentals and Applications", Tata McGraw Hill Publishing Co., New Delhi, 2006.

REFERENCES:

1. Modi, P. N. and Seth, S. M., "Hydraulics and Fluid mechanics", Standard Publishers & Distributors, New Delhi.
2. Grade, R. J., "Fluid mechanics through problems", Wiley eastern Ltd., Chennai, 2002.
3. Jagadish Lal, "Hydraulic machines", Metropolitan book house, New Delhi, 2000.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3	3												2	
4		3											2	
5				3								2		1
CO (W.A)	3	3		3								2	2	1

22AGC09 - HEAT AND MASS TRANSFER FOR AGRICULTURAL ENGINEERS (Use of heat and mass transfer data book permitted)				
	L	**T**	**P**	**C**
	2	**1**	**0**	**3**
PRE - REQUISITE : NIL				
Course Objective:	• To impart the knowledge on heat transfer mechanisms in fluids and solids, and their applications in various heat transfer equipment • To introduce non-dimensional numbers and their effects in governing various modes of mass transfer • To analyze heat exchangers and methods of evaluating the performance			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of heat transfer to thermal systems	Ap	20%
CO2	Analyze conduction heat transfer phenomenon for transient processes	An	20%
CO3	Determine convective heat transfer for free and forced convection	Ap	20%
CO4	Interpret the heat transfer process in heat exchangers for parallel and counter flow arrangement.	An	20%
CO5	Evaluate the parameters of radiative heat exchange process between surfaces and non-dimensional numbers and their effects in governing various modes of mass transfer	An	20%

UNIT I CONDUCTION	**(6+3)**
Basic concepts - Mechanism of Heat transfer. Conduction - Fourier"s Law, General differential equation in Cartesian and cylindrical coordinates, one dimensional steady state heat conduction, conduction through plane wall, cylinders and spherical systems.	
UNIT II – CONVECTION	**(6+3)**
Basic Concepts - Heat transfer coefficients, boundary layer concept. Types of convection – Natural and Forced convection, dimensional analysis, non-dimensional numbers, external flow, flow over plates, cylinders and spheres, internal flow, laminar and turbulent flow, combined laminar and turbulent.	
UNIT III - RADIATION	**(6+3)**
Radiation heat transfer - concept of black and grey body-Laws of Radiation - Stefan-Boltzmann Law, Kirchhoff"s Law Black body radiation - Grey body radiation - Shape factor algebra - Radiation shields	
UNIT IV HEAT EXCHANGERS	**(6+3)**
Heat exchangers - Types, heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU (number of transfer units) Method - Overall Heat Transfer Coefficient.	

UNIT V - MASS TRANSFER	(6+3)
Mass transfer- introduction - Fick law for molecular diffusion - molecular diffusion in gases - equimolar counters diffusion in gases- diffusion through a varying cross-sectional area-diffusion coefficients for gases - molecular diffusion in liquids	
TOTAL (L:30 + T: 15): 45 PERIODS	

TEXT BOOKS:

1. Rajput, R. K., "Heat and Mass Tranfer", S Chand and company Ltd., New Delhi, 2019
2. Sachdeva, R. C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International private limited, New Delhi, 2020.

REFERENCES:

1. Yunus A. Cengel, "Heat and Mass Transfer: a Practical Approach", Tata McGraw Hill publishing Company private limited, New Delhi, 2019.
2. Kothandaraman, C. P. and Subramanyan, S., "Fundamentals of Heat and Mass Transfer", New Age International private limited, New Delhi, 2014.
3. Frank P. Incropera, "Fundamentals of Heat and Mass Transfer", John Wiley, New Delhi, 2020.
4. Holman, J. P., "Heat Transfer", Tata McGraw Hill publishing Company private limited, New Delhi, 2018.
5. NPTEL Heat Transfer course for Mechanical Engineering, http://nptel.ac.in/courses/112101097/
6. Heat And Mass Transfer Data Book 10th multi colour edition (New Age International publishers, c p kothandaraman, s subramanyan)

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		3												
3	3												2	
4				3										
5			3										2	
CO (W.A)	3	3	3	3									2	

22AGC10 - CROP PROCESS ENGINEERING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				

Course Objective:	• To provide students with a comprehensive understanding of post-harvest engineering principles and practices for cereals, pulses, and oilseeds. • To equip students with the knowledge and skills necessary to design, operate, and maintain various post-harvest handling, drying, storage, and processing systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the operate effective drying systems for various agricultural products, using principles from psychometric and drying techniques.	E	20%
CO2	Analyze the direct and indirect methods to accurately measure and control moisture content in agricultural materials, ensuring optimal storage conditions.	An	20%
CO3	Apply knowledge of post-harvest engineering to develop and optimize methods for reducing losses in cereals, pulses, and oilseeds.	Ap	20%
CO4	Development and optimize the use of mechanical threshers, air screen cleaners, and other separation equipment to enhance the quality and value of agricultural products.	An	20%
CO5	Analyze and manage scientific storage structures to minimize spoilage and damage, incorporating temperature and humidity control measures to maintain the quality of stored products.	AN	20%

UNIT I- INTRODUCTION	(9)
Post-harvest engineering – introduction – objectives – post harvest losses of cereals, pulses and oilseeds – importance – optimum stage of harvest. Engineering properties of agricultural materials- optimum stage of harvest and its importance – importance of loss reduction- post harvest handling operations- moisture content – measurement - direct and indirect methods- equilibrium moisture content- RH measurement, airgrain measurement.	
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 THRESHING, CLEANING, GRADING AND MATERIAL HANDLING	(9)
Threshing – traditional methods mechanical threshers – types – principles and operation - principles – air screen cleaners – types – adjustments – cylinder separator – spiral separator – magnetic separator – colour sorter – inclined belt separator – length separators – effectiveness of separation and performance index. Different types of graders. Materials handling – belt conveyor – screw conveyor – bucket elevators – pneumatic conveying.	
UNIT IV- PRINCIPLES AND PRACTICES OF STORAGE	(9)
Importance of scientific storage systems, Post-harvest Physiology of semi-perishables and	

perishablesDamages direct damages-indirect damages- causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, Sprouting)- destructive agents (rodents, birds, insects, etc.,)- sources of infestation and control. Storage structures- traditional storage structures- modern storage structures - conditions for storage - control of temperature and relative humidity inside storage.

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– performance evaluation of modern mills. Wheat milling. Pulse milling methods – Wet, Dry, CFTRI, CIAE, Punjab. Oil seed processing. Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator – castor sheller.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Chakraverty, A., "Post Harvest Technology of cereals, pulses and oilseeds", Oxford & IBH publishing & Co. Pvt. Ltd., Third Edition, New Delhi, 2017
2. Sahay, K. M. and Singh, K. K., "Unit operations in Agricultural Processing", Vikas Publishing House Pvt. Ltd., Second revised and enlarged edition, New Delhi, 2004.
3. Ojha, T. P. and Michael, A. M., "Principles of Agricultural Engineering". Jain Brothers, Tenth edition, Vol.- 1, New Delhi, 2018.

REFERENCES:

1. Henderson, S. M. and Perry, R. L., "Agricultural process engineering", John Willey and Sons, New York, 1995.
2. Pandey, P. H., 1994, "Principles of agricultural processing", Kalyani Publishers, Ludhiana.
3. Mohsenin, N. N., "Physical Properties of Plant and Animal Materials", Gordon and Breach publishers, New York, 1986.
4. McCabe, W. L. and Smith, J. C., "Unit Operations of Chemical Engineering", McGraw Hill Education (India) Pvt. Ltd, Seventh Edition, Tokyo, 2015.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											2		
2	3													
3	3	2	2						2				2	
4	3	2												3
5	3	2	2	2	2				2		2	2	2	3
CO (W.A)	**3**	**2**	**2**	**2**	**2**				**2**		**2**	**2**	**2**	**3**

22AGC11 - IRRIGATION AND DRAINAGE ENGINEERING				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To equip students with a comprehensive understanding of water resource management and irrigation systems, enabling them to effectively plan, design, and implement irrigation practices and drainage solutions that optimize crop production, ensure sustainable water use, and address soil and water quality issues in agricultural settings.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of surface and groundwater resources to develop an efficient irrigation plan for a given agricultural area, considering regional water availability and crop requirements.	Ap	20%
CO2	Analyze soil water tension and retention properties to assess the impact of soil type on crop water stress and determine soil water with appropriate irrigation tools.	An	20%
CO3	Evaluate different irrigation methods (e.g., pressurized systems, surface irrigation) and their suitability for various soil types and crop needs to optimize water usage and efficiency.	An	20%
CO4	Design an irrigation and drainage system that incorporates principles of hydraulic design, soil-water-plant relationships, and land grading to enhance crop yield and water quality management.	Ap	40%
CO5	Summarize a report as a team member on the advanced techniques and constraints, observed in the irrigation, drainage and water quality management.	An	Internal Assessment

UNIT I – WATER SOURCES AND IRRIGATION REQUIREMENTS	**(9)**
Surface and ground water resources – River basins- Irrigation- development and Utilization in India and TamilNadu -Moisture use of crop- Evapotranspiration-methods. Crop water Requirement – duty and delta- Effective rainfall – crop water Requirement –measurement of irrigation water: weirs, notches and flume - Irrigation Scheduling - Irrigation Frequency, Irrigation Efficiencies.	
UNIT II – SOIL WATER TENSION AND MEASUREMENT OF SOIL WATER	**(9)**
Rooting characteristics – soil water tension and soil water stress - crop adaptation to moisture stress. Soil water potential concept – soil-water-plant relationships – soil water retention – hydraulic conductivity – determination. Measurement of soil water-gravimetric, volumetric – tensiometric, electrical resistance, pressure plate and pressure membrane apparatus methods – neutron scattering, immersion, dielectric, thermal conductivity, penetrometric and air permeability methods.	
UNIT III – METHODS AND QUALITY IRRIGATION	**(9)**
Soil, plant and meteorological factors determining water needs of crops, depth and Methods of Irrigation – Pressurized Irrigation, Hydraulics and design- alluvial channels Kennedy's and Lacey's theories, Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system - Land grading - Land leveling methods. Quality of irrigation water and management of saline water for irrigation; water management in problem soils.	

UNIT IV – COMMAND AREA DEVELOPMENT	(9)
Command area - Concept, Components of CADA - CADA programmes in Tamil Nadu - On Farm Development works, Execution - maintenance and economics of OFD works, Farmer's committee and its role for water distribution and system operation, Strategic outlet command – stream size for efficient warabandhi and rotational irrigation system	
UNIT V - AGRICULTURAL DRAINAGE AND SYSTEM	**(9)**
Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy 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 (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Michael, A.M., "Irrigation – Theory and Practice", Vikas publishing house, Second edition, New Delhi, 2015.
2. Murthy, V. V. N., "Land and water management", Kalyani publishing, Sixth edition, New Delhi, 2016.
3. Suresh, R., "Land and water management principles", standard publishers, Second edition, New Delhi, 2017.

REFERENCES:

1. Dilip Kumar Majumdar, "Irrigation water Management – Principles and Practice", Prentice – Hall of India Pvt. Ltd., New Delhi, 2006.
2. Luthin, J. N., "Drainage Engineering", John Wiley and Sons, New York, 1966.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3			2									
3		3											3	
4			3										3	
5					2				3	3				
CO (W.A)	**3**	**3**	**3**		**2**				**3**	**3**			**3**	

22AGC12 - HYDROLOGY AND WATER RESOURCES ENGINEERING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• Design and implement various hydrological measurement and analysis techniques to understand and manage precipitation, runoff, hydrological extremes, reservoirs, and groundwater systems effectively. • Students will evaluate and optimize water resource management practices, focusing on flood estimation and management, drought assessment, reservoir design, and groundwater recharge methods, considering both rural and urban contexts.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the basic concept of hydrologic cycle and measure the interception losses including evaporation, transpiration, infiltration and infiltration indices	Ap	20%
CO2	Classify the methods of estimation of runoff and construct the hydrographs based on different methods	An	20%
CO3	Analyze the frequency of disaster and provide solution to the area	An	20%
CO4	Classify and estimate the sedimentation and storage of reservoirs	An	20%
CO5	Calculate the ground water flow and estimate the aquifer parameters by following various methods based on the groundwater movement and geological formation.	An	20%

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 – GROUNDWATER AND MANAGEMENT	**(9)**
Origin - Classification and types - Properties of aquifers - Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas – Government schemes for Groundwater management.	

TEXT BOOKS:

1. Raghunath, H. M., "Groundwater", New Age International (p) Ltd., New Delhi, 2011.
2. Subramanya, K., "Engineering Hydrology", Tata McGraw Hill pub. Co., New Delhi, 2013.

REFERENCES:

1. Mutreja, K. N.,1990, "Applied Hydrology", Tata McGraw Hill pub. Co. New Delhi.
2. Ven te chow, David R. Maidment, Larry W. Mays, "Applied Hydrology", McGraw Hill pub. Co. New Delhi.
3. http://ecoursesonline.iasri.res.in/course/view.php?id=39

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				2								3	
2	3						2					2		
3		2					2		2	2				
4	3	2	2										3	
5					2									
CO (W.A)	3	2	2		2		2		2	2		2	3	

22AGC13 - SURVEYING AND LEVELLING FOR AGRICULTURAL ENGINEERS				
	L	T	P	C
	2	0	2	3

PRE - REQUISITE : NIL

Course Objective:	• To understand the principle, concepts and methods of surveying • To understand area and volume computation • To practice compass traversing and plane table surveying • To learn leveling and contouring • To gain knowledge in total station survey

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the instruments required for conducting the chain survey in level and sloping ground.	Ap	20%
CO2	Find the area of the land by chain surveying and also can apply the necessary chain corrections.	An	20%
CO3	Compute the area and volume of earth work by simple and numerical methods.	Ap	20%
CO4	Find the reduced level for all points by using dumpy level, prepare the contour map and also identify the horizontal, vertical angle using Theodolite.	Ap	20%
CO5	Demonstrate proficiency in planning and executing field surveys using a total station.	Ap	20%

UNIT I - PRINCIPLES OF SURVEYING	**(6)**
Introduction - Principles and basic concepts and uses of surveying - classification and basic methods of surveying- Types of chains, Ranging rod, Ranging - Direct and Indirect methods –Method of Chaining on level and sloping ground - Obstacles in chaining.	
UNIT II - COMPUTATION OF AREA AND VOLUME	**(6)**
Introduction – Formulae for calculation of cross sectional area – calculation of volume - Area computation, Mid-Ordinate rule, Average ordinate rule, Trapezoidal rules, Simpson rule and Coordinate method of finding area-Computation of volume. Computation of Area from field notes and plot plan	
UNIT III - COMPASS TRAVERSING	**(6)**
Basic terminologies of Compass traversing – Prismatic and Surveyors Compass - Checking the accuracy of traverse - Errors and mistakes in Compass survey - Plane tabling - instruments and accessories - Radiation, Traversing, Orientation - Intersection and Resection.	
UNIT IV - LEVELLING AND CONTOURING	**(6)**
Levelling - definition - Benchmarks - different types of levels - Basic principles of leveling - Theory of simple, compound, cross sectional and reciprocal levelling -Contouring - definition - contour characteristics - direct and indirect methods -gradient contour - uses – Minor instruments, Hand level - Clinometer - Abney level– Theodolite types – adjustments – setting up – reading angles – measurements – Area and elevation determination.	

UNIT V - TOTAL STATION	(6)
Introduction- Accuracy of a Total Station- Accessories for Total Station- Functions Performed by Total Stations- Applications of Total Station- Remote Elevation Measurement (REM)- Missing Line Measurement (MLM)- Area Calculation- Setting out	

LIST OF EXPERIMENTS:

1. Open and closed compass traversing, Plotting and correction of closing error
2. Differential levelling problems - Cross-sectioning – plotting
3. Contouring – Grid method - Plotting of contour - preparation of map
4. Theodolite surveying - elevation determination by measuring horizontal and vertical angles
5. Remote elevation measurement Using Total Station
6. Missing Line Measurement Using Total Station
7. Area measurement using Total Station

TOTAL (L+P: 30+30) = 60 PERIODS

TEXT BOOKS:

1. Basak, V. N., "Surveying and Levelling", Tata McGraw hill publications, New Delhi. 1994.
2. Gopi, S., "Advanced surveying: total station, GIS and remote sensing", Pearson Education, Second Edition, India. 2018

REFERENCES:

1. Duggal, S. K., "Surveying", McGraw hill education (India) Pvt. Ltd., 4th edition, New Delhi, 2013.
2. Kanetkar, T. P., and Kulkarni, S. V., "Surveying and levelling Part II", Pune Vidyarthi Griha Prakashan.
3. Bharikatti, S. S., "Surveying Theory and Practice", I.K. International publishing house Pvt. Ltd., New Delhi, 2013.
4. Narinder Singh, "Surveying", Tata McGraw hill publishing company Ltd., New Delhi, 1992.
   Michael, A. M. and Ojha, T. P., "Principles of Agricultural Engineering", Jain Brothers, Vol. II, New Delhi, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												-	
2													3	
3				3										2
4		3			3								2	
5			3									2		
CO (W.A)	3	3	3	3	3							2	2.5	2

22AGP05 - CROP PROCESS ENGINEERING LABORATORY				
	L	T	P	C
	0	0	4	2

PRE - REQUISITE : 22CHC09

Course Objective:	• To provide students with practical skills and theoretical knowledge required to evaluate and improve the efficiency of various post-harvest processing operations for grains. • To enable students to apply advanced techniques and methodologies for the determination of physical and mechanical properties of grains and their implications on post-harvest handling and processing.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Develop the ability to accurately measure and interpret the moisture content of grains, enhancing post-harvest handling and storage decisions.	Ap
CO2	Critically evaluate the porosity, coefficient of friction, and angle of repose of grains to optimize handling, processing, and storage practices.	An
CO3	Formulate methods to improve the efficiency and performance of grain cleaning and grading machines, contributing to better quality control in grain processing.	An
CO4	Analyze the use of grain handling equipment by determining their efficiency and identifying areas for improvement, leading to more effective grain logistics and management.	An
CO5	Synthesize knowledge from site visits to modern rice mills and pulse milling industries to propose enhancements in processing technologies and practices, improving overall industry standards.	Ap

LIST OF 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. Evaluation of efficiency of grain cleaning cum grading machine
5. Evaluation of cleaning efficiency of spiral separator and inclined belt separator
6. Evaluation of shelling efficiency of rubber roll sheller
7. Determining the efficiency of bucket elevator
8. Determining the efficiency of screw conveyor
9. Evaluation of thin layer drier
10. Visit to modern rice mill and pulse milling industry

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
Cos	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3				2	2			1					
2		2											2	
3			3			2							2	
4					2	2			1				2	3
5			3			3								3
CO (W.A)	**3**	**2**	**3**		**2**	**2**			**1**				**2**	**3**

22AGP06 - IRRIGATION AND DRAINAGE ENGINEERING LABORATORY				
	L	T	P	C
	0	0	4	2

PRE - REQUISITE: NIL

Course Objective:	• To develop students' ability to design, implement, and evaluate various irrigation and meteorological systems by applying analytical techniques and hands-on methods to measure soil moisture, infiltration rates, evapotranspiration, and flow properties, ultimately enhancing their practical skills and understanding of efficient water management practices.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply different methods to determine soil moisture content and analyze the effectiveness and accuracy of each method in varying soil conditions.	Ap	20%
CO2	Analyze infiltration rates, their understanding to compare results and assess the implications for irrigation efficiency and soil management.	An	20%
CO3	Estimate evapotranspiration rates, duty and delta to apply this data to various crops irrigation scenarios.	An	20%
CO4	Design both drip and sprinkler irrigation systems, applying principles of uniformity and efficiency, and will analyze their designs using catch can methods to determine uniformity coefficients.	Ap	20%
CO5	Analyze flow properties in open irrigated channels using tools like flumes and notches, applying their findings to evaluate channel performance and design improvements for effective water distribution.	An	20%

List of Experiments:

1. To study various instruments in the Meteorological Laboratory
2. Determination of soil moisture by different methods – gravimetric and tensiometer
3. Determination of infiltration rate using double ring and digital infiltrometer
4. Estimation of Evapotranspiration
5. Problems on Duty and Delta relationship of water
6. Measurement of flow properties in open irrigated channels (flumes, notches)
7. Design of Drip irrigation system
8. Determination of uniformity coefficient for drip irrigation system (catch can method)
9. Design of sprinkler irrigation system
10. Determination of uniformity coefficient for sprinkler irrigation system (catch can method)

TOTAL (P: 60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3											3	
3				3										
4			3										3	
5			3		3								3	
CO (W.A)	3	3	3	3	3								3	

22MAN08 - SOFT / ANALYTICAL SKILLS – IV (Common to All Branches)				
Applicable for (2022 – 2026) Batch only	**L**	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE - REQUISITE : NIL

Course Objective:	• To recollect the functional understanding of basic grammar and its structure • To enrich their knowledge and to develop their logical reasoning ability

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of Continuous Assessment test**
CO1	Construct the sentences with basic grammar.	U	40%
CO2	Analyze quantitative aptitude problems and find solutions.	Ap	30%
CO3	Develop the ability to solve problems through logical reasoning.	An	30%

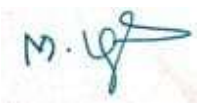
UNIT I - VERBAL	(5+10)
Articles - Fill in the blanks - Grammatical Error - Sentence improvement	
UNIT II - APTITUDE	(5+10)
Speed and Distance-Time and Work- Mixture And Alligations- Permutation and Combinations	
UNIT III - LOGICAL AND REASONING	(5+10)
Seating Arrangement- Directions and Distance- Non verbal Reasoning	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

3. Murphy, Raymond. *English Grammar in Use*. Fourth Edition, Cambridge University, 2012.
4. Dr. R.S. Aggarwal. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S Chand and Company Limited, New Delhi, 2014.
3. Aggarwal, Ashish. *Quick Arithmetic*. S Chand and Company Limited, New Delhi, 2014.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**1**		**1**					**1**	**1**				



22MAN08R - SOFT/ANALYTICAL SKILLS – IV (Common to All Branches)				
Applicable for (2023 – 2027) Batch only	**L**	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE - REQUISITE : Nil

Course Objective:	• To enhance the ability to communicate coherently and effectively across contexts • To develop quantitative aptitude and analytical reasoning skills

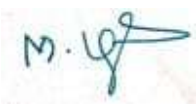
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with more confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I – VERBAL ABILITY	**(15)**
Grammar - Sentence Completion – Sentence Improvement - Error Spotting - **Listening** - TOEFL Listening Practice Tests - **Speaking** – Interview Skills - **Reading** - GRE Reading Passages - **Writing** - Paragraph Writing.	
UNIT II – APTITUDE	**(15)**
Probability - Permutations and Combinations - Data Interpretation on Multiple Charts - Mensuration - Area, Shapes, Perimeter - Races and Games.	
UNIT III - REASONING	**(15)**
Data Sufficiency - Mathematical Operations - Pattern Completion - Cubes - Embedded Images.	
TOTAL(L:45) = 45 PERIODS	

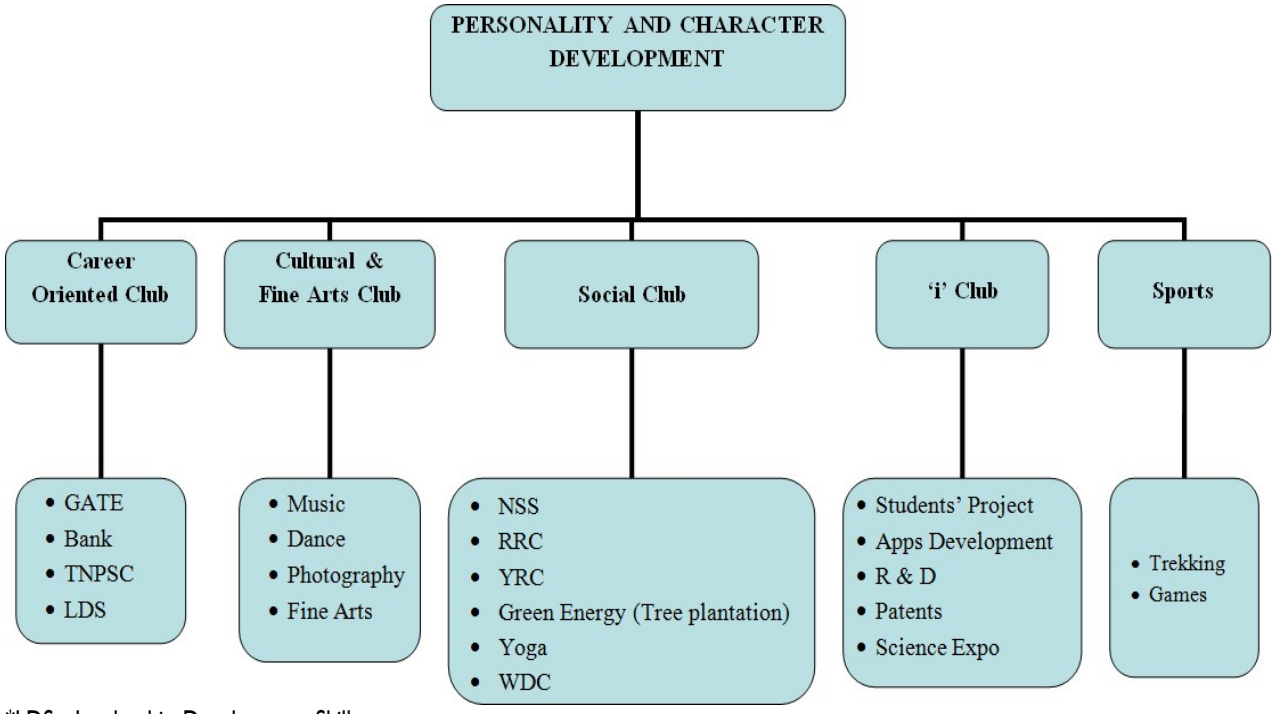
REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication.* Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative* Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. *How to Prepare for Quantitative Aptitude for the CAT*. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		1		1					1	1				



22GED01 – PERSONALITY AND CHARACTER DEVELOPMENT				
	L	T	P	C
	0	0	I	0
PRE REQUISITE : NIL				



*LDS - Leadership Development Skills

OBJECTIVES :

Career Oriented Club	Cultural & Fine Arts Club	Social Club	'i' club	Sports
• To provide support for identifying specific career field of interests and career path • To provide support for preparing for competitive exams	• To bring out the hidden talent of students in music, dance and other fine arts. • To promote photography skill among the students • To develop and enhance the performance of students by participating in	•To create social awareness and develop a sense of social and civic responsibility •To inculcate socially and environmentally sound practices and be aware of the benefits •To encourage the students to work along with the	•To inculcate the basic concepts of innovation •To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities. •To enrich the academic experience, build	•To provide opportunities to excel at sports •To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. •To develop an ability to observe, analyze and judge the performance of self and peers in sporting

	various events. • To inculcate managerial capabilities such as event management and stage organization.	people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community.	competencies and relationships beyond the classroom	activities. • To develop leadership skills and nurture the team building qualities. **Trekking:** • To provide opportunities to explore nature and educating about the purityof nature • To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
• Find a better career of their interest. • Make use of their knowledge during competitive exams and interviews.	• Take part in various events. • Develop team spirit, leadership and managerial qualities.	• Develop socially responsive qualities by applying acquired knowledge. • Build character, social consciousness, commitment and discipline.	• Apply the acquired knowledge in creating better solutions that meet new requirements and market needs. • Develop skills on transforming new knowledge or new technology into viable products and services on commercial markets as a team.	• Demonstrate positive leadership skills that contribute to the organizational effectiveness • Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle • Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [2 x (P: 15)]: 30 PERIODS
(Cumulatively for Two Semesters)

22AGC14 - SOIL AND WATER CONSERVATION ENGINEERING				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE :Nil

Course Objective:	• To have an awareness on the soil, water and wind erosion problems and principles along with the water shed and water harvesting methods in order to conserve water and soil

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Simplify the water harvesting structures for insitu and exsitu water conservation	Ap	20%
CO2	Design the gully control structures for controlling the landslides	Ap	20%
CO3	Apply universal soil loss equation to estimatethe soil erosion	An	40%
CO4	Calculate the runoff in a structure todetermine the dissipation of energyhappenings due to jumps.	Ap	20%
CO5	Demonstrate a mini project/Case Study for watershed management and implement the same as a prototype	Ap	Internal & External Assessment

UNIT I – INTRODUCTION TO SOIL AND WATER EROSION	(9)
Principles of soil erosion –Types- Factors Affecting Soil Erosion- Geological and Accelerated erosion, Factors affecting water erosion, Types of water erosion - Splash, sheet and rill, Gully, stream bank, road erosion and ravines, Universal Soil Loss Equation (USLE) - Rainfall Erosion Index, Soil erodibility Index, Slope length and topographical factors, Measurement of runoff and soil loss.	
UNIT II – WATER EROSION AND CONTROL	(9)
Introduction; classification of structures, functional requirements of soil erosion control structures; flow in open channels-types of flow, state of flow, regimes of flow, specific energy and specific force - Hydraulic jump and its application - Types –Spillways – Energy Dissipation.	
UNIT III – SEDIMENTATION	(9)
Sediment yield and sedimentation- Methods of estimation of wind erosion –Erosivity and Erodibility- Desertification, deforestation and shifting cultivation - Gully control and control of landslides, Temporary gully control measures, Permanent Gully Control Structures - Wind breaks and shelter belts.	
UNIT IV – WATERSHED MANAGEMENT	(9)
Watershed – concept – planning, Principles – Levelling and grading of Land - Land use capability classification Grassed Waterways - Components of watershed development – Modeling of Watershed Process – Case studies for Soil and Water Conservation.	

UNIT V – WATER QUALITYAND HARVESTING	(9)
Introduction to water harvesting – Water Quality – Water pollution - techniques, Farm Pond, Dry farming techniques for improving crop production – Topographic Survey and Contour Maps.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Suresh, R., "Soil and Water Conservation Engineering", Standard Publishers &Distributors, New Delhi, 2012.
2. Michael, A. M. and Ojha, T. P., "Principles of Agricultural Engineering', Vol II Jain Brothers, New Delhi, 2012.

REFERENCES:

1. Gurmel Singh et al. "Manual of Soil and Water Conservation Practices'. Oxford & IBH publishing Co. New Delhi, 1996.
2. Murthy, V.V.N. and Madan K. Jha., "Land and water management", Kalyani publishing, New Delhi, 2013.
3. Gustafson, A.F., "Conservation of the soil", Biotech Books, New Delhi-35, 2011.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	3													
3			3										3	
4		3											3	3
5		3					2		3	2	2	2	3	3
CO (W.A)	3	3	3				2		3	2	2	2	3	3

22AGC15 - UNIT OPERATIONS IN AGRICULTURAL PROCESSING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• Apply principles of mass and energy conservation, dimensional analysis, and unit consistency to analyze and optimize various unit operations in food processing, such as evaporation, mechanical separation, size reduction, crystallization, and membrane separation.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate the efficiency of various types of size reduction mechanisms.	Ap	20%
CO2	Analyze the factors influencing the operation of evaporators	An	20%
CO3	Assess the principle of separation involved in various unit operations	An	20%
CO4	Analyze the advanced separation methods applied for foods through membranes	An	20%
CO5	Review crystallization and distillation processes and identify processing equipment	An	20%

UNIT I - EVAPORATION AND CONCENTRATION PROCESS	(9)
Unit operations in food processing –conservation of mass and energy – overall view of an engineering process-dimensions and units – dimensional and unit consistency – dimensionless ratios-evaporation – definition – liquid characteristics – single and multiple effect evaporation – types of evaporators – performance of evaporators and boiling point elevation – capacity – economy and heat balance – evaporation of heat sensitive materials.	
UNIT II – MECHANICAL SEPARATION	(9)
Filtration – definition –filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press-sedimentation – gravitational sedimentation of particles in a fluid – Stoke's law, sedimentation of particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid-liquid separation – centrifuge equipment.	
UNIT III – SIZE REDUCTION	(9)
Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger's, Bond's and Kick's laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills – attrition, rod, ball and tube mills – construction and operation.	
UNIT IV – CRYSTALLIZATION AND DISTILLATION	(9)
Crystallization – equilibrium – rate of crystal growth – equilibrium crystallization-crystallization equipment – classification – construction and operation-tank, agitated batch, Swenson-Walker vacuum crystallizers. Distillation – binary mixtures – flash and differential distillation-steam distillation – theory – consumption – continuous distillation with rectification – vacuum distillation - batch distillation – operation and process – advantages and limitations -distillation equipments – construction and operation – factors influencing the operation	

UNIT V - MEMBRANE SEPARATION	(9)
Membrane separation-terminologies-membrane classification and configuration-types of filtration-osmosis-Reverse osmosis-rate of flow through membranes- Thevan't Hoff equation-membrane equipment.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Geankoplis C.J. 2017. Fourth edition. Transport Processes and Separation Process Principles. Pearson India Education Services Pvt. UP.
2. K. M. Sahay and K.K.Singh, Unit operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 2004. (Second revised and enlarged edition).

REFERENCES:

1. J.M. Coulson and J.F. Richardson, Chemical Engineering, Volume I to V. The Pergamon Press, New York, 1999.
2. W.L. McCabe, J.C.Smith and P.Harriot, Unit Operations of Chemical Engineering, McGraw- Hill. Inc. Kosaido Printing Ltd. Tokyo, Japan, 2001.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3												
3														3
4				3	3			2						
5		3		3										
CO (W.A)	3	3		3	3			2						3

22AGC16 - FARM IMPLEMENTS AND EQUIPMENT (Theory + Lab)				
	L	T	P	C
	3	0	2	4

PRE - REQUISITE : NIL

Course Objective:	• Design and implement various farm mechanization techniques to enhance agricultural productivity, focusing on the use of tillage, sowing, and fertilizer application equipment. • Evaluate and optimize the performance of different farm equipment, understanding their construction, operation, and field capacity to improve efficiency and reduce operational costs.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret the objectives and working principle of farm tools, implements, sowing equipment and suitable fertilizer applicators.	Ap	20%
CO2	Implementation of various fertilizer application techniques, including the use of seed cum fertilizer drills and liquid fertilizer applicators, to improve nutrient management	Ap	20%
CO3	Analyze the performance and applications of different primary tillage implements.	An	20%
CO4	Evaluate the construction and use of secondary tillage implements for effective field preparation and crop management.	E	20%
CO5	Apply the concepts of farm mechanization and evaluate various tillage methods to improve farm efficiency.	Ap	20%

UNIT I- FARM MECHANIZATION	(9)
Farm mechanization – objectives. Tillage - objectives - methods – primary tillage implements - secondary tillage implements - animal drawn ploughs - construction. Types of farm implements – trailed, mounted and semi mounted implements - Field capacity.	
UNIT II PRIMARY 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. – Spading machine – coir pith applicators.	
UNIT III SECONDARY TILLAGE IMPLEMENTS	(9)
Cultivators - types - construction. Disc harrows - Bund former - ridger – leveller. Basin lister-Wetland preparation implements. – puddler – cage wheel – leveller	
UNIT IV- SOWING EQUIPMENT	(9)
Crop planting – methods – row crop planting systems. Seeding machines – Devices for metering seeds – furrow openers – furrow closers – types – Types of seed drills and planters– paddy transplanters – nursery tray machines.	
UNIT V - FERTILIZER APPLICATION	(9)
Drill calibration – sprayer- introduction-types-spray pattern- application of fertilizers-– metering devices – seed cum fertilizer drill – application of liquid fertilizers.	

Practical

1. Operation of tractor drawn mould board plough – adjustments and determination of field capacity
2. Operation of tractor drawn disc plough – adjustments and determination of field capacity
3. Operation of tractor drawn cultivator – adjustments and determination of field capacity
4. Operation of subsoiler – adjustments and determination of field capacity
5. Operation of paddy drum seeder in the field and determination of field capacity
6. Field testing of rocker arm sprayer, power sprayer and knapsack power sprayer and duster and their maintenance
7. Determination of operational cost of farm implement

TOTAL (L: 45+P:30) = 75 PERIODS

TEXT BOOKS:

1. Jagdishwar Sahay. 2006. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6
2. Ojha T.P. and A.M. Michael. 2018. Tenth edition. Principles of Agricultural Engineering, Vol – Jain Brothers, New Delhi.

REFERENCES:

1. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.
2. Kepner, R.A., R.Bainer, E.L. Barger. 2005. Third Edition. Principles of farm machinery. CBS Publishers and Distributers, Delhi.

Mapping of COs with POs / PSOs

	Pos												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3				3									
2	3				3		1							
3		3											3	
4				3									3	
5	3												3	
CO (W.A)	**3**	**3**		**3**	**3**		**1**						**3**	

22AGP07 - CAD FOR AGRICULTURAL ENGINEERING				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE - REQUISITE :

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

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Develop knowledge in using specific CAD software packages (Solid Works,) to create 2D and 3D models, assemblies, and drawings.	Ap
CO2	Construct to produce detailed technical drawings of agricultural component and engineering documentation from CAD models, including orthographic projections, section views	An
CO3	Focus on three dimensional assembly models consisting of Engine components with tolerances.	An
CO4	Sketch three dimensional assembly model of simple energy conversion/power transmission system	Ap
CO5	Plan and draw the assembled views of machine parts using modeling software.	An

LIST OF EXPERIMENTS:

1. Introduction to modeling software: Practicing sketching, Dimensioning and Modelling Tools and Creating simple 3D models by using any CAD Modelling Software
2. Create a orthographic views of machine components from isometric component drawing
3. Create a two-dimensional sketch diagrams of simple machine components
4. Create a three-dimensional model of spur gear
5. Create a three-dimensional model of helical gear
6. Create a three-dimensional model of bearing from detailed orthographic drawings
7. Create a three-dimensional assembly model of bolt and nut from detailed orthographic drawings
8. Create a three-dimensional assembly model of simple mechanism
9. Create a three-dimensional assembly model of simple energy conversion/power transmission system

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2				3							2	3	
2					3							2	3	
3	2		3		3							2		3
4			3		3							2	3	
5	2				3							2		
CO (W.A)	**2**		**3**		**3**							**2**	**3**	**3**

22AGP08 - UNIT OPERATIONS IN AGRICULTURAL PROCESSING LABORATORY				
	L	T	P	C
	0	0	4	2

PRE - REQUISITE : NIL

Course Objective:	• To break down raw agricultural materials into smaller particles for easier processing and improved extraction of desired components. • To separate different components of raw materials based on size, density, or other physical properties. • To separate solid particles from liquids or gases. • To improve efficiency, reduce waste, and maximize yield while maintaining product integrity. • To maintain hygienic conditions throughout processing to prevent contamination and ensure product safety.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the knowledge of physical properties of foods to estimate the efficiency of the system	Ap
CO2	Calculate the efficiency of various separators involved in agricultural processing operations	Ap
CO3	Experiment and identify the suitable size reduction mechanism based on the properties of agricultural products	An
CO4	Analyze the energy requirements of different size reduction methods	An
CO5	Participate and investigate the industrial scale unit operation equipments	An

LIST OF EXPERIMENTS :

1. Determination of thermal efficiency of open pan evaporator for concentration of juice/Milk
2. Performance evaluation of a sieve and determination of particle size of granular foods by sieve analysis
3. Determination of effectiveness of screen
4. Determination of separation efficiency of centrifugal separator
5. Determination of collection efficiency in cyclone separator
6. Determination of energy requirement in size reduction using the burr mill
7. Determination of energy requirement in size reduction using the ball mill
8. Determination of energy requirement in size reduction using the hammer mill
9. Determination of energy requirement in size reduction using the pin mill
10. Visit to sugar industry

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2					3									
3				3										3
4		3												
5					3			2	2			2		3
CO (W.A)	**3**	**3**		**3**	**3**			**2**	**2**			**2**		**3**

22MAN10R - COMMUNICATION AND QUANTITATIVE REASONING				
Applicable for 2022 – 2026 Batch only	**L**	**T**	**P**	**C**
	1	**0**	**2**	**0**

PRE - REQUISITE : Nil

Course Objective:	• To enhance the proficiency of the students in both spoken and written communication • To acquire skills required to solve quantitative aptitude problems

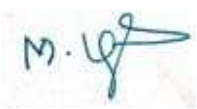
Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Converse and draft ideas clearly and persuasively in various contexts.	U	40%
CO2	Solve quantitative aptitude problems with confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I - LANGUAGE BOOSTERS	**(5+10)**
JAM - General Topic Presentation - Group Discussion - Mock Interview - E Mail Writing - Essay writing	
UNIT II – APTITUDE	**(5+10)**
Mensuration - Area, Shapes, Perimeter - Races and Games - Data Interpretation on Multiple Charts.	
UNIT III - REASONING	**(5+10)**
Venn diagram - Syllogism - Data Sufficiency - Cubes & Embedded Images.	
TOTAL (L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. Effective Technical Communication. Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. Quantitative Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Arun Sharma. How to Prepare for Quantitative Aptitude for the CAT. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. Quantitative Aptitude and Reasoning. PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		1		1					1	1				



22AGC17 - RENEWABLE ENERGY RESOURCES				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To introduce students with renewable energy resources availability, potential and suitability as a substitute for conventional energy resources in future energy demand.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of solar technologies to extract power generation from solar thermal and photovoltaic energy	Ap	20%
CO2	Analyze the source of natural energy available in different sources	An	20%
CO3	Analyze wind energy conversion technologies to find the efficiency of power generation through wind mills	An	20%
CO4	Examine the factors affecting biochemical conversion of biomass	An	20%
CO5	Assess the impact of energy production through non – renewable and renewable sources	An	20%

UNIT I NON - RENEWABLE AND RENEWABLE ENERGY SOURCES	**(9)**
Coal, Oil, Natural gas, Nuclear power and Hydro energy - Sector-wise energy consumption – Energy scenario in India – Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Types and limitations of renewable energy sources	
UNIT II SOLAR ENERGY	**(9)**
Solar Radiation, Radiation Measurement, Flat plate and Concentrating collectors – Air and water heaters – Cookers - Solar Thermal Power generation – Applications - Solar Photovoltaic systems : Basic Principle of SPV conversion - Types of Solar Cells, Solar PV Power generation, Applications	
UNIT III WIND ENERGY	**(9)**
Nature of the wind – power in the wind - Betz limit - suitable sites - types of wind mills – wind mill components – applications – Safety and environmental aspects	
UNIT IV BIOMASS ENERGY	**(9)**
Bio mass resources – Energy from Bio mass: conversion processes - Thermo chemical conversion – combustion, gasification, pyrolysis - biochemical conversion – anaerobic digestion - applications – bioethanol and bio diesel production - Cogeneration - Environmental Benefits.	
UNIT V OTHER ENERGY SOURCES	**(9)**
Geothermal Energy - Tidal Energy - Wave Energy - Ocean Thermal Energy Conversion (OTEC) - Fuel cell: Principle of working- types and applications.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Khan, B. H.. Non-conventional Energy Resources. 3rd Edition. India, McGraw-Hill Education (India) Pvt Limited, 2017.
2. Rai.G.D., Non-Conventional Energy Sources, 6th Edition. Khanna Publishers, New Delhi, 2017.

REFERENCES:

1. Twidell, J.W. & Weir A., Renewable Energy Resources, EFNSpon Ltd., UK, 2015.
2. Bent Sorensen , Renewable Energy, Elsevier, Academic Press, 2011
3. Sengio C. Capareda. Introduction to biomass energy conservations. CRC Press. 2014

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3											3	
3		3												
4				3										
5				3		2		2				2	3	
CO(W.A)	3	3		3		2		2				2	3	

22AGC18 - FOOD AND DAIRY ENGINEERING				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To impart knowledge about different processing methods in food and Dairy industry eg. Evaporation, drying, pasteurization, homogenization and process equipments.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the cause of food spoilage and suggest suitable remedial measures to overcome the same	An	20%
CO2	Assess the right method of processing the solid and liquid food	An	20%
CO3	Determine the properties of milk and find the best way of storing milk under various temperatures.	C	20%
CO4	Analyze the suitable equipment for preserving and processing the diary products for a longer time.	An	20%
CO5	Interpret the physical and chemical properties for choosing the best method of preserving food and dairy products through case study.	An	20%

UNIT I –PROPERTIES AND CONCENTRATION OF FOOD MATERIALS	**(9)**
Constituents of food and their energy values – Engineering properties of food materials – Physical, mechanical, thermal, rheological, electrical and physico-chemical properties of food materials – texture of food materials – definition – Terminologies – viscometry – basic concepts – Concentrations of foods – freeze concentration – membrane concentration	
UNIT II – THERMAL PROCESSING OF FOODS	**(9)**
Newtonian and non-Newtonian liquid foods - Thermal processing of foods – product-time-temperature relationships – cooking, blanching, Canning – sterilization of solid and liquid foods – batch and continuous sterilization equipment. Preservation by irradiation – retort processing – principles and applications – microwave and radio frequency heating in food processing.	
UNIT III – DRYING AND DEHYDRATION	**(9)**
Food spoilage – causes for spoilage – Moisture content – free moisture – bound and unbound moisture – equilibrium moisture content – Water activity – sorption behavior of foods – dehydration – methods of dehydration – osmotic dehydration – microwave drying – foam mat drying of materials – freeze drying – types of dryers -advantages and disadvantages.	
UNIT IV –MILK PROCESSING	**(9)**
Physical, chemical, thermal and rheological properties of milk. Receiving handling and testing of milk – storage. Pasteurization – principles and methods – equipment – Low Temperature Long Time – High Temperature Short Time – Ultra High Temperature pasteurization.	

UNIT V - DAIRY EQUIPMENT AND PRODUCTS	(9)
Homogenization- theory and working of homogenizers– high pressure homogenization of milk and other food suspensions Clarifiers- butter churns– ghee, whey, milk powder manufacture- equipment – ice-cream freezers - drying equipment – drum drier and spray drier - milk products–milk plant sanitation requirements -Cleaning in-place and its functions.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. R.Paul Singh and R.Dennis Heldman, Introduction to Food Engineering. 5th Edition, Academic Press, London, 2013.
2. Toledo, Romeo T., et al. Fundamentals of Food Process Engineering. 4th Edition, India, Springer International Publishing, 2019.

REFERENCES:

1. Sivasankar, B. Food Processing & Preservation, Prentice Hall of India, 2002
2. K. M. Sahay and K. K. Singh, Unit Operations of Agricultural Processing, 2nd Edition Vikas Publishing House Pvt. Ltd., New Delhi, 2002.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2		3												
3	3													3
4				3										
5				3	3			2				2		3
CO(W.A)	3	3	3	3	3			2				2		3

22AGP09 - FOOD AND DAIRY ENGINEERING LABORATORY				
	L	T	P	C
	0	0	4	2

PRE - REQUISITE : NIL

Course Objective:	• To get hands on experience in testing of properties and thermal processing of food materials

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Experiment and detect the type of contamination in foods	Ap
CO2	Analyze the preservation of food using freezing and drying of foods	An
CO3	Test dehydration and rehydration of foods	Ap
CO4	Assess the milk properties and separation efficiency	An
CO5	Investigate the processes in dairy industry through participative learning	An

LIST OF EXPERIMENTS:

1. Estimation of microbial load in food materials
2. Analysis of engineering properties and adulteration in foods
3. Refrigeration and freezing of foods
4. Determination of drying rate of tray dryer
5. Determination of drying rate of foam mat dryer
6. Experiment on microwave heating of food
7. Experiment on osmotic dehydration of foods
8. Determination of rehydration ratio of dehydrated foods
9. Determination of properties of milk/ Sensory evaluation of milk powders
10. Determination of separation efficiency of cream separator
11. Visit to a dairy industry

TOTAL (P: 60) = 60 PERIODS

COURSE OUTCOMES	**PROGRAMME OUTCOMES**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2		3												
3	3													
4				3	3									3
5				3		2			2			2		3
CO(W.A)	**3**	**3**		**3**	**3**	**2**			**2**			**2**		**3**

22AGP10 - RURAL AGRO INDUSTRY WORK EXPERIMENT				
	L	T	P	C
	0	0	2	1
PRE - REQUISITE : NIL				
Course Objectives:	• To understand various scenario of village resources, development department, constraints of agriculture and its allied sectors. • To gain knowledge on government schemes, technologies, business development programmes and its extension activities			

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Collect the prevailing scenario of resources available in agricultural departments and developmental activities of village.	Ap
CO2	Apply the knowledge gained to avail benefits from agricultural departments and other banking sectors to empower farmers.	Ap
CO3	Analyze the constraints involved in disseminating agriculture products to market.	An
CO4	Focus on agri products and marketing strategies to meet the agro based industrial standards with the recent advanced technologies.	An
CO5	Illustrate by analyzing the real scene with a presentation of the problems and constraints observed on agriculture and allied sectors as being a member of the team.	An

UNIT I – VILLAGE ATTACHMENT TRAINING PROGRAMME	**(2)**
Describe the Natural Resources (village & farm) - agricultural scenario –demographic details –Assess the Village Infrastructure –Analyze the Problems/Constraints related to farming, marketing, processing, transport, communication, access to extension and other services, etc.	
UNIT II – STUDYING DEVELOPMENT DEPARTMENTS	**(3)**
Visit to office of Assistant Director of Agriculture, Agricultural Engineering and KVK - study the organizational structure, functions, duties and responsibilities of extension personnel, ATMA, schemes implemented, extension activities conducted etc.	
UNIT III – STUDYING ACTIVTIES OF AN NON- PROFIT ORGANIZATIONS	**(3)**
Study of NGO, Primary Agricultural Cooperative Bank (PACB), Regulated Market Committee (RMC), FPO, NABARD and Lead Banks – Roles and objectives – organizational pattern – sources of funding – extension activities – Contacting target groups.	
UNIT IV – STUDYING ACTIVITIES OF AGRI- BUSINESS FIRM	**(4)**
Visit to an Agri-business firm (SHG / Custom Hiring Centers / District Industrial Center (DIC) and Agri Clinic Agri Business Center) - study the business activities, projects, managerial functions viz., planning, supervision, delegation, communication, budgeting and related aspects and documentation of success stories of the farmers.	

UNIT V – AGRO INDUSTRIAL ATTACHMENT	(3)
Visit to Agro-and Cottage industries and Commodities Boards: Industries include Seed/Sampling production, Post harvest processing, Food processing, Value addition, Hi- Tech farms, etc.	
TOTAL (L: 0, P:2) = 15 PERIODS	

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3		2		2	2			1				
2	3										2		2	
3				3									2	
4					3									3
5									3	2				
CO (W.A)	**3**	**3**		**2.5**	**3**	**2**	**2**		**3**	**1.5**	**2**		**2**	**3**

22GEA01 UNIVERSAL HUMAN VALUES (For Common To All Branches)				
	L	**T**	**P**	**C**
	2	**0**	**0**	**2**

PRE - REQUISITE : NIL

Course Objective:	• To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity. • To facilitate the development of a holistic perspective among students towards life and profession. • To highlight plausible implications of holistic understanding in terms of ethical human conduct. • To understand the nature and existence. • To understand human contact and holistic way of living

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession.	E	Internal Assessment
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	Ap	
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession.	An	
CO4	Examine the role of a human being in ensuring harmony in society and nature.	Ap	
CO5	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	Ap	

UNIT I: INTRODUCTION-BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL- ENCOMPASSING RESOLUTION	(6)
The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution	
UNIT II: RIGHT UNDERSTANDING (KNOWING)- KNOWER, KNOWN & THE PROCESS	(6)
The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	
UNIT III: UNDERSTANDING HUMAN BEING	(6)
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self	

UNIT IV: UNDERSTANDING NATURE AND EXISTENCE	(6)
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	
UNIT V: UNDERSTANDING HUMAN CONDUCT, ALL-ENCOMPASSING RESOLUTION AND HOLISTIC WAY OF LIVING	(6)
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence	
TOTAL (L:30) : 30 PERIODS	

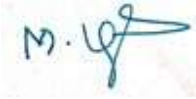
TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course inHuman Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi

REFERENCES:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins,USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers
8. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists&Engineers, Oxford University Press
9. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
10. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1						2	2	3	2	2		3		
2						2	2	3	2	2		3		
3						2	2	3	2	2		3		
4						2	2	3	2	2		3		
5						2	2	3	2	2		3		
CO (W.A)						**2**	**2**	**3**	**2**	**2**		**3**		



22GED02 – INTERNSHIP / INDUSTRIAL TRAINING					
		L	T	P	C
		0	0	4	2
PRE - REQUISITE : NIL					
Course Objective:	• To obtain a broad understanding of the emerging technologies in Industry • To gain knowledge about I/O models.				
Course Outcomes The Student will be able to		**Cognitive Level**			
CO1	Engage in Industrial activity which is a community service.	U			
CO2	Prepare the project report, three minute video and the poster of the work.	Ap			
CO3	Identify and specify an engineering product that can make their life comfortable.	An			
CO4	Prepare a business plan for a commercial venture of the proposed product, together with complying to relevant norms.	Ap			
CO5	Identify the community that shall benefit from the product.	E			

During semester breaks, students are encouraged to engage in industrial training or undergo internship in an industry related to the field of study. The duration of the activity shall be of 4 to 6 weeks. The work carried out in the semester break is assessed through an oral seminar accompanied by a written report. It is expected that this association will motivate the student to develop simple Electronic (or other) products to make their life comfortable and convert new ideas into projects.

Every student is required to complete 12 to 16 weeks of internship (with about 40 hours per week), during the Summer/Winter semester breaks. The Internships are evaluated through Internship Reports and Seminars during the VI and VIII semesters. The internships can be taken up in an industry, a government organization, a research organization or an academic institution, either in the country or outside the country, that include activities like:

- Successful completion of Internships/ Value Added Programs/Training
- Programs/ workshops organized by academic Institutions and Industries
- Soft skill training by the Placement Cell of the college
- Active association with incubation/ innovation /entrepreneurship cell of the institute;
- Participation in Inter-Institute innovation related competitions like Hackathons
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership Talks, Idea/ Design/ Innovation contests
- Internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises
- Development of a new product/ business plan/ registration of a start-up

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						2								
2										3				
3		1												
4							2	3			2			
5						2								
CO (W.A)		1				2	2	3		3	2			

22AGD01- PROJECT WORK					
		L	T	P	C
		0	0	20	10
PRE - REQUISITE : NIL					
Course Outcomes The Student will be able to		**Cognitive Level**		**Weightage of COs in End Semester Examination**	
CO1	Engage in independent study to research literature in the identified area and consolidate the literature search to identify and formulate the engineering problem.	Ap		20 % - First Review (Internal)	
CO2	Prepare the Gantt Chart for scheduling the project , engage in budget analysis, and designate responsibility for every member in the team and identify the community that shall benefit through the solution to the identified research work and also demonstrate concern for environment	Ap, E		20 % - Second Review (Internal)	
CO3	Identify, apply the mathematical concepts, science concepts, and engineering concepts necessary to implement the identified engineering problem, select the engineering tools /components required to reproduce the identified project, design, implement, analyze and interpret results of the implemented project	Ap, An, C		20 % - Third Review (External)	
CO4	Engage in effective written communication through the project report, the one-page poster presentation, and preparation of the video about the project and the four page IEEE format of the work and effective oral communication through presentation of the project work and demonstration of the project.	E		20 % - Final Review (External)	
CO5	Perform in the team, contribute to the team and mentor/lead the team, demonstrate compliance to the prescribed standards/ safety norms and abide by the norms of professional ethics and clearly specify the outcome of the project work (leading to start-up/ product/ research paper/ patent)	Ap, An		20 % - Final Review (External)	

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 3 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide. The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations

TOTAL (P: 300) = 300 PERIODS

Mapping of COs with POs / PSOs														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3										3	3	3
2						3	3				3		3	3
3	3	3	3	3	3								3	3
4								3		3			3	3
5									3		3	3	3	3
CO (W.A)	3	3	3	3	3	3	3	3	3	3	3	3	3	3

22AGX01 - TESTING AND MANAGEMENT OF FARM MACHINERY				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• Analyze the performance and power requirements of various farm machinery systems to optimize their field performance and operational cost. • Evaluate the effectiveness and safety of agricultural machinery including tractors, power tillers, and harvesting equipment based on Indian standards and testing codes.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Demonstrate proficiency in testing and evaluating the performance of agricultural tractors in accordance with Indian and international standards.	Ap	20%
CO2	Investigate the working and efficiency of power tillers and various tillage implements, ensuring they meet the required specifications.	An	20%
CO3	Apply knowledge of farm machinery management to improve the efficiency and safety of field operations.	Ap	20%
CO4	Evaluate the performance of plant protection and harvesting machinery, such as sprayers, dusters, combine harvesters, and threshers, ensuring they operate within safety and performance guidelines.	E	20%
CO5	Assess the functionality and effectiveness of tillage and sowing equipment, including seed cum fertilizer drills, weeders, and rice transplanters.	E	20%

UNIT I – MANAGEMENT OF MACHINERY	(9)
Field machinery system – Importance of farm machinery management- field Performance and Power requirements. Cost of operation - Machinery for operator comfort and safety.	
UNIT II – TRACTOR	(9)
Testing and evaluation systems in India – General Guidelines on the use of test codes. Testing and Evaluation of agricultural tractors – Indian standards. Performance of agricultural tractors – analysis of results – Nebraska tractor test and test reports.	
UNIT III - POWER TILLER AND IMPLEMENTS	(9)
Testing and evaluation of power tiller. Testing and evaluation of tillage implements- Mould board – rotovator.	
UNIT IV - TILLAGE AND SOWING EQUIPMENT	(9)
Testing and evaluation of Tillage machinery - seed cum fertilizer drill – weeders - Rice transplanter.	
UNIT V -PLANT PROTECTION AND HARVESTING MACHINERY	(9)
Testing and evaluation of manually operated sprayer and duster - Combine harvester - thresher.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Metha M.L., SR.Verma, K Mishra and V.K. Sharma. 1995. Testing and Evaluation of Agricultural Machinery, National Agricultural Technology Information Centre, Ludhiana- 141001.
2. RNAM test codes and procedure for farm machinery, 1983
3. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.
4. Indian standard test codes related to tractors, power tillers and agricultural implements.

REFERENCES:

3. Liljedahl, J.B., P.K. Turnquist, D.W.Smith and M.Hoki. 2004. Fourth Edition. Tractors and their power units. CBS Publishers and Distributers, Delhi.
4. Kepner, R.A., R.Bainer, E.L. Barger. 2005. Third Edition. Principles of farm machinery. CBS Publishers and Distributers, Delhi.
5. Claude Culpin (198) Profitable farm mechanization Crosby Lockwood & Sons Ltd., 26, Old Brompton Road, SW.7
6. Donnell R. Hunt 1986. Engineering models for Agricultural production. The AVI publishing co.INC, Connecticut-06881.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			2				2		3			3	
2			3		2				2			2	3	3
3		3												3
4														
5					3			2				2	3	
CO (W.A)	3	3	3	2	3			2	2	3		2	3	3

22AGX02 - PLANT PROTECTION AND HARVESTING MACHINERY				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Analyze the functionality and effectiveness of various weeding, spraying, and dusting equipment in agricultural applications. • Evaluate the design, construction, and operational principles of harvesting, threshing, and other specialized agricultural machinery.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of atomization and droplet size determination to optimize the use of sprayers in different agricultural settings.	Ap	20%
CO2	Apply knowledge of Operate various types of weeding equipment, including manual and power-operated weeders, to enhance crop management.	An	20%
CO3	Examine the construction and working principles of different types of harvesters and mowers, and implement best practices for their maintenance and adjustment.	Ap	20%
CO4	Integrate knowledge of multi-crop threshers, fruit harvesting machinery, and other specialized agricultural equipment to improve efficiency and productivity in agricultural operations.	An	20%
CO5	Analyze the effectiveness and maintenance requirements of dusters and other plant protection devices.	An	20%

UNIT I - WEEDING EQUIPMENT	(9)
Weeding equipment – hand hoe – long handled weeding tools – dryland star weeder – wetland cono weeder and rotary weeder – Power Operated Weeder : Engine/Tractor/Battery	
UNIT II – SPRAYERS	(9)
Sprayers –types-classification – methods of atomization, spray application rate, droplet size determination– Number Median Diameter (NMD) and Volume Median Diameter (VMD)-Sprayer operation – boom sprayer - precaution - coverage - factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) - Electrostatic sprayers.	
UNIT III – DUSTERS	(9)
Dusters - types - mist blower cum duster - other plant protection devices, care and maintenance.	

UNIT IV – HARVESTERS	(9)
Principles and types of cutting mechanisms. Harvesters - types - mower mechanism – construction and adjustments - registration and alignment. Mowers, windrowers, reapers, reaper binders and forage harvesters. Combine harvester – types - parts - construction and working. Diggers for potato, groundnut and other tubers. Sugarcane harvesters - cotton pickers - corn harvesters.	
UNIT V -THRESHERS AND OTHER MACHINERIES	(9)
Thresher – construction and working of multi crop thresher. Fruit pluckers - tree shakers - fruit harvesting machinery. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.
2. Jagdishwar Sahay. 2006. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6

REFERENCES:

7. Sanjay Kumar. 2013. Fundamentals of Agricultural Engineering. Kalyani publishers, Ludhiana- 141 008.
8. Surendar singh, 2011. Farm Machinery Principles and Applications. Indian Council of Agricultural Research, New Delhi-12.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			2									3	
2		3											3	3
3			3										3	3
4				3									3	
5					2		2							3
CO (W.A)	3	3	3	3	2		2						3	3

22AGX03 - HUMAN ENGINEERING AND SAFETY IN FARM MACHINERY OPERATIONS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To Apply ergonomic principles to evaluate and improve agricultural practices, focusing on human metabolism, energy expenditure, and physical function to optimize work efficiency and reduce fatigue. • To Design ergonomic solutions and safety measures tailored to agricultural tools and equipment, ensuring better alignment with human physical capabilities and enhancing overall safety and productivity.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the anthropometric data to design and modify agricultural tools and equipment, ensuring they fit the physical dimensions of users and improve comfort and efficiency.	An	20%
CO2	Develop and Implement safety protocols and safety gadgets for agricultural machinery and operations, in accordance with regulations and best practices, to minimize risk and enhance worker safety.	Ap	20%
CO3	Evaluate the impact of physiological functions, including muscle structure and function, on work efficiency and ergonomics, taking into account age and individual differences.	E	20%
CO4	Apply ergonomic concepts to analyze and improve human workload management in agricultural tasks, considering factors such as energy expenditure and physiological stress.	An	20%
CO5	Develop the ergonomic interventions for specific agricultural operations, such as spraying and weeding, to optimize body movements, strength, and endurance, while ensuring speed and accuracy.	Ap	20%

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 FUNCTION	(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.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Sanders,M.S. and McComack,EJ. Human factors in Engineering and Des ign. Tata McGraw Hill, New York, 1992
2. Obome, David.J. Engieering Work. John Wiley and Sons Ltd., 1982

REFERENCES:

1. Astand, P.P. and Rodaid,K. Text book of Work Physiology, McGraw Hill Book Company,New York, 1970
2. Grandjean,E. Fitting the Track of the Man, Taylor and France Ltd., U.K.,1981

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2							2					3	
2			3					2						
3				3									3	
4		3					2							3
5			2		3									3
CO (W.A)	2	3	3	3	3		2	2					3	3

22AGX04 - DESIGN OF AGRICULTURAL MACHINERY (Use of the PSG Design Data Book is permitted in the examination)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE - REQUISITE : NIL				
Course Objective:	• To learn design considerations and their applications in agricultural • To understand the standards and procedures for design of agricultural machinery components. • To analyze factor affecting of gears and bearing • To Recognize the standards and procedures for design of power transmission system • To understand the standards and procedures for design of agricultural machinery			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design and drawing of basic machine components.	Ap	20%
CO2	Examine the design considerations of Agricultural machinery components.	Ap	20%
CO3	Analyze the factors affecting design and construction of gears and bearings.	An	20%
CO4	Illustrate various machine components through drawings.	An	20%
CO5	Engage in independent study to select components for agricultural machinery applications	An	20%

UNIT I STRESSES IN MACHINE MEMBERS	**(6+3)**
Introduction to design process- factor influencing the machine design, selection of material based on mechanical properties- Direct, bending and torsional stress equations- calculation of Principal stresses for combined loading. Design thinking.	
UNIT II DESIGN OF POWER TRANSMISSION SYSTEMS	**(6+3)**
Selection of V-Belts and pulleys- selection of flat belts and pulleys- selection of transmission chains and sprockets. Design of pulleys and sprockets.	
UNIT III DESIGN OF SHAFTS AND COUPLINGS	**(6+3)**
Design of solid and hollow shafts based on strength and rigidity- Design of keys, keyways - Design of rigid and flexible couplings. -Design of knuckle joints.	
UNIT IV DESIGN OF GEARS	**(6+3)**
Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation. - Failure of gear teeth.- Applications of different types of Gears	
UNIT V DESIGN OF BEARINGS	**(6+3)**
Bearing -Types of bearings – sliding contact and rolling contact types. – Bearing selection based on application - Lubrication in journal bearings – calculation of bearing dimensions.	
TOTAL (L:30 T :15) = 45 PERIODS	

TEXT BOOKS:

1. Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house,2020.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2017.

REFERENCES:

1. Norton R.L, Machine Design – An Integrated Approach, Pearson Publications, 6 th Edition, 2021.
2. Srivastava A.K., Goering.C.E. and Rohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993.
3. Gary Krutz, Lester Thompson and Paul Clear., "Design of Agricultural Machinery", John Wiley and Sons, New York, 1984.
4. Handbook of Design Thinking: Tips & Tools for How to Design Thinking by Christian Mueller-Roterberg,2018.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2			3											
3		3											3	
4				3										
5									2					3
CO (W.A)	3	3	3	3					2				3	3

22AGX05 - HYDRAULIC DRIVES AND CONTROLS				
	L	T	P	C
	3	0	0	3
PRE REQUISITE : NIL				
Course Objective:	• To assess the application of hydraulics in agricultural machinery • To design drives and controls agricultural machinery, equipment, and implements • To know about the safety in design and operation of hydraulic drives • To analyze given pumps, valves, and hydraulic circuits systematically in order to reach appropriate conclusions • To assess the safety standards for hydraulic system			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the hydraulic fundamentals in design of hydraulic system and controls	Ap	20%
CO2	Design pumps for hydraulic systems applied in agricultural machinery techniques	An	20%
CO3	Develop accumulators, and circuits for hydraulic systems	Ap	20%
CO4	Select the valves and create valve circuit diagrams for troubleshooting	An	20%
CO5	Apply the safety standards for hydraulic systems	Ap	20%

UNIT I- HYDRAULIC PRINCIPLE AND COMPONENTS	**(9)**
Hydraulic Basics- Pascal's Law, Flow, Energy, Work, and Power. Hydraulic Systems, Color Coding, Reservoirs, Strainers and Filters, Filtering Material and Elements.	
UNIT II - PUMPS	**(9)**
Pump Classifications, operation, performance, Displacement, Design of Gear Pumps, Vane Pumps, Piston Pumps.	
UNIT III - ACCUMULATORS,AND CIRCUITS	**(9)**
Accumulators, Pressure Gauges and Volume Meters, Hydraulic Circuit, Fittings and Connectors. Hydraulic Actuators, Cylinders, Construction and Applications, Maintenance, Hydraulic Motors.	
UNIT IV - VALVES	**(9)**
Valves, Pressure-Control Valves, Directional- Control Valves, Flow-Control Valves, Valve. Installation, Valve Failures and Remedies, Valve Assembly, Troubleshooting of Valves- Hydraulic Circuit Diagrams and Troubleshooting	
UNIT V – SAFETY AND CONTROLS	**(9)**
United States of American Standards Institute (USASI) Graphical Symbols Tractor hydraulics, nudging system, ADDC. Pneumatics: Air services, logic units, Fail safe and safety systems Robotics: Application of Hydraulics and Pneumatics drives in agricultural systems, Programmable Logic Controls (PLCs)	
TOTAL (L: 45): 45 PERIODS	

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", New International Edition 7th Edition, 2013.
2. Srinivasan R., "Hydraulics and Pneumatic Controls", Vijay Nicole Imprints 3 rd edition, 2019.:

REFERENCES:

1. Manring, N. D. "Hydraulic Control Systems: Design and Analysis of Their Dynamics" CRC Press.2014.
2. Watanabe, K. "Hydraulic Proportional and Servo Control Systems" CRC Press. 2003
3. Sivaraman, I. "Introduction to Hydraulics and Pneumatics" CRC Press. 2015

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2			3											
3				3									3	
4		3												3
5	3					2				2				3
CO(W.A)	3	3	3	3		2				2			3	3

22AGX06 - PRECISION FARMING EQUIPMENT				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Analyze the integration of electronics in precision agriculture, including the use of GIS and GPS systems, to enhance farm machinery and equipment efficiency. • Evaluate the application and performance of sensors, microcontrollers, and actuators in precision farming to optimize site-specific management practices.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Demonstrate the functionality and application of various sensors, microcontrollers like Arduino and Raspberry Pi, and actuators in agricultural practices.	Ap	20%
CO2	Apply the principles of precision agriculture and the tools required for its implementation, including GIS and GPS systems, to improve farm operations.	Ap	20%
CO3	Assess site-specific management techniques for nutrient, weed, and agro-chemical management, incorporating data analysis and decision-making processes.	E	20%
CO4	Evaluate the use of unmanned vehicles, including drones and IoT applications, in agriculture for tasks such as crop yield estimation, pest identification, pesticide spraying, and environmental monitoring.	E	20%
CO5	Investigate precision farming concepts, including map-based and real-time systems, and their application in site-specific management and precision tillage, planting, and harvesting.	An	20%

UNIT I- ROLE OF ELECTRONICS IN AGRICULTURAL ENGINEERING	(9)
Electronics in 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 - PRECISIONFARMING 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.	

UNIT IV - SITE-SPECIFIC MANAGEMENTSYSTEM	(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 UAV	(9)
Drones- Types - applications - rules and regulations - Autonomous ground vehicles - Robotic platforms and unmanned agricultural vehicles- IoT - crop yield estimates-threat identification- crop insurance-pesticides spraying, environmental monitoring- protected cultivation- food quality monitoring.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Krishna, K. R. Push Button Agriculture Robotics, Drones, Satellite-Guided Soil and Crop Management. Apple Academic Press. 2016
2. Kepner, R.A., Bainer, R. and Berger, E.L. Principles of Farm Machinery.AVI Publ. 1978.

REFERENCES:

1. Brase, T.A. Precision Agriculture. Thomson Delmar Learning, New York.2006 Total: 45 Hours
2. Hermann, J.H. Precision in Crop Farming, Site Specific Concepts and Sensing Methods: Applications and Results. Springer, Netherlands.2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		2		3										3
3		2	2										3	
4	2												3	
5				3	2							2		3
CO (W.A)	**3**	**2**	**2**	**3**	**2**							**2**	**3**	**3**

22AGX07 - THEORY OF MACHINES				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Develop a clear understanding of the kinematics and dynamics of different types of machinery and mechanical systems. Also explain of various types of mechanisms and their applications in mechanical systems.	Ap	20%
CO2	Analysis of kinematic linkages, gears, cams, and other mechanisms to determine positions, velocities, and accelerations of different components.	An	20%
CO3	Evaluate forces, torques, energy transformations and mechanical vibrations on machine performance in mechanical systems	Ap	20%
CO4	Develop and design mechanical components and systems, such as linkages, cams, and gears, that meet specific functional requirements.	An	20%
CO5	Apply theoretical knowledge to practical problems in machinery design and analysis and recognize and address ethical and professional responsibilities in engineering practice.	Ap	20%

UNIT I - KINEMATICS OF MECHANISMS	**(9)**
Definitions - Kinematic links - Pairs -Joints- degrees of freedom- Kinematic Chain - Machines and mechanism - Types and uses – Grashofs law-Inversions of mechanism-D Alemberts principle, Kinematic inversion of four bar chain and slider crank mechanism. Velocity and acceleration in simple four bar mechanisms - Ratchets and escapements	
UNIT II - FRICTION IN MACHINE ELEMENTS	**(9)**
Sliding and rolling friction – Bearing - Friction clutches - working principles of single and multiple plate – Brakes – band and shoe brakes - belt drives, types - power transmitted - velocity ratio - effect of centrifugal tension - creep and slip on power transmission	

UNIT III - GEARS AND GEAR TRAINS	(9)
Law of toothed gearing - Gears - classification - spur gear terminology - tooth profile - interference between rack and pinion. Gear trains - Introduction of gear trains - Speed ratio, simple and compound reverted and epicyclic gear trains.	
UNIT IV - CAM AND FOLLOWER	**(9)**
Introduction of Cam and follower – types – Applications - knife edge, roller and flat faced followers -– displacement diagram – cam profiles for uniform velocity - Uniform acceleration - simple harmonic and cycloidal motion –flywheel - fluctuation of speed and energy – Applications of flywheel	
UNIT V – BALANCING AND VIBRATION	**(9)**
Introduction - Static and Dynamic balancing - Balancing of rotating masses and reciprocating masses- Introduction to vibration - Types of vibration, Longitudinal, Transverse and torsional-free, forced and damped vibrations - Governor	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Rattan, S.S, Theory of Machines, 3rd Edition, Tata McGraw-Hill, 2009.
2. Khurmi, R.S. and Gupta, J.K, Theory of machines, Eurasia Publication House, 1994.
3. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 3rd edition 2019

REFERENCES:

1. Thomas Beven, Theory of Machines, CBS Publishers and Distributors, New Delhi,1984.
2. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2017.
3. Ballaney, P.L, Theory of machines, Khanna Publishers, New Delhi,1994

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2	2	3												
3														
4	2		3										3	3
5		2	2					3					3	3
CO (W.A)	2.3	2.5	2.5					3					3	3

22AGX08 - TRACTOR AND AUTOMOTIVE ENGINES				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• Understand the basic principles of IC Engines and Learn the differences between two-stroke and four-stroke engines • Understand the working and purpose of cooling system and lubrication system Transmission system in tractor engines. • Able to know the implements used in tractors and learn skill on structure of tractors			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge on IC engines, cooling and lubrication systems and Learn about different types of fuel systems	Ap	20%
CO2	Identify and explain the functions of various engine components, such as pistons, cylinders, crankshafts, camshafts, valves, fuel systems, and lubrication systems.	An	20%
CO3	Analyze engine performance parameters, including power, torque, efficiency, and fuel consumption and Understand factors affecting engine performance and methods to enhance efficiency..	Ap	20%
CO4	Select emission control technologies and regulations for reducing pollutants from engines for environment safety	Ap	20%
CO5	Develop troubleshooting skills to identify and resolve common engine problems also Understand the safety protocols and practices required when working with engines and related machinery.	Ap	20%

UNIT I- SOURCES OF FARM POWER AND ENGINE SYSTEM	**(9)**
Sources of farm power - conventional and non - conventional energy sources; principles of IC engine - CI and SI; engine - functional components and their construction, comparison, measurement of indicated horse power - theoretical and numerical method; valve mechanism valve timing diagram and valve clearance adjustment, air cleaning system; turbocharger; supercharger; emission characteristics of IC engine, biofuels in IC engine, modern trends in engine design.	
UNIT II - COOLING, LUBIRCATION, FUEL SUPPLY AND ELECTRICAL SYSTEM	**(9)**
Engine cooling system - pressurized cooling; anti - freeze solutions; lubrication system - types of lubricants and systems, fluid film theory and boundary layer theory, working principle; fuel supply system - fuels, properties of fuels, calculation of air - fuel ratio and calorific value; fuel test for SI and CI engines, detonation and knocking; carburetion system; fuel injection system; fuel injector nozzles; engine; ignition system of SI engines; electrical system	

UNIT III - TRANSMISSION SYSTEM	(9)
Clutch - construction and principle of operation; gear box - gearing theory, functional requirements and calculation for speed ratio; planetary gear system, torque converter; differential system; final drive and wheels; brake system; steering system, front axle and wheel alignment, ackerman steeringgeometry.	
UNIT IV - HYDRAULIC SYSTEMS AND TRACTOR MECHANICS	**(9)**
Hydraulic system - automatic draft and position control; tractor power outlets - PTO, PTO standards; wheels and tyres - construction and tyre specifications; tractor mechanics - forces acting on the tractor in static and dynamic mode; determination of CG of a tractor and moment of inertia of a tractor; tractor static equilibrium, tractor stability especially at turns.	
UNIT V – POWER TILLER AND TRACTOR TESTING	**(9)**
Power tiller - types, application, functional components and attachments; types of tests - test procedure - need for testing and evaluation of farm tractor and power tiller; test code for performance testing of tractors and power tillers - RNAM, BIS, etc	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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. Dhanpat Rai & Co. (P) Ltd., Educational and Technical Publishers, Delhi,1999.

REFERENCES:

1. Jain SC and CR Rai. Farm Tractor Maintenance and Repair, standard publishers,1999.

2.Liljedahl J B and Others. Tractors and Their Power Units., CBS Publisher, New Delhi,1997.

3. Michal AM and Ojha TP. Vol I. Principles of Agricultural Engineering. Jain Brothers, New Delhi,1996.

4.Jagadeeshwar Sahay, Elements of Agricultural Engineering, Standard Publishers Co., New Delhi, 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											2	3	
2	2											2	3	
3		3												3
4						3	2							
5	2													3
CO (W.A)	2.3	3				3	2					2	3	3

22AGX11 – BIOCHEMICAL AND THERMO - CHEMICAL CONVERSION OF BIOMASS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To learn types of biomass, properties, handling and transportation, bio and thermo chemical conversion and power generation using biomass			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate stoichiometric air requirement and products of combustion	Ap	20%
CO2	Analyze the product distribution of gasification and pyrolysis processes	An	20%
CO3	Design biogas plant based on the raw material availability	C	20%
CO4	Analyze the carbon emission reduction potential of different sequestration systems	An	20%
CO5	Test the properties of biomass to interpret the applications in energy sector	An	20%

UNIT I - BIOMASS CHARACTERIZATION AND CONVERSION	**(9)**
Biomass – types – fuels from biomass. Biomass fuel characterization – physical, chemical and thermal – energy release. Supply chain – harvesting / collection – transportation and processing. Biomass conversion technologies - Methods of densification - Briquetting – types.	
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, enrichment – high rate biomethanation process – bioethanol, biodiesel – feedstock – process – utilization - composting - methods – applications.	
UNIT III - THERMO CHEMICAL CONVERSION BY COMBUSTION	**(9)**
Combustion process – chemistry of combustion - combustion zones – emissions – Stoichiometric air requirement – Problems – Volumetric and gravimetric conversion. Co firing of biomass. Incinerators. Wood burning stoves – types – operation.	
UNIT IV - THERMOCHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS	**(9)**
Biomass gasification – chemistry of gasification – types of gasifiers – Gas cleaning & conditioning - utilization of producer gas - emissions – commercial gasifier plants. Pyrolysis– types and reactors – product recovery – biochar – bio oil – application.	
UNIT V - COGENERATION AND WASTE HEAT RECOVERY	**(9)**
Carbon cycle - Carbon sequestration – methods - Carbon emission reduction calculation. Cogeneration technology – cycles – topping – bottoming – applications – waste heat recovery – WHR devices.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Rajput, R. K.. Non-Conventional Energy Sources and Utilisation: For Students of B.E./B. Tech, Also Useful for Competitive Examinations. India, S. Chand Pvt. Limited, 2012.
2. Basu, Prabir. Biomass Gasification and Pyrolysis: Practical Design and Theory. Netherlands, Elsevier Science, 2010.
3. Nijaguna, B.T. Biogas Technology. New age international publishers. 2006.

REFERENCES:

1. Kothari, D.P., K.C.Singal and Rakesh Ranjan. 2008. Renewable energy sources and emerging technologies. Prentice Hall of India Pvt. Ltd., New Delhi – 01.
2. Sengio C. Capareda. 2014. Introduction to biomass energy conservations. CRC Press.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												
3			3										3	
4				3										
5				3	2	2		2	2			2	3	
CO (W.A)	3	3	3	3	2	2		2	2			2	3	

22AGX12 - WASTE AND BY-PRODUCTS UTILIZATION				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• Analyze the different types and magnitudes of food by-products and waste generated in food production and processing. • Evaluate various waste management concepts, including effluent treatment and thermo-chemical and bio-chemical conversion processes, to optimize waste utilization.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the ability to characterize waste and implement effective waste management and effluent treatment strategies.	Ap	20%
CO2	Apply knowledge of food by-products and waste to understand their types, magnitudes, and implications in food production and processing.	Ap	20%
CO3	Evaluate the thermo-chemical conversion techniques, such as biomass gasification, including the mechanism, types of gasifier reactors, and utilization of producer gas.	E	20%
CO4	Evaluate the bio-chemical conversion processes, including the selection and utilization of biogas plants for cooking, lighting, and engine operations.	E	20%
CO5	Analyze the process of direct combustion of biomass, including conducting proximate and ultimate analyses and understanding the operating conditions affecting furnace design.	An	20%

UNIT I –Introduction	(9)
By-products/waste, types of food by-product and waste, magnitude of by-products and waste in food production, magnitude of by-products and wastes in food processing.	
UNIT II –Waste management concepts	(9)
Waste characteristics, waste management and effluent treatment.	
UNIT III –Direct combustion of solid waste	(9)
Proximate and ultimate analysis of biomass, theory of combustion, direct combustion of biomass as fuel in furnaces, operating conditions affecting design of furnace.	
UNIT IV –Thermo-chemical conversion of solid waste	(9)
Biomass gasification, gasification process mechanism, types of gasifier reactors, utilization of producer gas.	
UNIT V – Bio-chemical conversion	(9)
Selection of proper size of biogas plant, utilization of biogas for cooking purpose. Utilization of biogas for lighting purposes and engine operation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Michael, A.M. and Ojha, T.P., "Principles of Agricultural Engineering Vol II", Jain Brothers, New Delhi, 2002.
2. Suresh, R., "Land and Water Management Principles", Standard Publishers & Distributors, New Delhi. Press India Pvt. Ltd, 2007.
3. Jagadish Prasad., "Principles and Practices of Dairy Farm Management", Kalyani Publishers, New Delhi, 1996.

REFERENCES:

1. Jan C. van Dam., "Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.
2. Jeffery Star and John Estes, "Geographical Information System – An Introduction," Prentice Hall India Pvt. Ltd., New Delhi, 1998.

Website Reference:

1. https://www.icar.org.in/content/agricultural_engineering_division
2. https://www.agroengineering.org/index.php/jae

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			2		2	3					2		3
2		3							2		2			3
3			3			3								
4	3												3	
5		2		2	2						2	3		
CO (W.A)	3	2	3	2	2	3	3		2		2	3	3	3

22AGX13 - SOLAR ENERGY ENGINEERING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To impart the basics of solar energy harnessing through thermal and photovoltaic systems			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate solar angles and time	Ap	20%
CO2	Test the efficiency of solar focusing and non-focusing collectors	An	20%
CO3	Analyze the solar thermal energy conversion technologies	An	20%
CO4	Review different PV technologies available in the market	An	20%
CO5	Design solar photovoltaic systems	C	20%

UNIT I- BASICS OF SOLAR ENERGY	(9)
Thermal Radiation Fundamentals - Black-Body Radiation - Intensity of Radiation and Shape Factor - Sun–Earth Geometric Relationship - Solar Time and Angles - Extraterrestrial Solar Radiation - Instruments for Measuring Solar Radiation and Sunshine	
UNIT II –SOLAR THERMAL SYSTEMS AND NON – FOCUSSING COLLECTORS	(9)
Radiative Properties and Characteristics of Materials - Selective Surfaces - Reflecting Surfaces - Transparent Materials - Solar Water and air Heating Systems - Flat-Plate Collectors - Liquid-Type Collectors - Air-Type Collectors - Evacuated-Tube Collectors - Solar space heating and Cooling	
UNIT III –FOCUSSING COLLECTORS	(9)
Concentrating Solar Collectors - Thermodynamic Limits to Concentration - Concentrator Types - Fixed Concentrators - Parabolic Trough Concentrator - Paraboloidal Concentrators - Spherical Concentrators - Compound Parabolic Concentrator - Central Receiver Collector	
UNIT IV –FUNDAMENTALS OF SOLAR PV	(9)
Solar Cell and its function - Solar PV technologies - Solar Cell Parameters - Efficiency of Solar Cell - Solar PV Module - Connection of PV Module in Series and Parallel - Estimation and Measurement of PV Module Power – Types of solar cells	
UNIT V –SOLAR PV POWER GENERATION AND DESIGN	(9)
Types of Solar PV System, Design methodology for SPV system, Design of Grid connected PV systems, Case studies of SPV and Off grid Solar PV Systems	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. Goswami, D. Yogi. Principles of solar engineering. CRC press, 2022.
2. S P Sukhatme and J K Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2006.
3. C S Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice Hall India, 2nd Edition, 2011.

REFERENCES:

1. G N Tiwari, Solar Energy, Fundamentals, Design, Modeling and Applications, Narosa, 2002.
2. K.R.Gopalakrishna., "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2			3											
3		3											3	
4				3										
5			3									2	3	
CO (W.A)	**3**	**3**	**3**	**3**								**2**	**3**	

22AGX14 - WIND ENERGY ENGINEERING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To explain the basic theory and principles involved in wind energy, wind turbine siting, installation and environmental aspects • To describe the types of wind turbine and estimation of power from wind and the electrical aspects of wind turbine			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate the power available in wind	Ap	20%
CO2	Illustrate the working principle of wind turbine blades	An	20%
CO3	Assess the wind power generation potential of different sites	An	20%
CO4	Design wind power systems	C	20%
CO5	Analyze the environmental aspects of wind turbine installation	An	20%

UNIT I- BASICS OF WIND ENERGY	**(9)**
Need, importance and scope of Wind Energy resources - History of Wind Energy - Sources and potentials - Wind Characteristics - Wind Data Analysis - Wind Prediction and Forecasting - Wind Measurement and Instrumentation.	
UNIT II –TYPES OF WIND TURBINE SYSTEMS AND POWER ESTIMATION	**(9)**
Wind turbine types and their construction - Drag and lift - principle of rotation of the wind turbine rotor - horizontal and vertical axis windmills - Wind Turbine Energy Production – Betz Coefficient	
UNIT III – AERODYNAMICS OF WIND TURBINES	**(9)**
Aerodynamics of Wind Turbines - Aerodynamics of Airfoils - Blade Design - Blade Element Theory - Wind Turbine Loads	
UNIT IV – ELECTRICAL ASPECTS AND STANDARDS	**(9)**
Electrical Aspects of Wind Turbines - Basic Concepts of Electrical Power - Electrical Machines Methods of Generating Synchronous Power - Induction Machine - Asynchronous Electrical generators - Permanent magnet generators - AC generators - self-excitation- Wind Turbine Standards, Technical Specifications	
UNIT V – INSTALLATION AND ENVIRONMENTAL ASPECTS	**(9)**
Wind Turbine Siting - Installation and Operation Issues - Wind Farms - Wind Energy Applications - Hybrid Power Systems - Environmental Aspects and Impacts - Wind Turbine Noise	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. J. F. Manwell, J.G. McGowan, A.L. Rogers, Wind Energy Explained, Theory, Design and Application, Wiley, 2012.
2. Gary Johnson, L., 2006. Wind Energy Systems, John Wisley& Sons Ltd, USA.

REFERENCES:

1. Tony Burt, Nick Jenkins, David Sharpe and Ervin Bossanyi, Wind Energy Handbook, John Wiley & Sons Ltd, 2011. Second Edn.
2. Sathyajith Mathew. 2006. Wind energy: fundamental, resources analysis and economics. Springer Berlin Heidelberg, The Netherlands. ISBN: 139783540309055.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3				2										
4			3										3	
5		3					2							
CO(W.A)	3	3	3	2			2						3	

22AGX15 - ALTERNATE ENERGY SOURCES				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To understand the basic theory and principles, involved in solar power generation, types of wind turbine and estimation of power from wind, geothermal, OTEC power generation, MHD systems and fuel cells.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate solar angles and time	Ap	20%
CO2	Estimate the power available in wind	Ap	20%
CO3	Assess the working principle of geothermal, OTEC, MHD and fuel cell systems	An	20%
CO4	Analyze the growth of renewable energy and the challenge of its integration	An	20%
CO5	Assess the challenges of transportation storage and use of hydrogen compared to other fuels	An	20%

UNIT I- ENERGY SOURCES	**(9)**
Major sources of energy - Renewable and Non-renewable - Primary and Secondary energy sources - Energy scenario - Need of alternate energy sources.	
UNIT II – SOLAR ENERGY	**(9)**
Solar radiations at earth's surface - solar radiation geometry – declination - hour angle - altitude angle - incident angle - zenith angle - solar azimuth angle - principle of conversion of solar energy into heat and electricity - applications	
UNIT III – WIND ENERGY	**(9)**
Wind power - wind power formulation - power coefficient - maximum power - principle of wind energy conversion - considerations in selecting a site for wind mills - advantages - limitations – classification – working – comparison - applications	
UNIT IV – GEOTHERMAL AND OTEC ENERGY	**(9)**
Geothermal energy - dry rock - wet rock - geo thermal power plant – function - principal parts – types of geothermal power systems – limitations – OTEC – Tidal and wave energy	
UNIT V –MAGNETO HYDRO DYNAMIC SYSTEMS AND FUEL CELLS	**(9)**
magneto hydro dynamic –principle - common gases – MHD power plant - components - limitations – applications – Fuel cells – types - Advantages - limitations – applications – Hydrogen production – types – applications	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Non conventional Energy sources - G.D.Rai. 2014
2. S P Sukhatme and J K Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill, 2006.

REFERENCES:

1. Non conventional Energy sources – B. H. Khan. 2014

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3				2										
4		3											3	
5		3												
CO(W.A)	3	3		2									3	

22AGX16 - ENERGY STORAGE SYSTEMS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand the basics of energy storage and importance of storage in E – Vehicles and the material availability and efficiency for energy storage • To explain the principle and types of thermal, chemical, electromagnetic and electrochemical energy storage systems. • To know the design aspects and the heat and mass balance of an energy storage system			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess different energy storage systems based on the application	An	20%
CO2	Select appropriate devices for energy storage	Ap	20%
CO3	Analyze the available phase change materials for energy storage	An	20%
CO4	Design an energy storage system based on the application	C	20%
CO5	Analyze fundamental heat and mass balances of different energy storages	An	20%

UNIT I- ENERGY STORAGE SYSTEMS OVERVIEW	**(9)**
Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines. Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market.	
UNIT II – THERMAL STORAGE SYSTEM	**(9)**
Heat pumps, hot water storage tank, solar thermal collector, application of phase change materials for heat storage-organic and inorganic materials	
UNIT III – CHEMICAL STORAGE SYSTEM	**(9)**
Concept of chemical storage, application of chemical energy storage system, advantages and limitations of chemical energy storage, challenges, and future prospects of chemical storage systems	
UNIT IV – ELECTROMAGNETIC STORAGE SYSTEMS	**(9)**
Concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems.	
UNIT V – ELECTROCHEMICAL STORAGE SYSTEM	**(9)**
Working principle of battery, primary and secondary (flow) batteries, Working principle of supercapacitor, types of supercapacitors, Operational principle of a fuel cell, types of fuel cells	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Frank S. Barnes and Jonah G. Levine. 2011. Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press
2. Ralph Zito. 2010. Energy storage: A new approach, Wiley

REFERENCES:

1. Pistoia, Gianfranco, and BoryannLiaw. 2018. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG,
2. Robert A. Huggins. 2010. Energy storage, Springer Science & Business Media

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2	3													
3		3												
4			3										3	
5				3		2						2	3	
CO (W.A)	3	3	3	3		2						2	3	

22AGX17 - ENERGY AUDITING AND MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand the energy management, conservation processes, principles of energy auditing, energy flow diagram, economics of energy conservation opportunities.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the energy conservation techniques, ensure safety in various sectors of energy use	Ap	20%
CO2	Calculate the simple payback period, ROI, NPV and IRR of a project	An	20%
CO3	Evaluate the boiler losses	E	20%
CO4	Improve the power factor by load management	An	20%
CO5	Perform energy efficiency study for lighting systems	An	20%

UNIT I- ENERGY AUDITING	**(9)**
Energy statistics in India and World - importance of energy conservation - EC Act-2001 and its features - Energy audit - definition - energy management approach - types of energy audit - energy costs - bench marking - fuel and energy substitution - energy auditing instruments	
UNIT II – FINANCIAL ANALYSIS	**(9)**
Financial analysis techniques - simple payback period - ROI - NPV - IRR - financing options -case studies - role of ESCOs - scope of project - steps in project management - financing - contracting, implementation and performance monitoring -CPM and PERT	
UNIT III – PERFORMANCE ANALYSIS OF BOILERS	**(9)**
Boilers - performance evaluation - direct and indirect method - analysis of losses - feed water treatment - blow down - energy conservation opportunities - Mechanism of fluidized bed combustion - retrofitting FBC system to conventional boilers - saving potential	
UNIT IV – ELECTRIC POWER SUPPLY SYSTEMS	**(9)**
Electric Power Supply Systems - electricity billing - load management and maximum demand control - benefits power factor improvement - performance assessment of PF capacitors - distribution and transformer losses	
UNIT V – LIGHTING SYSTEMS AND AUDIT REPORT PREPARATION	**(9)**
Lighting system - basic terms - choice of lighting - luminance requirements - methodology of lighting system energy efficiency study - energy saving potential calculations - good practices in lighting - energy audit reporting format - case study on industrial energy audit	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Guide book for National Certification Examination for Energy Managers and Energy Auditors. Book 4. Energy Performance Assessment for Equipment and Utility Systems, Bureau of Energy Efficiency, DOE, New Delhi.
2. Choudhary, S. 2005. Project Planning, Analysis Selection. Implementation & Review. Tata Mcgraw Hill, New Delhi
3. PCRA, 2006. Fuel economy in furnaces and Waste heat recovery, Petroleum Conservation Research Association, New Delhi.

REFERENCES:

1. Energy Management Handbook, John Wiley and Sons -Wayne C. Turner.
2. Energy Auditing made Simple by P. Balasubramanian -Bala Consultancy Services Publishers.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3										2	3	
3			3											
4				3								2	3	
5				3	2	2								
CO (W.A)	3	3	3	3	2	2						2	3	

22AGX18 - CARBON CAPTURE AND STORAGE					
		L	T	P	C
		3	0	0	3
PRE - REQUISITE : NIL					
Course Objective:	• To understand the basic concepts of carbon capture and storage technology • To know the environmental and technological challenges of CO_2 Storage				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the processes used for carbon capture in power generation systems and industries.	Ap	20%
CO2	Analyze the carbon sequestration potential of different storage systems.	An	20%
CO3	Evaluate the critical role of subsurface to achieve a carbon neutral society	An	20%
CO4	Assess the environmental and technological challenges of CO_2 Storage	An	20%
CO5	Present a seminar about the real time case studies on CCS in Indian context either as an individual or a team.	C	20%

UNIT I – BASICSOF CARBON CAPTURE AND STORAGE (CCS)	**(9)**
Carbon Capture and Storage (CCS): Fundamentals, The Carbon Cycle, CCS options, types of CO_2 Sequestration technologies: Importance, associated problems.	
UNIT II – CARBON CAPTURE FROM POWER GENERATION	**(9)**
Introduction, Pre-combustion Capture, Post-combustion Capture, Oxy- fuel Combustion Capture, Chemical Looping Capture Systems. Approaches to Zero-Emission Power Generation.	
UNIT III – CARBON CAPTURE FROM INDUSTRIAL PROCESSES	**(9)**
Cement Production, Steel Production, Oil Refining, Natural Gas Processing.	
UNIT IV – GEOLOGICAL AND OCEAN STORAGE	**(9)**
Introduction, Geological and engineering fundamentals, Enhanced oil recovery, Saline aquifer storage, Other geological storage options, Ocean sequestration - Direct CO2 injection	
UNIT V–STORAGE IN TERRESTRIAL ECOSYSTEMS AND ADVANCED SYSTEMS	**(9)**
Biological and chemical fundamentals, Terrestrial carbon storage options, Full GHG accounting for terrestrial storage, Algal biofuel production	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Stephen A. Rackley. 2010. Carbon Capture and Storage. Elsevier
2. Smit, B., Reimer, J.A., Oldenburg, C.M., Bourg, I.C. 2014. Introduction to Carbon Capture and Sequestration. Imperial College Press.
3. T. Ahmed, 2010. Reservoir Engineering Handbook, Gulf Professional Publishing. Elsevier.

REFERENCES:

1. Wilcox, J., (2012) Carbon Capture. Springer.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		3												
3		3												
4				3										
5			3		2				3			3	3	
CO(W.A)	2	3	3	3	2				3			3	3	

22AGX21 - DESIGN OF MICRO IRRIGATION SYSTEM				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand the basic concepts, tools, and skills used to deliver water efficiently and effectively on both a field and garden scale efficiency • To Gain knowledge on traditional and micro irrigation methods and advantages • To Acquire knowledge on components, design, operation and maintenance of sprinkler irrigation system • To learn about the role of irrigation water in agriculture, and the environmental factors that influence the type, frequency, and duration of irrigation			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the working principle of pump as well as its characteristics with efficiencies and design the pump including impeller design, casing and other parts of pumps.	Ap	20%
CO2	Categorize the different types of pumps based on the principle, components, and working efficiency.	An	20%
CO3	Apply the knowledge of modern irrigation concepts in agricultural field.	Ap	20%
CO4	Design and apply the drip and sprinkler irrigation system including, main line, sub main and laterals designs by consider pump capacity.	Ap	20%
CO5	Analyze the importance of sprinkler irrigation system in sustainable agricultural and water resource management.	An	20%

UNIT I - WATER LIFTS AND PUMPS	**(9)**
Indigenous water lifts, types and their working. Types of pumps: Positive displacement and variable displacement pumps. Reciprocating pump, principle, components, single acting and double acting, work done, coefficient of discharge, slip.	
UNIT II - CENTRIFUGAL, SUBMERSIBLEAND TURBINE PUMPS	**(9)**
Centrifugal pump: classification, principle and working, fundamental equations of centrifugal pumps, ideal, virtual and manometric heads of centrifugal pumps, net positive suction head, work done by centrifugal pump. Efficiencies, priming and cavitation in centrifugal pumps, multistage centrifugal pumps. Design of impellers and casing, selection of centrifugal pumps. Submersible, Turbine pumps, Mixed flow, Axial flow, jet and Airlift pumps.	
UNIT III - MICRO IRRIGATION CONCEPT AND APPLICATIONS	**(9)**
Classification of irrigation methods - Micro irrigation- Importance- Comparison between Traditional and Micro irrigation methods, Types of micro irrigation system- Scope and potential problem of micro irrigation - Low-cost Micro irrigation Technologies- Gravity fed micro irrigation -Care and maintenance of micro-irrigation System- Economics of micro irrigation system - automation in micro-irrigation.	

UNIT IV - DRIP IRRIGATION DESIGN	(9)
Drip irrigation - Components- Dripper- types- suitable crops for drip irrigation-planning and layout- design of drip irrigation -Wetting pattern- Merits and demerits - Chemigation application- - Operation and maintenance of Drip irrigation system - Design of surface and sub-surface drip irrigation.	
UNIT V - SPRINKLER IRRIGATION DESIGN	**(9)**
Sprinkler irrigation- Components and accessories – types - Sprinkler performance- Sprinkler discharge- Merits and demerits of sprinkler irrigation system - Factor affecting sprinkler performance.- Water distribution pattern- design and layout of sprinkler system- Sprinkler selection and spacing -Droplet size, filtering unit, fertigation - maintenance of the sprinkler irrigation system.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. Suresh, R., "Principles of Micro-Irrigation Engineering", Standard Publishers Distributors, New Delhi, 2015.
2. Michael, A.M. 2015. Second Edition. Irrigation: Theory and Practices, Vikas Publishing House Pvt., Limited.

REFERENCES:

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", Vannistr and 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 Manufacturing Corporation, Glendora, California, USA.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												3
2	3													
3			3		1									
4	3				1								3	
5		3					2						3	
CO (W.A)	3	3	3		1		2						3	3

22AGX22 - RESERVOIR AND FARM POND DESIGN				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To acquire knowledge about water harvesting structures and their design. • To understand the design aspects of reservoirs and farm ponds. • To infer the design, operation and maintenance of reservoirs and farm ponds. • To learn about construction of earthen dam. • To study the economic analysis of farm pond and reservoir.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the hydrological and watershed concepts of reservoirs and farm ponds.	Ap	20%
CO2	Design of reservoirs, embankment ponds and excavation ponds.	An	20%
CO3	Assess the seepage discharge and its impact on stability aspects of the dams.	Ap	20%
CO4	Find the constructional, operational and maintenance aspects of reservoirs and farm ponds.	Ap	20%
CO5	Calculate the Organize the economic indicators for the cost-benefit analysis of water harvesting projects.	Ap	20%

UNIT I –FUNDAMENTALS OF RESERVOIR AND FARM PONDS	**(9)**
Water harvesting - hydrological aspects - watershed aspects - topographical aspects for location - General considerations - drainage area - pond capacity - landscape evaluation - dam reservoir - classification - selection criteria - farm ponds - classification - design criteria.	
UNIT II –DESIGN ASPECTS OF RESERVOIR AND FARM POND	**(9)**
Earthen embankments - functions - advantages and disadvantages -classification - hydraulic fill and rolled fill dams - basic design concepts - site selection - foundation requirements - grouting -harvesting principles - components - catchment and reservoir yield.	
UNIT III – SEEPAGE AND STABILITY ANALYSIS	**(9)**
Estimation of seepage discharge - location of seepage line - graphical and analytical methods -flow net and its properties - seepage pressure - seepage line in composite earth embankments - drainage filters - piping and its causes - drainage system for seepage control - stability of slopes	
UNIT IV –CONSTRUCTION OF EARTHEN DAM	**(9)**
Earthen dam - staking for construction - construction methods and specifications - considerations in implementation - checking with compliance standards - sealing methods -considerations in maintenance - monitoring evaluation and protection - extension and training - miscellaneous aspects.	

UNIT V – ECONOMIC ANALYSIS OF FARM POND AND RESERVOIR	(9)
Estimation of earthwork - cost analysis - initial investment - variable cost - annual returns - present worth analysis - economic indicators - net present value - benefit cost ratio - internal rate of return - Payback period.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. Murthy, V.V.N. and Jha. M. K. (2011). Land and Water Management Engineering. Kalyani Publication.
2. Garg, S. K. (2011). Irrigation Engineering and Hydraulic Structures. Khanna Publishers.

REFERENCES:

1. Suresh R, Soil and Water Conservation Engineering, Standard Publisher Distributors, New Delhi, 2014
2. Agriculture in the Dry Areas, CRC Press, Taylor and Francis Group, London, 2012.
3. Gustafson, A.F., 2011. Conservation of the soil. Biotech Books, New Delhi-35 .

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	2												2	
3			3										3	
4				2									3	
5												1	3	
CO (W.A)	2.5	3	3	2								1	3.0	

22AGX23 - IRRIGATION WATER QUALITY AND WASTE WATER MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To equip students with a comprehensive understanding of water quality principles, including the physical and chemical properties of water, the impact of pollutants, and the methods for assessing, managing, and improving water quality for various uses, particularly in irrigation, pollution control, recycling, and reuse, ensuring sustainable water resource management.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply appropriate sampling and data collection methods to conduct comprehensive water quality investigations and utilize field kits and software packages for accurate analysis and inference.	Ap	20%
CO2	Analyze the physical and chemical properties of water to determine its suitability for various applications, including drinking, irrigation, and industrial uses.	An	20%
CO3	Evaluate the impact of organic and inorganic pollutants on water resources and develop strategies for pollution control and water treatment using advanced technologies.	An	20%
CO4	Assess and implement water recycling and reuse techniques in agricultural and industrial contexts, incorporating low-cost treatment technologies and modern methods to promote sustainable water management practices.	Ap	40%
CO5	Summarize a report with a presentation as a team member on the water quality parameters by field sample analysis of the allotted area.	An	Internal Assessment

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 (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Vladimir Novonty, Water Quality: Diffuse pollution and watershed Management, 2nd edition, John Wiley & Sons, , 2003
2. Mackenzie L Davis, David A Cornwell, Introduction to Environmental Engineering, McGraw-Hill 2006.

REFERENCES:

1. George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, Wastewater Engineering: Treatment and Reuse, McGraw-Hill, 2002.
2. Stum, M and Morgan, A., Aquatic Chemistry, Plenum Publishing company, USA, 1985.
3. Lloyd, J.W. and Heathcote, J.A., Natural inorganic chemistry in relation to groundwater resources, Oxford University Press, Oxford, 1988.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1					3									3
2		3											3	
3	3		3											3
4					3									3
5									3	3				
CO (W.A)	**3**	**3**	**3**		**3**				**3**	**3**			**3**	**3**

22AGX24 - WATERSHED PLANNING AND MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To enhance the awareness about watershed planning and management • To acquire knowledge about watershed management. • To practice the water budgeting and dry farming techniques. • To learn about integrated watershed management. • To study the watershed development programmes.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the watershed characteristics for their classification and prioritization.	Ap	20%
CO2	Execute the watershed planning activities based on the inventory and scope.	An	20%
CO3	Find the needs, methods and implementation strategies of watershed management projects	An	20%
CO4	Assess the watershed responses for suggesting suitable control measures	Ap	20%
CO5	Organize the selection of hydrologic models for watershed management	Ap	20%

UNIT I –INTRODUCTION	**(9)**
Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.	
UNIT II –WATERSHED MANAGEMENT	**(9)**
Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index.	
UNIT III – WATER BUDGETING	**(9)**
Water budgeting in a watershed. Management measures - rainwater conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques- inter-terrace and inter-bund land management.	
UNIT IV – INTEGRATED WATERSHED MANAGEMENT	**(9)**
Integrated watershed management - concept, components, arable lands - agricultureand horticulture, non-arable lands - forestry, fishery and animal husbandry. Effect of cropping systems, land management and cultural practices on watershed hydrology.	

UNIT V – WATERSHED DEVELOPMENT PROGRAMMES	(9)
Watershed programme - execution, follow-up practices, maintenance, monitoring, and evaluation. Participatory watershed management - the role of watershed associations, user groups, and self-help groups. Planning and formulation of a project proposal for watershed management programme including a cost-benefit analysis.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi. .
2. Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K.Mishra. 1995. Field Manual on Watershed Management. CRIDA,Hyderabad.

REFERENCES:

1. Singh, G.D., and T.C. Poonia. 2003. Fundamentals of Watershed ManagementTechnology. Yash Publishing House, Bikaner. .
2. Tideman, E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi. .

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	2												2	
3			3										3	
4				2				1				1	3	
5													3	
CO (W.A)	2.5	3	3	2				1				1	3	

22AGX25 - GROUNDWATER WELLS AND PUMPS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To provide students with an understanding of the principles of groundwater and its behavior. • To introduce the methods and technologies used in groundwater exploration, development, and management. • To familiarize students with the design and installation of wells and pumping systems. • To learn about groundwater quality. • To study the sustainable groundwater management.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the Identify the sources and availability of groundwater in a given area.	Ap	20%
CO2	Design and construct wells for accessing groundwater.	An	20%
CO3	Evaluate Assess the Select and operate pumps for groundwater extraction.	Ap	20%
CO4	Find the water quality of groundwater resources.	Ap	20%
CO5	Find sustainable management practices for groundwater resources.	Ap	20%

UNIT I –INTRODUCTION TO GROUNDWATER RESOURCES	**(9)**
Sources and availability of groundwater, groundwater exploration methods, hydrologic cycle and water budget, water quality parameters and their significance, water scarcity issues and solutions.	
UNIT II –WELLS	**(9)**
Types of wells, design principles and construction methods, logging and interpretation, well development, well rehabilitation, wellhead protection, well maintenance and troubleshooting.	
UNIT III – PUMPS	**(9)**
Types of pumps and their selection criteria, operating characteristics and performance evaluation, pump installation and operation, energy efficiency of pumps, pump maintenance and troubleshooting.	

UNIT IV –GROUNDWATER QUALITY	(9)
Parameters affecting water quality, water quality standards and guidelines, water quality testing methods, interpretation of water quality data, water treatment options, safe use and disposal of water.	
UNIT V – SUSTAINABLE GROUNDWATER MANAGEMENT	**(9)**
Groundwater management principles, groundwater monitoring and modeling, groundwater recharge techniques, conjunctive use of surface and groundwater resources, integrated water resources management, policies and regulations for sustainable groundwater management.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007 . .
2. Bhagu R. Chahar, Groundwater Hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017

REFERENCES:

1. Subramanya K, Fluid Mechanics and Hydraulic Machines: Problems and Solutions, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2018. .
2. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014 .

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	2													
3			3											
4				3								1	3	
5													3	
CO (W.A)	2.5	3	3	3								1	3	

22AGX26 - WATER HARVESTING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To enhance the awareness about water resources management and conservation. • To acquire knowledge about water harvesting techniques and their implementation. • To practice the design aspects of sustainable rainwater harvesting solutions for communities. • To learn about construction of flood water and groundwater harvesting. • To study the design aspects of water harvesting systems.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the basic concepts of water conservation and water harvesting based on watershed.	Ap	20%
CO2	Implement the methods of water harvesting and their design criteria based on the hydrogeology.	Ap	20%
CO3	Analyze various flood water and groundwater harvesting techniques..	An	20%
CO4	Find the suitable soil erosion control structures with their design criteria based on the flow hydraulics.	Ap	20%
CO5	Assess various water storage structures with detailed design criteria.	Ap	20%

UNIT I –WATER RESOURCES AND CONSERVATION CHALLENGES	**(9)**
Global water distribution – primary and secondary sources of water – technical social and cultural aspects; Global challenges in water and climate – water scarcity – water pollution – Indian scenario; Watershed – water resources management – public participation – integrated approach; Water governance – water sharing plans – policy, schemes and concerns.	
UNIT II –WATER HARVESTING CONCEPTS	**(9)**
Earthen embankments - functions - advantages and disadvantages -classification - hydraulic fill and rolled fill dams - basic design concepts - site selection - foundation requirements - grouting -harvesting principles - components - catchment and reservoir yield.	
UNIT III – WATER HARVESTING TECHNIQUES	**(9)**
Water harvesting principles for rural and urban – classification based on source, storage and use; Short-term and micro-level harvesting techniques for runoff – terracing and bunding – rock and ground catchments; Long-term and macro-level harvesting techniques for runoff – farm ponds.	

UNIT IV –FLOOD WATER AND GROUNDWATER HARVESTING	(9)
Floods – causes of urban floods and droughts – characteristics of water spread – impacts; Flood water harvesting – permeable rock dams – water spreading bunds – flood control reservoir; Groundwater harvesting – aquifer characteristics – subsurface techniques – infiltration wells – recharge wells – groundwater dams.	
UNIT V – DESIGN ASPECTS OF WATER HARVESTING SYSTEMS	**(9)**
Estimation of water quantity – selection of runoff coefficients – computation of rainwater runoff volume – hydrograph analysis; Design of drainage system – types – design criteria – filter design – causes of failures; Design of storage structures - storage capacity.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. Theib YO, Dieter P, Ahmed YH, Rainwater Harvesting for Agriculture in the Dry Areas, CRC Press, Taylor and Francis Group, London, 2012 . .
2. Lancaster, Brad. Rainwater Harvesting for Drylands and Beyond, Volume 1, 3 rd edition, Rain source Press. 2019

REFERENCES:

1. Das M, Open Channel Flow, Prentice Hall of India Pvt. Ltd., New Delhi, 2008 .
2. Agriculture in the Dry Areas, CRC Press, Taylor and Francis Group, London, 2012.
3. Michael AM, Ojha TP, Principles of Agricultural Engineering, Volume II, 4th Edition, Jain Brothers, New Delhi, 2003 .

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2														
3			3											
4				3				1				1		
5													3	
CO (W.A)	3	3	3	3				1				1	3	

22AGX27 - ON FARM WATER MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE REQUISITE : NIL

Course Objective:	• To impart on farm water management , techniques and its history • To acquire the knowledge on design of irrigation channels • To gain the knowledge on command area development programme • To understand the concept of water balance and water pricing in command area • To impart knowledge on economic indicators for the cost-benefit analysis of on farm water management projects

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design water distributing system in command area	Ap	20%
CO2	Apply the Kennedy's and Lacey's theories and Markov chain method in rainfall analysis	Ap	20%
CO3	Analyze the concepts related to on farm water management	An	20%
CO4	Examine water use efficiency in field level and water pricing in command area and make an oral presentation of the application and developments in water balance	Ap	20%
CO5	Organize the economic indicators for the cost-benefit analysis of on farm water management projects	An	20%

UNIT I - DESIGN OF IRRIGATION CHANNELS	**(9)**
Design of Erodible and Non-Erodible, Alluvial channels- Kennedy‟ s and Lacey‟ s Theories - Materials for Lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land Leveling methods.	
UNIT II - COMMAND AREA	**(9)**
Command area - Concept – CADA Programmes in Tamil Nadu - Duty of water - expression - relationship between duty and delta - Warabandhi - water distribution and Rotational Irrigation System – case studies.	
UNIT III - CONJUNCTIVE USE OF SURFACE AND GROUNDWATER	**(9)**
Availability of water - Rainfall, canal supply and groundwater – Irrigation demand - water requirement and utilization - Prediction of over and underutilization of water – Dependable rainfall – Rainfall analysis by Markov chain method – Probability matrix.	
UNIT IV - WATER BALANCE	**(9)**
Groundwater balance model – Weekly water balance - Performance indicators – Adequacy, Dependability, Equity and efficiency – conjunctive use plan by optimization – Agricultural productivity indicators – Water use efficiency.	
UNIT V - SPECIAL TOPICS	**(9)**
National water policy - Institutional aspects - Socio-economic perspective- Reclamation of salt affected soils- Seepage loss in command area- Irrigation conflicts- Water productivity – Water pricing.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS

1. Michael, A.M. Irrigation Theory and practice, Vikas publishing house, New Delhi, 2006
2. Keller, .J. and Bliesner D.Ron, 2001 Sprinkler and Trickle irrigation, An ari book, Published by Van No strand Rein hold New York.

REFERENCES:

1. Israelson, 2002, Irrigation principles and practices, John Wiley & sons, New York.
2. Modi, P.N., 2002. Irrigation and water resources and water power engineering, Standard Book House, New Delhi.
3. Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.
4. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1			3										3	
2	3												3	
3		3												
4				2										
5						1		1			2			
CO (W.A)	3	3	3	2		1		1			2		3	

22AGX28 - BUILDING MATERIALS, ESTIMATION AND COSTING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand the fundamental knowledge on different building materials. • To impart knowledge on design of different aspects of building construction. • To select materials, design and supervision of suitable type of foundation. • To impart knowledge on design of different aspects of building construction. • To learn to prepare detailed estimate and cost estimate of buildings.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of brick manufacturing to identify suitable types for specific construction needs.	Ap	20%
CO2	Determine the water cement ratio based on the material properties and its classifications	An	20%
CO3	Apply knowledge of masonry types to simple building design scenarios.	Ap	20%
CO4	Analyze test results and quality control measures related to concrete cube strength.	An	20%
CO5	Calculate the expenditure of item wise building materials used for construction of a building.	Ap	20%

UNIT I – CONSTRUCTION MATERIALS	(9)
Classification of rocks - Characteristics of Stones -Testing of Stones-Manufacture of Bricks - Moulding – Drying and Burning of bricks-Properties of good Brick -Classification of bricks -Clay Products- Ceramics - Tiles -Earthenware and Stoneware and uses.	
UNIT II –LIME AND CEMENT	(9)
Lime-Natural Sources -Types of lime - Calcination-Cement -Raw materials - Water Cement Ratio. Manufacture of Portland Cement Wet and Dry process-Standard Specifications- Storage of cement-Timber - Definition -Defects in timber-Qualities of good timber.	
UNIT III –STONE MASONRY AND FOUNDATION	(9)
Concept of Foundation -Factors affecting Selection of Foundations -Types of soils-Subsurface Investigations - Bearing Capacity of soil -Testing & Improving Bearing Capacity of soil- Types of Foundations-Piles - Foundation in Black Cotton soil-Site Selection - General principles - classification of brick masonry-precautions in brick masonry -Stone Masonry -Comparison between Brick and Stone Masonry - Classification -General Principles and precautions in stone masonry.	

UNIT IV –BUILDING CONSTRUCTION	(9)
Walls -Classification of walls - Dampness -Causes of Dampness -Methods of Preventing Dampness - Damp Proofing materials - Methods of providing Damp Proofing Materials-Mortars -Functions and Types of mortars - Concrete -Characteristics -Types and uses - Cube Strength of Concrete -Roofs - Classification - Floors -Types of Floor-Types of Plastering and Pointing -Painting and Distempering.	
UNIT V – ESTIMATING AND COSTING	(9)
PWD schedule of rates - data sheet - detailed estimate - abstract estimate - preparation of estimate market rate estimation-Contract and Types of Contracts-Tender-Tender form.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. B.N. Datta, Estimation and costing. Published by the Author, Tagore Palli, Motilal Bose road, Lucknow, 2014
2. S.C Rangwala, Estimating and costing, Charotar book stall, Station road, Anand, 2011.

REFERENCES:

1. National Building Code(NBC) of India
2. PWD Schedule Rates 2024.
3. B.L. Handoo and V.M. Mahajan, Civil engineering materials. Sathyaprakasam, 16/7698, New market, New Rohtak road, New Delhi-5, 2015
4. S.C. Rangwala, Building construction, Charotar publishing house, Anand, 2000
5. S.V Deodhar and Singhal, Civil engineering materials. Khanna publishers, 2B, Nath market, Naisark, Delhi - 2001

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	3												3	
3			3										3	
4				3				2				2	3	
5														
CO (W.A)	3	3	3	3				2				2	3	

22AGX31 - EMERGING TECHNOLOGIES IN FOOD PROCESSING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To gain a deep insight on processing foods and its variation in texture under high pressure, high intensity, cold plasma and cryogenic grinding.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principle of cold plasma technology and cryogenic grinding in food to infer the changes	Ap	20%
CO2	Identify the suitable method of heating techniques applied to foods for its conditional changes.	An	20%
CO3	Infer the results of high intensive heating of foods to observe the temperature changes under varying climatic conditions	E	20%
CO4	Review the non thermal processing technique applied for foods in various food applications.	Ap	20%
CO5	Analyze the difference in radio frequency and microwave heating of food preparation	Ap	20%

UNIT I- NON - THERMAL PROCESSING TECHNIQUES:	**(9)**
Introduction- Need for, non- thermal processing techniques, scope, non- thermal techniques membrane technology, High Pressure Processing, Pulse electric field, Ultra sound, Super critical fluid extraction techniques- Concept, property of near critical fluids NCF and extraction methods. Application of SCFE in food processing.	
UNIT II -MICROWAVE AND RADIO FREQUENCY:	**(9)**
Microwave and radio frequency, IR drying: Definition, Advantages, mechanism of heat generation, inductive heating in food processing and preservation. Application in food processing: microwave blanching, sterilization and finish drying.	
UNIT III- HIGH PRESSURE PROCESSING OF FOODS:	**(9)**
High Pressure processing: Principle, Mechanism and Effect of HPP on -fruit juices, meat products, jam. Types of equipment, mechanism of microbial inactivation.	
UNIT IV- HIGH INTENSITY LIGHT AND OHMIC HEATING:	**(9)**
High intensity light generation system, Application of high intensity light in food processing, Pulse electric field-mechanism of inactivation, PEF generation system, PEF treatment chambers, Mechanism of ohmic heating and its application in liquid food processing.	
Unit V- COLD PLASMA TECHNOLOGY AND CRYOGENIC GRINDING	**(9)**
Principle of cold plasma technology and its generation systems and its application, Cryogenic grinding-Properties of cryogens, systems, and their different application.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Barbosa-Canovas Novel Food Processing Technologies. CRC Press 2002 .
2. Dutta AK & Anantheswaran RC Handbook of Microwave Technology for food Applications CRC Press 1999.
3. Tönu, P Principles of Food Toxicology CRC Press 2007.

REFERENCES:

1. Han Jung H., "Packaging for Non-thermal Processing of Food", 1st Edition, Wiley-Blackwell, Oxford, 2007.
2. Mujumdar A.S., "Handbook of Industrial drying", 4th Edition, CRC Press, UK, 2014.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												3	
3	3		3										3	
4	3			2									3	3
5		3											3	3
CO(W.A)	3	3	3	2									3	3

22AGX32 - STORAGE AND PACKAGING TECHNOLOGY				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To gain knowledge on different storage methods and understand the storage losses and types of spoilage. • To discuss the functions, types and applications of different packaging materials

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Assess the importance of various storage systems	An	20%
CO2	Analyze food losses occurred during the storage	An	20%
CO3	Apply different control measures to prevent food spoilage	Ap	20%
CO4	Analyze novel food packaging technique and innovation in food packaging	An	20%
CO5	Propose a suitable packaging methodology depending on the requirement of the consumer	C	20%

UNIT I - SPOILAGE AND STORAGE LOSSES	**(9)**
Factors affecting shelf of food material during storage, spoilage mechanism during storage – intrinsic and extrinsic factors causing spoilage, infestation – Control measures	
UNIT II - STORAGE METHODS	**(9)**
Traditional, Improved and modern storage structures for food materials -temperature and moisture changes in storage structures	
UNIT III –BASICS OF PACKAGING MATERIALS	**(9)**
Definition, requirement, importance and scope of packaging of foods, types and classification of packaging system, advantage of modern packaging system	
UNIT IV –FORMS OF PACKAGING MATERIALS	**(9)**
Different forms of packaging, metal container, glass container,plastic container,flexible films,shrink packaging,vacuum & gas packaging, advanced packaging systems	
UNIT V - SELECTION OF PACKAGING TECHNIQUES	**(9)**
Packaging requirement & their selection for the raw & processed foods – Meat, Fish and seafoods, fruits and vegetables, milk	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=28
2. D.W.Hall 1990. Handling and Storage of Food grains in tropical and sub tro[pical areas. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Richard Coles, Derek Mcdowell and Mark J. Kirwan. 2003. Food Packaging Technology, CRC press, London. 2nd Edn
4. GordenL.Roberttson. 2006. Food Packaging-Principles and Practices. CRC

REFERENCES:

1. Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2. Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi
3. Chakaraverty, A. 2000. Third edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co. Pvt. Ltd. New Delhi.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1				2										
2				2										
3	3													
4		3										2		3
5			3									2		3
CO (W.A)	3	3	3	2								2		3

22AGX33 - REFRIGERATION AND COLD CHAIN MANAGEMENT $				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To maintain quality, safety, and shelf life. Continuous monitoring systems should be in place to detect and address any deviations promptly. • To minimize energy consumption and reduce environmental impact. • To strict hygiene standards, regular equipment maintenance, and proper handling procedures. • To proper documentation, labeling, and adherence to industry standards. • To reduce product losses due to temperature fluctuations, handling errors, or equipment failures.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of refrigeration to analyze the performance of vapour compression systems using T-S and p-h diagrams.	Ap	20%
CO2	Demonstrate the working of refrigeration components such as compressors, condensers, evaporators, and cooling towers through system-level analysis.	An	20%
CO3	Select appropriate refrigerants based on their properties and environmental impact, and compare the performance of vapour absorption and compression systems.	Ap	40%
CO4	Apply concepts of air conditioning to evaluate the operation of comfort and industrial systems across seasonal variations and different configurations.	Ap	20%
CO5	Collaborative application of refrigeration concepts in real-world case studies.	Ap	Internal Assessment

UNIT I - REFRIGERATION -VAPOUR COMPRESSION SYSTEM:	**(9)**
Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - simple vapour compression cycle – T-S diagram – p-h chart- vapour compression system-different types-solving problems	
UNIT II - REFRIGERATION COMPONENTS:	**(9)**
Refrigeration components – compressor – classification - principle and working – condensers -types - construction, principle and working. Evaporators – types-principle and working. – cooling towers.	
UNIT III - REFRIGERANTS AND VAPOUR ABSORPTION CYCLE:	**(9)**
Refrigerants – properties – classification – – selection of refrigerants - effect on environmental pollution - alternate refrigerants - vapour absorption cycle – simple and practical vapour absorption system- advantages- ideal vapour absorption system- Electrolux refrigerator - construction and principles.	
UNIT IV - AIR CONDITIONING SYSTEM:	**(9)**

Air conditioning systems-equipments 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.	
UNIT V - COLD CHAIN MANAGEMENT IN STORAGE AND FARMING:	**(9)**
Role and importance of refrigerator vehicle. Design of cold storage. Applications: ice – plant – food storage plants – milk chilling plants. Refrigeration during sorting, processing, packaging. Cold chain concept to minimize post harvest losses	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Sadhu Singh. 2017. Refrigeration and Air Conditioning. Khanna Book Publishing Co. (P). Ltd.
2. Kurmi.R.S and J.K.Gupta. 2002. A Text book of Refrigeration and Air conditioning. Eurasia Publishing House (P) Ltd, Ram Nagar, New Delhi.

REFERENCES:

1. Bellaney, P.L. 2001. Thermal Engineering. Khanna Publishers, New Delhi.
2. William, H.S., R.F. Julian, 1986. Air conditioning and Refrigeration. John Wiley & Sons, Inc. London.
3. Arora, C. P. 1981. Refrigeration and Air conditioning. Tata-McGraw-Hill Publishing Co., New Delhi.

Mapping of COs with POs / PSOs

	Pos												**PSOs**	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2		3											3	
3			3											3
4	3													
5							3		3			1		
CO (W.A)	**3**	**3**	**3**				**3**		**3**			**1**	**3**	**3**

$ Ratified by Thirteen Academic Council

22AGX34 - FOOD PROCESS EQUIPMENT AND DESIGN				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Apply principles of design to various food processing equipment. • Evaluate design considerations and materials of construction for different types of equipment used in food processing.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of design and selection to food processing equipment.	Ap	20%
CO2	Evaluate design aspects and materials of construction for pressure vessels, storage tanks, and pulpers.	E	20%
CO3	Analyze design considerations and materials of construction for various types of dryers and extruders	An	20%
CO4	Evaluate design principles and materials of construction for heat exchangers and evaporators.	E	20%
CO5	Analyze design considerations for size reduction and material conveying equipment.	An	20%

UNIT I- DESIGN OF PRESSURE VESSELS, STORAGE TANKS AND PULPER	**(9)**
Introduction to design - principles and selection of food processing equipment - design of pressure vessels - design aspects of storage tanks, design of sterilizers and process vats - design of pulper - design considerations - materials of construction - installation and operation.	
UNIT II - DESIGN OF HEAT EXCHANGERS AND EVAPORATORS	**(9)**
Design of heat exchangers - plate heat exchanger, shell and tube heat exchangers - materials of construction - installation and operation - design of single effect evaporators - applications -multiple effect evaporators entrainment separators-installation and maintenance.	
UNIT III - DESIGN OF DRYERS AND EXTRUDERS	**(9)**
Design of dryers - cabinet dryer, fluidized bed dryer, heat pump dryer, foam mat dryer - freeze dryer - Spray dryer - design considerations, installation, operation and maintenance - design considerations of food extruders - single and twin screw extruders - installation, operation and maintenance of food extruders.	
UNIT IV - DESIGN OF COLD STORAGE AND FREEZERS	**(9)**
Design of cold storage - estimation of cooling load - construction, operation and maintenance of cold storage -design consideration for controlled atmospheric storage and modified atmospheric storage of perishables - design of freezers - types of freezers - design considerations - construction and operation- design of frozen storage.	
UNIT V – DESIGN OF SIZE REDUCTION AND CONVEYING EQUIPMENTS	**(9)**
Design consideration of size reduction equipment- installation and maintenance-design consideration of material conveying equipment- belt conveyor- screw conveyor - bucket elevator- pneumatic conveyor.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. P.S. Phirke, "Processing and conveying equipment design", Jain Brothers, New Delhi, 2004
2. M.V. Joshi and V.V. Mahajani, "Process Equipment Design" (3rd edition), New India Publishing Agency, New Delhi, 2004.

REFERENCES:

1. Jasim Ahmed and Mohammad Shafiur Rahman (Editors), "Handbook of Food Process Design", John Wiley and Sons, Ltd., U.K., 2012
2. Zacharias B. Maroulis and George D. Saravacos, "Food Process Design, Marcel Dekker", Inc. U.S.A, 2003

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2		3								3	
2		3		3		2							3	
3		3	2	3										
4	2		3		2									
5		3		3						3				
CO(W.A)	2.5	3	2.3	3	2.5	2				3			3	

22AGX35 - PROCESSING OF FRUITS AND VEGETABLES				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE: Nil

Course Objectives:	• To equip students with comprehensive knowledge and practical skills in post-harvest technology, focusing on the classification, nutritional profile, processing and optimal storage of horticulture crops, its strategies to maintain quality and extend shelf life of fruits and vegetables.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Articulate various preservation techniques, effective process of horticultural products and produce value-added items.	An	20%
CO2	Analyze the physiological and biochemical changes during fruit ripening and storage, and evaluate how these changes impact the quality and nutritional value of horticultural crops.	An	20%
CO3	Infer different drying and dehydration methods, assess their impact on the quality of dried products, and troubleshoot common issues related to the storage and maintenance of dehydrated horticultural commodities.	An	20%
CO4	Apply appropriate post-harvest technology techniques to enhance the quality and shelf life of various fruits and vegetables, incorporating methods for cleaning, grading, and processing.	Ap	20%
CO5	Summarize a report with a presentation as a team member on the recent advancement in food processing sector with a case study.	An	20%

UNIT I- POST- HARVEST, COMPOSITION AND RIPENING	**(9)**
Fruits and vegetables: classification, nutritional profile - Importance of post-harvest technology of horticultural crops – composition and nutritive value of horticultural crops – fruit ripening – Post-harvest physiological and biochemical changes in fruits and vegetables; maturity indices and standards for selected fruits and vegetables.	
UNIT II – CLEANING, GRADING AND ON-FARM PROCESSING	**(9)**
Harvesting and washing of fruits, vegetables – cleaning and grading - peeling - equipments – construction and working – pre-cooling – importance, methods. Commodity pretreatments -chemicals, wax coating, pre-packaging.	
UNIT III – PRESERVATION OF HORTICULTURAL CROPS	**(9)**
Thermal and non-thermal techniques for preservation of fruits and vegetables- minimal processing - quick freezing – canning – processing and concentration of juice - membrane separation process and application - hurdle technology. Preparation of processed products – Jam, jelly, squash, sauce, preserve and pickle.	
UNIT IV – DRYING AND DEHYDRATION	**(9)**
Drying and Dehydration of horticultural crops– types of dryers, principles, construction and working - methods – solar, cabinet, fluidized bed dryer, spouted bed dryer, foam mat drying and osmotic dehydration – Problems related to storage of dried and dehydrated products.	

UNIT V – STORAGE	(9)
Storage of horticultural commodities – storage under ambient conditions, low temperature storage - chilling, frozen storage- chilling injury - freeze burn, evaporative cooling – cold storage of horticultural commodities – estimation of cooling load - controlled atmosphere storage–modified atmosphere storage - concepts and methods – gas composition - Changes during storage.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS

1. Srivastava R.P. and Kumar, S., "Fruit and Vegetable Preservation: Principles and Practices", Third Edition, CBS Publishers & Distributors, New Delhi, 2002.
2. Norman W. Desrosier, and James N. Desrosier. The Technology of Food Preservation 4th Edition, CBS Publisher & Distributions, New Delhi, 2004.
3. Sudheer K. P. and Indra, V., "Post-harvest Technology of Horticultural Crops", New India Publishing Company, New Delhi, 2007.

REFERENCES:

1. Heid, J. L. and Joslyn, M. A., "Food processing operations". Vol. II. AVI Publishing Co. Inc. Westport, Connecticut, 1983.
2. Potter, N.N., "Food science". AVI Publishing Co. Inc.Westport, Connecticut, 2nd edition, 1976.
3. Lal G., Siddapa G. S. and Tandon G. L., "Preservation of Fruits and Vegetables", ICAR, 1986.
4. Thompson A.K., "Post-Harvest Technology of Fruits and Vegetables", Blackwell Sci., 1995.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3												3
3			3											3
4	3				3									3
5									3	3				
CO(W.A)	**3**	**3**	**3**		**3**				**3**	**3**				**3**

22AGX36 - FOOD PLANT DESIGN AND MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• Apply process charts and machinery layouts that enhance workflow efficiency, minimize product handling, and ensure compliance with hygiene and safety standards. • Implementing of sustainable practices and safety measures in food plant design and management and efficient utilization of resources like energy and water, waste reduction strategies, and adhering to environmental regulations.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret electrical and water supply layouts considering fittings, accessories and ensuring efficient operation and maintenance for food processing plant environments.	Ap	20%
CO2	Evaluate the layout options for different food processing sectors such as fruit and vegetable processing, meat processing, and bakery products.	E	20%
CO3	Analyze alternative methods for equipment maintenance and repair to optimize operational efficiency	An	20%
CO4	Apply knowledge of concrete characteristics to select appropriate types for food plant construction.	Ap	20%
CO5	Apply production planning and control techniques in both continuous and intermittent production environments with network planning methods.	Ap	20%

UNIT I - PLANT LOCATION AND LAYOUTS	(9)
Introduction to food plant design - special features of food and agricultural process industry - plant location - location factors, site selection, location theory and models - layout - objectives, classical and practical layout – preparation of process chart and machinery layout – product layout and process layout - plant layout fruit, vegetables and meat processing, size reduction machinery, bakery products, milk and milk products, solid – liquid and liquid – liquid separation plant-, evaporation plant, drying plant, bake ovens and frying plant, heat exchanger plant, refrigeration and air conditioning plant, boiler, packaging plant.	
UNIT II – PLANT CONSTRUCTION AND MATERIALS	(9)
Construction materials – sand, brick, cement, steel and wood – manufacture of bricks and types of kilns - refractory bricks - cement – properties, types and uses - testing and storage of cement - foundations – bearing capacity of soils, testing the bearing capacity - brick masonry - types of bonds - stone masonry – mortars - functions, types and their uses, functions of sand and surkhi in mortars and preparation of mortars - concretes – characteristics, types, uses and reinforced cement concrete - roofs – classification of roofs – steel and wooden sloping roofs – lean to roof - types of flat roofs and types of floorings.	

UNIT III – ELECTRICAL AND WATER SUPPLY	(9)
Estimation of services - peak and critical load – preparation of electrical layout – selection of fittings and accessories for electrical and water supply – provision of water supply – design of water storage system - selection of pipe, valves and safety devices - drainage – systems, pipeline, traps, safety devices - illumination and ventilation – materials, mounting, operation and maintenance - layout for effluent treatment plant – safe disposal of effluent.	
UNIT IV – PRODUCTION PLANNING AND CONTROL	(9)
Production planning and control – continuous and intermittent production – scheduling - routing and dispatching - activity chart and Gantt chart - net work planning methods – PERT and CPM -applications - method study – work study – methods – man-machine chart - time study – standard time of a job - inventory control – economic ordering quantity – inventory models.	
UNIT V - REPAIR AND MAINTENANCE OF EQUIPMENT	(9)
Repair and maintenance of equipment – preventive maintenance and breakdown maintenance – replacement of equipment – alternative methods and analysis – method of annual equivalence, present worth method and internal rate of returns.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. O.P.Kanna.2003. Industrial Engineering and Management. DhanpatRai Publication (P) Ltd. New Delhi.
2. S.P.Arora and S.P.Bindra. 2014. A Text Book of Building Construction.5th edition. Dhanpat Rai Publications (p) Ltd. New Delhi.

REFERENCES:

1. Zacharias B. Maroulisand George D. Saravacos.2003. Food Process Design. Marcel Dekker, Inc. U.S.A
2. Antonio López-Gómez and Gustavo V. Barbosa-Cánovas. 2005. Food Plant Design. CRC.London.
3. C.S.Rao.1999. Environmental Pollution Control Engineering. New age International (P) Ltd, New Delhi.

Mapping of COs with POs / PSOs

	Pos												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3		3		2									3
2	3		3											3
3	3		2											
4	3													
5	3		2											
CO (W.A)	**3**		**3**											**3**

22AGX37 - FOOD QUALITY AND SAFETY				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• Apply quality assessment techniques to evaluate various food materials, including fruits, vegetables, cereals, legumes, dairy products, meat, poultry, eggs, and processed foods, ensuring that quality attributes meet industry standards. • Implement quality control and safety standards by understanding national and international food laws, regulations, and best practices, thereby contributing to the production and distribution of safe and high-quality food products.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the functions and importance of quality control in the food industry, including the implementation of standards and specifications.	An	20%
CO2	Apply quality assessment techniques to evaluate the quality of fruits, vegetables, cereals, legumes, dairy products, meat, poultry, eggs, and processed foods.	Ap	20%
CO3	Develop quality control measures for food storage, processing, and marketing to ensure compliance with international standards and quarantine requirements.	Ap	20%
CO4	Implement safety measures to prevent food spoilage, contamination, and adulteration, including the management of food additives and toxicants.	AP	20%
CO5	Evaluate the implications of various national and international food laws, standards, and certifications, including FSSAI, FDA, ISO, HACCP, and others.	E	20%

UNIT I- FOOD QUALITY AND QUALITY EVALUATION OF FOODS	(9)
Food Quality - its need and its role in Food Industry, Food Quality and Quality Attributes-Classification of Quality Attributes and their role in food Quality, Quality Assessment of Food materials -Fruits, vegetables, cereals, legumes, dairy products, meat, poultry, egg and processed food, Sensory Evaluation of Food Quality, Requirements for conducting Sensory Evaluation, Methods of Sensory Evaluation and Evaluation cards, Different methods of Quantitative descriptive analysis.	
UNIT II - QUALITY CONTROL	(9)
Objectives, Importance and Functions of Quality Control, Quality control specifications, training of food technologists for quality control, implementation of standards and specifications, Quality control, principles of quality control - raw material control, process control, finished product inspection, process control, quality problems and quality improvement techniques- mechanization, future of quality control, Total quality management, Objective/Instrumental analysis of Quality Control.	
UNIT III - NATIONAL AND INTERNATIONAL FOOD LAWS AND STANDARDS	(9)
Standards for food packaging and labelling - FSSAI, Bureau of Indian Standards (BIS), Agricultural Grading and Marketing (AGMARK), The Agricultural and Processed Food Product Export Development Authority (APEDA), MPEDA. Food and Drug Administration Act (FDA), International Organization for Standards	

(ISO) and its implication, generally recognized as safe (GRAS), European Council (EU), Codex Alimentarius Commission (CAC), Total Quality Management (TQM), Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP), and Good Hygienic Practices (GHP), GMP, Hazard Analysis Critical Control Point (HACCP), FSMA, Legal Metrology Rules, Food Safety Standards for Organic foods, GFSi, HALAL and KOSHER.	
UNIT IV - QUALITY CONTROL MEASURES IN INDUSTRIAL AND MARKETING CENTRES	(9)
Quality control system in storage, Quality control aspects in food industries, Importance of quality control in marketing of Food products - domestic and export markets. International standards for export and quarantine requirements for export of Agricultural and Horticultural produce.	
UNIT V – FOOD SAFETY	(9)
Food safety - General principles of food safety. Characterization of food Hazards - physical, chemical and biological, Food spoilage and food borne infection hazards-sources of food spoilage and microorganisms-microbial problems in food safety-food toxicants and food poisoning – prevention, Cross contamination, Limits for pesticide and metal contamination of food. Adulteration, Food additives- types- usage, permissible limits, concept of safe food.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Manoranjan Kalia, "Food analysis and Quality control", Kalyani Publishers, Ludhiana, 2002.
2. Mehta, Rajesh and J. George, "Food Safety Regulation Concerns and Trade: The Developing Country Perspective", Macmillan, 2005.

REFERENCES:

1. P.A. Luning, F. Devlieghere and R. Verhe, "Safety in the agri - food chain", Wageningen Academic Publishers, Netherland, 2006.
2. Leo and M.L. Nollet, "Handbook of food analysis" - Methods and Instruments in applied food analysis, Marcel Dekker Inc., 2004

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1												3
2		3	2										3	
3			2		3									
4							2	2						3
5				3		3							3	
CO (W.A)	2	2	2	3	3	3	2	2					3	3

22AGX38 - DAIRY TECHNOLOGY				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Develop practical skills in microbiological analysis, product preparation, grading, and quality control measures essential for ensuring the safety and quality of milk and dairy products. • Understanding of milk composition, including the factors influencing its constituents and the physio-chemical properties of milk components.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret microorganisms associated with milk and dairy products, evaluate their impact on product quality and safety, and apply appropriate microbiological control measures.	Ap	20%
CO2	Execution of Preparation, judging, grading, and identification of defects in dairy products such as cream, butter, ghee, cheese, and fermented products, adhering to AGMARK standards and quality specifications.	Ap	20%
CO3	Analyze and interpret the constituents of milk, including proteins, lipids, carbohydrates, enzymes, and minerals, and apply this knowledge to assess the quality and composition of various dairy products.	An	20%
CO4	Identifying and mitigating sources of contamination during milk collection, transportation, and processing, applying quality control measures and ensuring compliance with hygienic standards in dairy product processing.	Ap	20%
CO5	Apply knowledge of the collection, processing, preservation, and utilization of dairy by-products such as skim milk, whey, and buttermilk, emphasizing their composition, nutritive value, and applications in food processing.	Ap	20%

UNIT I- MILK COMPOSITION	**(9)**
Introduction – Constituents of milk – factors affecting composition of milk – physico – chemical properties of milk constituents – milk protein – milk lipids – milk carbohydrates – milk enzymes – minerals in milk – milk and utensils – preservatives, neutralizers and adulterants in milk.	
UNIT II – MICROBIOLOGY OF MILK AND MILK PRODUCTS	**(9)**
Introduction – Micro – Organisms associated with milk and milk products – Microbiology of cream, butter, dried milk condensed and evaporated milk – frozen desserts – indigenous milk products, microbiology of starter cultures and fermented milk products – milk borne pathogens.	
UNIT III – PREPARATION AND GRADING OF DAIRY PRODUCTS	**(9)**
Introduction – preparation, judging, grading and defects of cream, butter and ghee – AGMARK standards - Frozen dairy products – concentrated and dried milk products – Cheese and other fermented products – indigenous milk products.	

UNIT IV – DAIRY BY PRODUCTS	(9)
Collection, processing and preservation of dairy by products – composition and nutritive value of skim milk, whey and buttermilk – Utilization of dairy by products.	
UNIT V – CLEAN MILK PRODUCTION	**(9)**
Clean milk production – sources of contamination during collection – transportation and processing of milk – quality control of milk and milk products – hygienic aspects of processing of dairy products – quality standards.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. C. P. Anantha Krishnan, "Technology of Milk Processing", Sri Lakshmi Publication, 42, Harley road, Kilpauk, Chennai, 1991.
2. Sukumar, De., "Outlines of Dairy Technology", Oxford University Press, 1980.

REFERENCES:

1. Shivashraya Singh, "Dairy Technology – Dairy Products and Quality Assurance", Zaccheus Entertainment Publication, Vol. 2, 2014.
2. Eckles, "Milk and Milk Products" Arobacterial Publishers, Bikaner, New Delhi, 1990.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2											
2	3		2		2									3
3	3													
4	2				2		1							3
5	2													
CO (W.A)	3		2		2		1							3

22AGX41 - AGRICULTURAL BUSINESS MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To understand the functions and planning of a business related to agricultural products in order to meet the global demands of agricultural marketing by effective utilization of the resources available.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Plan and exhibit agri business project to the marketing field	Ap	20%
CO2	Estimate the constraints involved in marketing agricultural products to reach the Indian Market	An	20%
CO3	Assess the management techniques involved for improving the business strategy in agricultural marketing	Ap	20%
CO4	Apply the principles of effective marketing strategy to achieve monetary benefit in agri business	An	20%
CO5	Analyse the concepts of business management for a wise decision process	An	20%

UNIT I - MANAGEMENT CONCEPTS & PRINCIPLE:	**(9)**
Basic Concepts of Management, Management and Manager, Managerial Environment, Decision Making Process, Management Functions- Planning, Organizing, Staffing, Leading and Leadership, Controlling.	
UNIT II - MARKETING MANAGEMENT:	**(9)**
Concepts of Marketing, Marketing Environment, Product Development and Product Lifecycle, Product Pricing and Pricing Strategies, Distribution Decisions, Promotional Decisions.	
UNIT III - CONCEPTS AND APPLICATION OF MANAGEMENT PRINCIPLES TO AGRIBUSINESS:	**(9)**
Nature and Characteristics of Agribusiness, Agro-based Industries in India, Agricultural Supply Chain Management, Strategic Management in Agribusiness, Risk Management in Agribusiness, Contract Farming, ICT in Agribusiness.	
UNIT IV - PRODUCTION, CONSUMPTION, PROCESSING AND MARKETING OF AGRICULTURAL PRODUCTS:	**(9)**
Agricultural Produce, Agricultural Marketing Functions, Classification of Markets, Agricultural Market Functionaries, Regulated Agricultural Markets , Cooperative Agricultural Marketing, Producer Surplus of Agricultural Commodities, Market Integration and Marketing Efficiency, Marketing cost-margins-price spreads, Food Processing Sector in India .	
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 (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Himanshu, "Agri Business Management – Problems and prospects", Ritu Publications, Jaipur, 2005.
2. Smita Diwase, "Indian Agriculture and Agribusiness Management", Krishi resource Management Network, Pune 2004.
3. A.C Broadway, A. A Broadway ,"Agri-Business Management",Kalyani Publishers, Ludhiana/New Delhi
4. S. S Acharya, N. L Agarwal "Agricultural Marketing in India" Oxford & IBH Publishing Co., New Delhi.,

REFERENCES:

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.

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	
2	3										3	3		
3	3										2		3	3
4		3									2		3	3
5		3				3			3		2		3	3
CO(W.A)	3	3				3			3		2.25	3	3	3

22AGX42 - ENTREPRENEURSHIP AND AGRIBUSINESS DEVELOPMENT				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To give a deep insight on Indian economy, international trade constraints in order to overcome the challenges encountered in the tenure of Entrepreneurship.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the business environment in the Indian economy, including factors influencing entrepreneurship.	Ap	20%
CO2	Understand the principles of international trade agreements in regulating trade in agricultural and food commodities.	An	20%
CO3	Enhance problem-solving skills essential for identifying, analyzing, and resolving challenges encountered in the entrepreneurial journey.	Ap	20%
CO4	Analyze entrepreneurial opportunities from an economic growth perspective	An	20%
CO5	Evaluate government schemes and incentives aimed at promoting entrepreneurship, including financial support	An	20%

UNIT I- ENTREPRENEURIAL ENVIRONMENT IN INDIAN CONTEXT	**(9)**
Entrepreneur Development(ED): Concept of entrepreneur and entrepreneurship assessing overall business environment in Indian economy- Entrepreneurial and managerial characteristics-Entrepreneurship development programmers (EDP)-Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment.	
UNIT II - AGRIPRNEURSHIP IN GLOBAL ARENA	**(9)**
Legal perspective importance of agribusiness in Indian economy – International trade-WTO agreements-Provisions related to agreements in agricultural and food commodities – Agreements on Agriculture (AOA) - Domestic supply, market access, export subsidies agreements on Sanitary and Phyto - Sanitary (SPS) measures, Trade Related Intellectual Property Rights (TRIPS).	
UNIT III - ENTREPRENEURSHIP DEVELOPMENT	**(9)**
Programme Entrepreneurship Development Programme (EDPs) objectives, phases, Government policies and programmes and schemes EDP Process-Stages, Developing organizational skills (controlling, supervision, monitoring and evaluation) Achievement Motivation, Problem solving skills	
UNIT IV -ENTREPRENEURIAL OPPORTUNITIES	**(9)**
Economic Growth Perspective Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political system and their implications for decision making by individual entrepreneurs-Economic system and its implication for decision making by individual entrepreneurs.	

UNIT V – ENTREPRENEURIAL PROMOTION MEASURES AND GOVERNMENT SUPPORT	(9)
Social responsibility of business. Morals and ethics in enterprise management- SWOT analysisGovernment schemes and incentives for promotions of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract framing (CF) and Joint Venture (JV), public-private partnerships (PPP) – overview of agricultural engineering industry, characteristics of Indian farm machinery industry.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS

1. S.S. Khanka, 2019, Entrepreneurship Development and Management, S.Chand& Company Ltd. ,India.
2. Robert D. Hisrich and Michael P. Peters, 2019 (2nd Edition), McGraw-Hill Education, USA.
3. Donald F. Kuratko and Richard M. Hodgetts, 2019 (9th Edition), Cengage Learning, India.

REFERENCES:

1. Mar J Dollinger, 1999, Entrepreneurship strategies and resources, Prentice -Hall, Upper Saddal Rover, New Jersey.
2. Thomas W Zimmer and Norman M Scarborough, 1996, Entrepreneurship, Prentice Hall, New Jersey.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2											3		
2		3												
3							3					3		3
4		3						3				3	3	3
5		3						3				3	3	3
CO (W.A)	**3**	**3**					**3**	**3**				**3**	**3**	**3**

22AGX43 - AGRICULTURAL MARKETING, TRADE AND PRICES				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To gain insight on marketing functions of agricultural products which includes prices and promotion to reach successfully and competite in the world market

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Ensure the policy, pricing and promotion strategies are done ethically and economically for competiting in the market.	Ap	20%
CO2	Contrast the traditional and modern marketing system in order to determine the slack and surplus quantity of agricultural products.	An	20%
CO3	Analyse the risk involved in marketing agri products and lead a path towards future trading process.	Ap	40%
CO4	Analyse the reasons for increased amount of marketing strategy/advertising done for commercializing the products of agriculture.	An	20%
CO5	Demonstrate the trade policies as a part of team followed for agro products and to reduce the barriers	An	Internal Assessment

UNIT I- AGRICULTURAL MARKETING – NATURE AND SCOPE	**(9)**
Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, classification and characteristics of agricultural markets. - Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities. Modern marketing systems versus traditional agricultural marketing systems.	
UNIT II - MARKETING FUNCTIONS AND MARKETING EFFICIENCY	**(9)**
Marketing process and functions: Marketing process - concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK).Definition and types of Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing, reasons for higher marketing costs of farm commodities.	
UNIT III –PRICING AND PROMOTION STRATEGIES	**(9)**
Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; Pricing andpromotion strategies: pricing considerations and approaches – cost based and competitionbased pricing; market promotion – advertising, personal selling, sales promotion.	
UNIT IV -TRADE IN AGRICULTURAL PRODUCTS	**(9)**
International Trade: Concept of International Trade and its need - Free trade, Autarky and its needs - Theories of Trade: Absolute and comparative advantage; Present status and prospects of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and nontariff barriers - Trade policy instruments – Terms of Trade-Free Trade Agreements.	

UNIT V – AGRICULTURAL PRICES AND RISK ANALYSIS	(9)
Agricultural Prices and Policy: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization. Risk in marketing: Meaning and Importance - Types of risk in marketing: Speculation and Hedging - Forward and Futures trading; an overview of futures trading.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. G.S. Bhalla and G.K. Kshirsagar, 2018,Agricultural Marketing in India, Oxford University Press India,New Delhi.
2. VenkateshPanchapagesan ,2018 , Agricultural Marketing and Supply Chain Management in India, PHI Learning Pvt. Ltd.,India.
3. PradumanKumar ,2016 , Agricultural Marketing and Price Policies in India, Springer, USA.

REFERENCES:

1.Acharya.S.S.and Agarwal,N.L.,2011,Agricultural Marketing in India, Oxford and IBH Publishing Co .Pvt. Ltd., New Delhi.

2 .Jhingan , M.L.,2011. International Economics, Vrinda Publications (P) Ltd. New Delhi.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						3		3				2		
2		3										2		
3	2	3										2		3
4	2	3										2		3
5	2								3			2	3	3
CO (W.A)	**2**	**3**				**3**		**3**	**3**			**2**	**3**	**3**

22AGX44 - EXTENSION METHODS AND TRANSFER OF TECHNOLOGY				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• Analyze new trends in agricultural extension, including digital and technological advancements. • Evaluate diffusion and adoption theories and their implications for agricultural innovation

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply communication models and principles in agricultural extension.	Ap	20%
CO2	Analyze extension teaching methods and their purposes.	An	20%
CO3	Apply capacity building strategies for extension personnel and farmers.	Ap	20%
CO4	Evaluate diffusion and adoption theories in agricultural innovation.	E	20%
CO5	Analyze new trends in agricultural extension.	An	20%

UNIT I - COMMUNICATION AND PROGRAMME PLANNING	**(9)**
Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes.	
UNIT II - EXTENSION TEACHING METHODS	**(9)**
Extension teaching methods - Audio-Visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits.	
UNIT III - NEW TRENDS IN AGRICULTURAL EXTENSION	**(9)**
New trends in agricultural extension –Privatization of extension, Cyber extension/ E- extension, internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone, Village Knowledge Centre (VKC)	
UNIT IV - DIFFUSION AND ADOPTION	**(9)**
Diffusion – meaning and elements. Adoption – meaning –adopter categories and factors influencing adoption, stages of adoption, Innovation decision process and attributes of innovation consequences of adoption.	
UNIT V - CAPACITY BUILDING	**(9)**
Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, farm women and rural youth, FTC & KVK.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Ray, G.L., 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
2. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork

REFERENCES:

1. Indian Journal of Social Sciences, Serials Publications, New Delhi
2. Agricultural Extension Review, Department of Agriculture and Co-operation, Ministry of Agriculture, New Delhi
3. MANAGE, NAARM, Hyderabad Yojana, Ministry of Rural Development, New Delhi
4. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. pvt. Ltd, New Delhi

COURSE OUTCOMES	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						3				3			3	
2		3		3										
3									3					
4		2			2									
5											3	3	3	
CO (W.A)		2.5		3	2	3			3	3	3	3	3	

22AGX45 - COMMERCIAL AGRICULTURE				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To equip students with comprehensive knowledge in diverse agricultural practices and animal husbandry techniques, emphasizing sustainability, economic viability and environmental stewardship.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply practical skills and techniques learned in the fields of crop cultivation, animal husbandry, pest management and sustainable agricultural practices.	Ap	20%
CO2	Analyze various constraints, pest and disease management practices to enhance production technologies on commercial sectors of agriculture.	An	20%
CO3	Articulate effectively on species, rearing techniques, collection, production, processing, value addition and post harvest technologies.	Ap	40%
CO4	Evaluate the economic viability, environmental impacts and sustainability of agricultural practices and livestock management techniques.	An	20%
CO5	Summarize a report as a team member on the techniques and constraints, observed in the commercial agriculture practices by visiting various agriculture sectors.	An	Internal Assessment

UNIT I – SERICULTURE	**(9)**
Sericulture – importance - Mulberry cultivation – Rearing – Reeling – Twisting - Species of Silkworms - Rearing Equipment – marketing of cocoons - Economics of rearing - Pest and diseases of silkworm and their management	
UNIT II – APICULTURE	**(9)**
Importance and history of apiculture - Different species of honey bees - Morphology, anatomy, colony organization and lifecycle – Bee keeping equipment - Social behavior - Queen rearing - Collection and preservation of bee pasture - Seasonal management - Economics of beekeeping.	
UNIT III – MUSHROOM CULTIVATION	**(9)**
Mushroom cultivation - Scope and Importance - Types of mushroom - Life cycle of mushroom - Mother Spawn Production - mushroom bed preparation - Spawning, spawn running, harvesting - diseases, pests and nematodes, and their management - Postharvest technology and value addition of mushroom	
UNIT IV – LIVESTOCK PRODUCTION & MANAGEMENT	**(9)**
Importance of livestock - Important exotic and Indian breeds of cattle and buffalo - reproductive system and behaviour of cattle - Feeding and management - Cost of milk production, economical unit of cattle and buffalo.	

UNIT V - VERMICOMPOSTING	(9)
Waste material- Classification, segregation - processing- Bed preparation - earthworm collection and applications-Inspection of beds and watering - separation, air drying, sieving - storing	
TOTAL (L : 45) = 45 PERIODS	

TEXT BOOKS:

1. Sanjay Sarkar. 2022. A Text Book on Sericulture, Techno World, West Bengal.
2. Gautam, V. N. and Shraddha Shrivastava. 2017. A Text Book on Livestock Production and Management, Aavishkar Pulishers, Jaipur.

REFERENCES:

1. Sunita, N.D, Guled, M.B, Mulla, S.R and Jagginavar, 2003, Beekeeping, UAS Dharwad
2. Ganga, G. and Sulochana Chetty, J. 1997. An Introduction to Sericulture (2nd Edn.). Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
3. B.C. Suman and V.P.Sharma.2007. Mushroom cultivation in india. Daya Publishing House, New Delhi.179p
4. G. C. Banergee. 1999, Text Book of Animal Husbandry , 9th ed Oxford and IBH Publishers, New Delhi.
5. Singh, D. and Singh, D.P. 2006. A Hand Book of Beekeeping, Agrobios (India)
6. V.N. Pathak, N. Yadav and M. Gaur. 2010. Mushroom production and processing technology. Published by Agrobios, Jodhpur
7. Khushbu, Rachna Gulati, Sushma and Komal Arya, 2022, Fundamentals of Vermicomposting, AkiNik Publications - 978-93-5570-365-1

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3					3								3	3
4				3										
5									3	3				
CO (W.A)	3	3		3	3				3	3			3	3

22AGX46 - AGRICULTURAL FINANCE, BANKING AND CO-OPERATION				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To provide knowledge on the finance and methods of financing the agricultural sector to improve all crop production.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the various banking sources available for agricultural sector.	Ap	20%
CO2	Apply the principle of cooperative banking in various plan periods for different spans.	An	20%
CO3	Estimate the yield of crops grown through by means of livestock and crop insurance schemes.	Ap	40%
CO4	Frame a network inculcating various institutions meant for financing agricultural needs.	An	20%
CO5	Examine and communicate the role played by institutional and non institutional agencies as a part of team member towards the history of crop culture in India.	An	Internal Assessment

UNIT I- AGRICULTURAL FINANCE – NATURE AND SCOPE	**(9)**
Agricultural Finance: Definition, Importance, Nature and Scope – Agricultural Credit: Meaning, Definition, Need and Classification – Sources of credit – Role of institutional and non – Institutional agencies: Advantages and Disadvantages – Rural indebtedness: consequences of rural indebtedness – History and Development of rural credit in India.	
UNIT II - FINANCIAL INSTITUTIONS	**(9)**
Institutional Lending Agencies – Commercial banks: Nationalization, Agricultural Development Branches – Area Approach – Priority Sector Lending – Regional Rural Banks, Lead bank, Scale of finance – Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India .	
UNIT III - CO-OPERATION	**(9)**
Agricultural Cooperation in India–Meaning, brief history of cooperative development inIndia - Pre and Post - Independence periods and Co-operation in different plan periods,objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Cooperative credit structure: short term and long term..	
UNIT IV –BANKING METHODS	**(9)**
Negotiable Instruments: Meaning, Importance and Types – Central Bank: RBI – functions – credit control – objectives and methods: CRR, SLR and Repo rate – Credit rationing – Dear money and cheap money – Financial inclusion and Exclusion: Credit widening and credit deepening monetary policies. Credit gap: Factors influencing credit gap – Non – Banking Financial Institutions (NBFI) -Assessment of crop losses, Determination of compensation.	

UNIT V –FARM INSURANCE	(9)
Crop insurance: Schemes, Coverage, Advantages and Limitations in implementation – Estimation of crop yields – Livestock, insurance schemes – Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.	
TOTAL (L : 45) = 45 PERIODS	

TEXT BOOKS

1. Warren F. Lee and Michael D. Boehlje,2017,Agricultural Finance,Routledge, USA.
2. P. M. Vyas,2016,Agricultural Banking and Finance,Oxford University Press,UK
3. N.S. Gopalakrishnan, 2017,Rural Banking and Agricultural Finance in India,PHI Learning Pvt. Ltd., New Delhi.

REFERENCES:

1. Muniraj, R., 1987, Farm Finance for Development, Oxford and IBH, New Delhi
2. Subba Reddy. S and P.Raghu Ram 2011, Agricultural Finance and Management, Oxford and IBH, New Delhi.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	
2	3										3	3		
3		2									2		3	3
4		3									3		3	3
5						2			3		2		3	3
CO (W.A)	**3**	**2.6**				**2**			**3**		**2.5**	**3**	**3**	**3**

22AGX47 - ORNAMENTAL AND LANDSCAPE GARDENING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To equip students with a comprehensive understanding of garden history, design principles, practical techniques, constructing and budgeting in ornamental and landscape horticulture, enabling them to effectively plan, design, and manage diverse landscapes.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of landscape design to create detailed garden plans that incorporate both softscape, hardscape and special elements.	Ap	20%
CO2	Analyze different types of gardens and landscaping features, evaluating their historical context, functional benefits, and suitability for various environmental conditions and client needs.	An	20%
CO3	Evaluate landscape drawings and construction plans, assessing the accuracy of scale, symbols, and design elements, and evaluating the feasibility and cost-effectiveness of proposed landscape projects.	An	20%
CO4	Articulate turf management techniques to establish, maintain, and rejuvenate turf areas, using appropriate species of grasses and management practices to address issues related to growth, pests, and soil conditions.	Ap	40%
CO5	Summarize a report with a presentation as a team member on the constraints observed during establishment and maintenance of ornamental garden.	An	Internal Assessment

UNIT I - GARDEN HISTORY, TYPES AND ELEMENTS	**(9)**
Ornamental and Landscape Horticulture – Definition – Scope – Importance – History of Gardening – Types of Gardens – Softscape elements – Plants for special purposes – Hardscape elements – other ornamental structures – Planting and Designing Position.	
UNIT II – SPECIAL FEATURES IN LANDSCAPING	**(9)**
Water gardens – Floating plants – Oxygenating plant – Bog gardens – Vertical Garden - Roof Garden – Xeriscaping – Bonsai – Plants, Culture, Pruning and Bending Techniques – Terrarium – Gardening Equipments.	
UNIT III – TURFING AND TURF MANAGEMENT	**(9)**
Turfing – Uses – Importance and scope of turf industry – Species of grasses – Growth and Development of turf grasses – Factor affecting growth – Site selection – Land preparation – Methods of establishment – Turf quality – weed, pest, disease and nutrient managements – Repair and rejuvenation of old turf – Care and maintenance of equipments.	

UNIT IV – DESIGNING ELEMENTS, PRINCIPLES AND SITE ANALYSIS	(9)
Elements of Beauty – Form, Colour, Texture and Line – Fundamental Principles of landscape designing – Different Concepts of laying of special types of gardens – Site analysis – Cliental preferences -Selection of components.	
UNIT V – LANDSCAPE DRAWINGS, CONSTRUCTION AND BUDGETING	**(9)**
Landscape drawing – manual and computer softwares –Fundamentals of drawing – scale, symbols, layout, plan view, elevation and perspective diagrams – Basics of establishment – leveling, gradient, filling, plastering, water proofing filters and aeration – Project report preparation – cost estimates – contract agreement and legal issues – terms and conditions for execution and payment.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Priyanka Kakkar, Surendar Lal, "Landscape and Ornamental Horticulture", Stella International Publication, Haryana, 2024.
2. Hemla Naik, B., Chandrasekhar, S. Y. and Jawaharlal, M., "Principles of Landscape Gardening", agrimoon.com, 2023.
3. Chadha, K. L. "Ornamental Horticulture in India", ICAR Krishi Bhavan, New Delhi, 1986.
4. Bose, T. K. and Mukerjee, D. "Gardening in India", Oxford and IBH Publication, 1977.

REFERENCES:

1. Roychowdhury, N. and Misra, H. P., "Text Book on Floriculture and Landscaping", Shyamal Ghosh Publication, Kolkata, 2001.
2. Nambisan, K. M. P., "Design elements of landscape gardening", Oxford and IBH Publication Co., (P) Ltd., New Delhi, 1992.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3										2	
4				3									2	
5														
CO (W.A)	3	3	3	3									2	

22AGX48 - SEED TECHNOLOGY APPLICATIONS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	To equip students with comprehensive knowledge and practical skills in seed science and technology, enabling them to analyze and apply principles of seed production, processing, testing, and marketing to ensure the production of high-quality seeds and support successful crop cultivation.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Categorize the fundamental characteristics that differentiate seeds from grains and evaluate the features of good quality seeds crucial for successful crop production.	An	20%
CO2	Articulate genetic improvement techniques such as selection, hybridization, mutation, and polyploidy to develop high-quality seed varieties.	Ap	20%
CO3	Analyze various seed production and processing techniques, including hybrid seed production, and apply appropriate methods for different crops to ensure high yield and quality.	An	20%
CO4	Apply the steps of seed processing and ensures the results of seed standards to meet the required quality parameters of seed programme for better pricing and marketing of the produce.	Ap	40%
CO5	Summarize a report with a presentation as a team member on the techniques and constraints, observed in quality seed production and marketing strategies by critically analyzing various case studies.	An	Internal Assessment

UNIT I - SEED CHARACTERS	**(9)**
Definition and characteristics of seed and how it differs from grain; Features of good quality seed; Importance of seed in successful crop production; Floral biology: self and cross pollination; Methods of genetic improvement of crop plants such as selection, hybridization, mutation and polyploidy.	
UNIT II - SEED PRODUCTION AND CERTIFICATION	**(9)**
Hybrid seed production techniques (multiplication models, multiplication ratio, field selection, planting ratio, isolation needs and rouging; Harvest and extraction of seed) - classes of seed; Genetic deterioration during crop production cycles; Seed certification process, detailed description of the specific steps of the certification process (with particular emphasis on field inspection).	
UNIT III - SEED PROCESSING AND TESTING	**(9)**
Components of seed processing; Steps in seed processing: preliminary cleaning, basic cleaning and grading, and equipment used in each of the steps; Seed treatment; Seed drying; Seed sampling; Seed testing: details of specific tests conducted for different purposes, seed testing laboratories – roles and establishment; Standards prescribed for different crops, Seed packaging.	

UNIT IV - SEED PROGRAMMES AND MARKETING	(9)
Seed legislations promulgated in India from 1966 to date and the purpose of each of these legislations, Seed law enforcement, Types of organizations involved in seed production, their objectives and features; Organizational set up of a seed company; Steps involved in planning and developing a seed programme; Seed marketing activities, and analysis of seed demand and supply; Costing and pricing strategies; Economics of production of different crop seed; Role of WTO in seed marketing; Export procedures and formalities; Seed/plant quarantine methods.	
UNIT V - SEED PRODUCTION IN SPECIFIC CROPS	**(9)**
Principles and special techniques used for seed production in important horticultural crops by selecting representatives of vegetable / flower / fruit / spice / condiment / plantation crops.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Singh, S.P., Commercial Vegetable Seed Production, Kalyani Publishers, Chennai, 2001.
2. Agarwal, R.L., Seed Technology, Oxford IBH Publishing Co., New Delhi, 1995.
3. Joshi A.K. and Singh B.D., Seed Technology, Kalyani Publishers, New Delhi, 2005.
4. Rajeev Kumar, Sushil Kumar Swarnkar, Sunil Kumar Singh and Sumati Narayan, A Text Book of Seed Technology, Kalyani Publishers, New Delhi, 2015.

REFERENCES:

1. Subir Sen and Ghosh, N., Seed Science, Kalyani Publishers, Chennai, 1999.
2. Dahiya, B.S., and Rai, K.N., Seed Technology, Kalyani Publishers, Chennai, 1997.
3. Hand Book of Seedling Evaluation, ISTA, 1979.

E-REFERENCES:

1. www.seednet.gov.in
2. https://agritech.tnau.ac.in/seed_certification/seedtech_index.html

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		2												
2					3								3	
3				3									3	
4	3													3
5									3	3				
CO (W.A)	**3**	**2**		**3**	**3**				**3**	**3**			**3**	**3**

22AGX51 - PROTECTED CULTIVATION				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To impart knowledge on protected cultivation and its types of vegetables and flower crops. • To develop skills in precision farming techniques to practice on other high value crops.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge on precision farming techniques for effective production of vegetable and flower crops under different protected structures.	Ap	20%
CO2	Analyze various crop, canopy, pest and disease management practices to enhance horticulture crop production through hi-tech protected cultivation techniques.	An	20%
CO3	Evaluate crop growth factors and gather information through précised data management software's and modeling tools.	An	20%
CO4	Employ advanced techniques to solve problems on irrigation, fertilizer application, post harvest handling and in storage of horticulture produce.	Ap	40%
CO5	Summarize a report as a team member on the advanced techniques and constraints, observed in the hi-tech protected farm of horticulture crops.	An	Internal Assessment

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 horticulture: 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 computers in developing comprehensive systems needed in site specific management (SSM), Sensors for information gathering, geostatistics, remote sensing, information and data management and crop growth models, GIS based modeling.	
UNIT V – PRECISION FARMING OF HORTICULTURAL CROPS	**(9)**
Precision farming techniques for horticultural crops: Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa - precision technologies in packaging and storage of crops - robotics and drones in precision farming.	
TOTAL (L : 45) = 45 PERIODS	

TEXT BOOKS:

1. Ashok Kumar, B., Eggadi Ramesh and Sindhu, V. A Textbook of Protected Cultivation and Precision Farming for Horticulture Crops, Jain Brothers, New Delhi, 2022.
2. Gurjar Nikhil Parikar, P. K. S., Precise and Protected Cultivation of Horticulture Crops, Blue Rose Publishers, New Delhi, 2022.

REFERENCES:

1. Mahesh Chand Singh, Sharma, K. K., Protected Cultivation – Structural Design, Crop Management, Modeling and Automation, Apple Academic Press, USA, 2023.
2. Precision Farming Development Centre, Protected Cultivation of Horticulture Crops, Technical Bulletin, ICAR, New Delhi, 2015.
3. Singh, D. K., and Peter, K. V., Protected Cultivation of Horticultural Crops, New India Publishing Agency, New Delhi, 2014.

e-REFERNCES:

1. TNAU, Protected Cultivation and Post Harvest Technology, Agrimoon.com, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2		3											3	
3					3									3
4				3									2	
5									3	3				
CO (W.A)	3	3		3	3				3	3			2.7	3

22AGX52 - CLIMATE CHANGE AND ADAPTATION					
		L	T	P	C
		3	0	0	3
PRE - REQUISITE : NIL					
Course Objective:	• To understand the concept of earth's climate system, impacts of climate change and mitigation measures.				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the earth's climate system	Ap	20%
CO2	Inspect the characteristics and profile of the atmosphere	An	20%
CO3	Assess the present and projected impacts of climate change on different sectors	An	20%
CO4	Examine the initiates taken in India to address climate change	An	20%
CO5	Organize different climate change mitigation strategies	An	20%

UNIT I – EARTH'S CLIMATE SYSTEM	**(9)**
Definitions- Climate, Climate system, climate change- Role of ozone in environment - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Green House Gases and Global Warming – Carbon Cycle- Hydrological Cycle- El Nino, La Nina – ENSO Teleconnections.	
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 and impacts 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 CHANGE INITIATIVES	**(9)**
Evidences of Changes in Climate and Environment – on a Global Scale and in India - Initiatives in India- Kyoto Protocol, Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC– IPCC.	
UNIT V –MITIGATION MEASURES	**(9)**
Clean Development Mechanism – Carbon credits , 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 funding Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Islam, Md Nazrul, and André van Amstel, eds. *India: Climate Change Impacts, Mitigation and Adaptation in Developing Countries*. Springer Nature, 2021.
2. Nilsson, Lennart. *Cleaner production: technologies and tools for resource efficient production*. Vol. 2. Baltic University Press, 2007.

REFERENCES:

1. Romm, Joseph J. *Climate change: What everyone needs to know*. Oxford University Press, 2022.
2. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
3. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2												
3				3									3	
4				3									3	
5		2												
CO (W.A)	2	2		3									3	

22AGX53 - REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS FOR AGRICULTURAL ENGINEERS				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objectives:	• To understand the concepts of remote sensing. • To introduce the students to the principles of various components of remote sensing and data components. • To introduce the spatial data models and map elements. • To introduce the various image enhancement and classification techniques. • To study the applications of Remote Sensing and GIS in agriculture, soil and water resources.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Correlate various electromagnetic radiations and assess their applications in remote sensing systems and satellite data processing..	Ap	20%
CO2	Apply the concepts of GIS and coordinate system.	Ap	20%
CO3	Analyze the Geographic Information System (GIS) images and categorize according to its application.	An	20%
CO4	Evolve RS & GIS tools to create a strategy on natural resource management.	Ap	20%
CO5	Recognize the problems related to agricultural engineering in crop production and found a solutionusing GIS.	Ap	20%

UNIT I –CONCEPTS OF REMOTE SENSING	(9)
Definition of remote sensing and its components -Electromagnetic spectrum - wavelength regions important to remote sensing - Wave theory, Particle theory, Stefan-Boltzman and Wein Displacement Law –Atmospheric scattering, absorption - Atmospheric windows - spectral signature concepts.	
UNIT II –REMOTE SENSING SATELLITES AND SENSORS DATA PRODUCTS	(9)
Types of platforms - orbit types, Sun synchronous and Geosynchronous - Passive and Active sensors. Indian Space Programme, Sensor characteristics LANDSAT,SPOT, ERS, IKONOS, IRS and others. Types of Data Products - types of image interpretation - basic elements of image interpretation –visual interpretation keys.	
UNIT III –GEOGRAPHICAL INFORMATION SYSTEM	(9)
Definition- Concept of GIS - Maps and their influences- Characteristics of Maps- Elements - Projection- Coordinate system- sources of spatial data- History and development of GIS.	
UNIT IV – DATA INPUT AND ANALYSIS	(9)
Data- spatial, Non spatial- Hirerachial Network- Data types- Raster and vector –files and their organization. Methods of Data input – Data Editing, Data structure- Database Management – digitizer – reclassification – spatial analysis – buffering – map –overlay – interpolation – Digital Elevation Model- Output data – devices for output.	

UNIT V – RS AND GIS APPLICATIONS IN AGRICULTURAL ENGINEERING	(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 – Water quality modeling - Drought monitoring - Cropping pattern change analysis. Application of Remote Sensing and GIS in Precision Agriculture - Monitor Crop Health.	
Practical 1. Aerial Photo interpretation – visual 2. Satellite images interpretation – Visual 3. Database Management systems 4. Spatial data input and editing – Digitizing 5. Raster analysis problem – Database query 6.GIS application in watershed analysis 7. GIS application in rainfall – runoff modeling 8. GIS application in Soil erosion modelling	
TOTAL (L: 30 , P:30) = 60 PERIODS	

TEXT BOOKS:

1. Basudeb Bhatta, Remote Sensing and GIS, II Edition, Oxford University Press, New Delhi, 2011
2. Floyd F.Sabins, Remote Sensing: Principles and Interpretation, III edition, Freeman and Company, NewYork, 2007.

REFERENCES:

1. Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2014.
2. P.A. Burrough, Principle of GIS for land resources assessment, Oxford Publications, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	2													
3			3	2									3	
4					2							1	3	
5													3	
CO (W.A)	2.5	3	3	2	2							1	3	

22AGX54 - AUTOMATION IN AGRICULTURE				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To expose the students to the concept of Irrigation Automation. • To optimize the use of resources like seeds, water, and fertilizers, ensuring better crop yields. • To monitor crops and soil conditions, ensuring precise and consistent application of inputs. • To introduce the concepts of Automatic Systems and IoT applications. • To create smart farming systems that can adapt to changing environmental conditions.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Optimize crop production, leading to higher yields.	Ap	20%
CO2	Reduce the time needed for planting, harvesting, and processing, allowing farmers to manage larger areas more efficiently.	An	20%
CO3	Handle crops with greater delicacy, reducing damage during harvesting and processing.	Ap	40%
CO4	Predict crop yields, disease outbreaks, and other critical factors, allowing for proactive management.	An	20%
CO5	Analyze the efficient use of resources like water, energy, and fertilizers, which can reduce the environmental impact of farming.	An	Internal Assessment

UNIT I - INTRODUCTION TO AUTOMATION	(9)
Automatic Irrigation - Traditional methods of irrigation - Need for Automation – Comparison between Traditional and Automated Irrigation - Advantages - Disadvantages - Economic impacts of Automation on Agricultural Firms - Future of Automation.	
UNIT II - SYSTEMS OF AUTOMATION	(9)
Automated Irrigation - Pneumatic System - Portable timer system - Timer/Sensor Hybrid/SCADA - Methods of automating Irrigation layout - Machine Learning in Tank Monitoring System.	
UNIT III - IoT IN IRRIGATION	(9)
IoT based Automated Irrigation System - IoT based Smart Irrigation - Sensor based Automation - ypes - operation - Solar based Automatic Irrigation System - components - operation - Automation by sensing soil moisture - Automation usinq ANN based controller - operation.	

UNIT IV - SURFACE AND MIGRO-IRRIGATION AUTOMATION	(9)
automation and control in surface Irrigation systems - equipments - benefits - barriers - automation design in bay, basin and furrow Irrigation - automation in micro Irrigation – systems of automation and its components - design - cost - operation and maintenance.	
UNIT V - ASSESSMENT OF PARAMETERS IN IRRIGATION	(9)
Crop water estimate using Satellite data - Automation of Lysimeter for PET Measurements and Energy based Remote Sensing model - Remote Monitoring design of Automatic Irrigation system- Cost and Benefits of Automation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. R.Haise, E.G.Kruse. et al., 1981. "Automation of Surface Irrigation: 15 years of USDA Research and Development at Fort Collins, Colorado"
2. Brian Wahlin and Darell Zimbelman, CanalAutomation for Irrigation Systems, American Society of Civil Engineers, 2014.

REFERENCES:

1. Darell D.Zimbelman, Planning, Operation, Rehabilitation and Automation of Irrigation water
2. delivery system, American Society of Aqricultural Enqineers,1987

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3					2					2		3
3	3										2		3	3
4				3			2			2			3	3
5		3												
CO (W.A)	3	3		3			2			2	2	2	3	3

22AGX55 - IT IN AGRICULTURE				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To equip students with the knowledge and skills to effectively utilize advanced technologies and management systems in precision agriculture, environmental control, and e-governance, enabling them to optimize agricultural practices, enhance productivity, and contribute to sustainable agricultural development.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply precision farming technologies, to analyze and optimize crop production, environmental control and resource management in various agricultural scenarios.	Ap	20%
CO2	Evaluate the effectiveness of environmental control systems through models to determine their impact on crop growth and greenhouse efficiency.	An	20%
CO3	Employ agricultural systems management techniques, to analyze and improve the efficiency and reliability of crop growth, agricultural operations and resource use with weather forecasting.	An	20%
CO4	Interpret weather prediction models and seasonal climate forecasts to assess their implications for agricultural planning and decision-making with the expert system database for rural development and information security.	Ap	40%
CO5	Summarize a report with a presentation as a team member on the techniques and constraints, observed in quality milk production, processing, grading and marketing of dairy products with a case study.	An	Internal Assessment

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 CO_2 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, e-learning, Rural development and information society.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. National Research Council, "Precision Agriculture in the 21st Century", National Academies Press, Canada, 1997.
2. Krug, H., Liebig, H.P. "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", 1989.

REFERENCES:

1. Peart, R.M., and Shoup, W. D., "Agricultural Systems Management", Marcel Dekker, New York, 2004.
2. Hammer, G.L., Nicholls, N., and Mitchell, C., "Applications of Seasonal Climate", Springer, Germany, 2000.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2		3												3
3				3									3	
4					3									3
5									3	3				
CO (W.A)	**3**	**3**		**3**	**3**				**3**	**3**			**3**	**3**

22AGX56 - INSTRUMENTATION AND CONTROL ENGINEERING				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To increases production speed, consistency, and safety by minimizing human intervention. • To optimize process performance, ensuring stability and efficiency. • To ensure that instrumentation and control systems are safe, reliable, and compliant with industry standards. • To integrate advanced technologies such as AI, IoT, and machine learning into instrumentation and control systems. • To design systems that optimize energy use in industrial processes.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design, analyze, and implement various instrumentation systems, including sensors, transducers, and signal processing units.	Ap	20%
CO2	Diagnose and fix issues in instrumentation and control systems.	An	20%
CO3	Plan, execute, and manage projects related to instrumentation and control, ensuring they meet specifications and deadlines.	Ap	20%
CO4	Implement safety standards in the design and operation of control systems.	Ap	20%
CO5	Develop innovative solutions and improvements in instrumentation and control technologies.	An	20%

UNIT I - INTRODUCTION	**(9)**
Basic concepts of measurement system configuration. Concept of accuracy, precision error, resolution repeatability bias, calibration, range; Performance characteristics of Instruments- Zero, first and second order instrument systems and their response to different input signals (step, ramp etc) Specification and testing of dynamic response	
UNIT II - INSTRUMENTFOR VARIOUS USES	**(9)**
Different types of measuring instruments, their working principles, construction features, measurement of level, flow, temperature, pressure, vacuum, force, torque, power, displacement, vibration, acceleration, pH, colour, viscosity, surface tension and composition. Indicating and recording type instruments, digital displays, transmitting and telemetering devices	
UNIT III - INTRODUCTIONTO CONTROL SYSTEM	**(9)**
Control system characteristics, purpose disturbances and stability Feed back and feed forward control strategies. Modelling the Dynamic and Static Behaviour of Process-Mathematical modelling for physical process control, state variables and state equations, modelling difficulties and considerations. Input-output models block diagram, degree of freedom, process controllers action, P, PI, PID controllers, final control system	

UNIT IV - ANALYSIS OF DYNAMIC BEHAVIOUR:	(9)
Linearization of systems, Deviation variables, Application of Laplace transform in mathematical modelling of process control. Transfer function; Transfer function matrix. for processes having multiple outputs, Poles and zeros of transfer function	
UNIT V - QUALITATIVE ANALYSIS OF RESPONSEOF SYSTEM:	**(9)**
Design of Feed Back System Block diagram, stability analysis, frequency response root locus analysis, Routh"s criteria, Nyquist plots and Bode diagrams. Control Systems for Various Uses Electronic pneumatic, hydraulic control system and their application in Farm machinery, food processing industry aquaculture, milk processing	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Coughanowr, D.R. "Process Systems Analysis and Control", McGraw Hill, 1991
2. Patranabis. D. "Principles of Industrial Instrumentation", Tata McGraw Hill, 1995

REFERENCES:

1. Doeblin, D.O. "Measurement Systems; Application and Design". McGraw Hill, 1984
2. Considine T..M. "Process/Industrial Instruments and ControlsÃ‚Â· Handbook", McGraw Hill 1993

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2		3					1					1	3	
3	2									2	1			
4	2						1			1				
5				2										
CO (W.A)	**2**	**3**		**2**			**1**			**1.5**	**1**	**1**	**3**	

22AGX57 - IoT IN AGRICULTURAL SYSTEMS				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To know the operation of various electronic circuits and its applications. • To get adequate knowledge about various sensors used in agriculture processes • To learn optimization techniques and e-governance in agricultural system

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the working operations of electronic devices and processors in agricultural system	Ap	20%
CO2	Implement the necessity of sensor requirements to analyze the soil parameters required for the field	An	20%
CO3	Examine various on-line measurement of plant growth and management of crop growth in green houses using various sensors	Ap	20%
CO4	Apply the concept of Information Technology in governing the agricultural systems.	Ap	20%
CO5	Analyze the basic statistical tools and optimization technique that can be used to analyze the data collected in modern agriculture business	An	20%

UNIT I – BASIC ELECTRONICS CIRCUITS	**(9)**
Passive devices -semi conductor devices -transistors - diode circuits - amplifier circuits- oscillator circuits thyristor circuits-Integrated circuits and operational amplifier - logic gates - flip flop - counters digital to analog - analog to digital converters microprocessor introduction	
UNIT II –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 III - ENVIRONMENTCONTROL SYSTEM	**(9)**
Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture. Understanding and predicting world's climate system	
UNIT IV - AGRICULTURAL SYSTEMSMANAGEMENT	**(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 V – E - G OVERNANCE IN AGRICULTURAL SYSTEMS	(9)
Concept of Information Technology (IT) and its application potential. Role of IT in natural resources management. Expert systems, decision support systems, Agricultural and biological databases, e- commerce, e-business systems & applications, Technology enhanced learning systems and solutions, e- learning, Rural development and information society. Internet application tools and web technology.	
TOTAL (L:45): 45 PERIODS	

TEXT BOOKS:

1. Hammer, G.L., Nicholls, N., and Mitchell, C., Applications of Seasonal Climate, Springer, Germany, 2019.
2. Peart, R.M., and Shoup, W. D., Agricultural Systems Management, Marcel Dekker, New York, 2015.

REFERENCES:

1. National Research Council, Precision Agriculture in the 21st Century, National AcademiesPress, Canada, 2020.
2. H. Krug, Liebig, H.P. International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation, 2014..

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												3
3	3													
4		3			1							2		3
5		3			2							2	3	
CO (W.A)	3	3			1.5							2	3	3

22AGX58 - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FOR AGRICULTURE				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE REQUISITE : NIL

Course Objective:	• To impart artificial intelligence principles, techniques and its history • To introduce basic concepts and techniques of Machine Learning • To select the unsupervised and supervised learning • To apply concept of AI and ML concepts in agricultural system • To analyze the applicability of AI and ML in Agriculture

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.	Ap	20%
CO2	Apply the machine learning algorithms to agricultural datasets for problem-solving	Ap	20%
CO3	Select appropriate unsupervised and supervised learning models to address specific challenges in agriculture	An	20%
CO4	Develop the AI and ML concepts in Agricultural application	Ap	20%
CO5	Analyze pest management strategies, integrating AI-based approaches for pest detection, monitoring, and control and use of ML for agricultural applications	An	20%

UNIT I- INTRODUCTION TO AI - INTELLIGENT AGENT AND UNINFORMED SEARCH	**(9)**
Introduction – Foundations of AI – History of AI – The state of the art – Risks and Benefits of AI - Intelligent Agents – Nature of Environment – Structure of Agent – Problem Solving Agents -Formulating Problems – Uninformed Search – Breadth First Search – Dijkstra's algorithm or uniform-cost search – Depth First Search – Depth Limited Search	
UNIT II - INTRODUCTION TO MACHINE LEARNING	**(9)**
Need for Machine Learning, Machine Learning Explained, and Machine Learning with respect to agriculture, Types of Machine Learning. Challenges of Machine Learning, Machine Learning process, Machine Learning applications.	
UNIT III - UNSUPERVISED LEARNING	**(9)**
Unsupervised Learning – Principle Component Analysis – Neural Network: Fixed Weight Competitive Nets – Kohonen Self-Organizing Feature Maps – Clustering: Definition – Types of Clustering – Hierarchical clustering algorithms – k-means algorithm.	
UNIT IV - SUPERVISED LEARNING	**(9)**
Neural Network: Introduction, Perceptron Networks – Adaline – Back propagation networks -Decision Tree:Entropy – Information gain – Gini Impurity – classification algorithm – Rule based Classification – Naive Bayesian classification – Support Vector Machines (SVM)	

UNIT V - APPLICATION OF AI AND ML FOR AGRICULTURE	(9)
Application of AI and ML for agriculture - Disease Classification - Pest detection and monitoring - Integrated pest management using AI - Early warning systems for pest outbreaks and Detection in Plants - Species Recognition in Flowers - Precision Farming - Use of ML For Portable Proximal Soil and Crop Sensors - Soil And Crop Image Processing - Digital Soil Mapping - General Overview - Digital Soil Mapping With Continuous Variables and Categorical Variables.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012
2. Dheepak Khemani, "A first course in Artificial Intelligence, McGraw Hill Education Pvt Ltd.," New Delhi, 2013.

REFERENCES:

1. Jason Bell, "Machine learning Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014.
2. Ethem Alpaydin, "Introduction to Machine Learning 3e" (Adaptive Computation and Machine Learning series) Third Edition, MIT Press, 2014
3. Ric, E., Knight, K and Shankar, B. "Artificial Intelligence," 3rd edition, Tata McGraw, 2009

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													3
3		2			3								3	
4			3											
5			3		1							1		
CO (W.A)	3	2	3		2							1	3	3

22GEA02 - PRINCIPLES OF MANAGEMENT				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: NIL

Course Objective:	• To provide with a foundational understanding of management concepts and practices. • To equip students with the knowledge and skills necessary to manage and lead organizations effectively, understanding both theoretical frameworks and practical applications in management. • To learn about various planning tools and decision-making processes crucial for organizational success. • To gain insights into human resource management functions. • To study effective communication strategies and the impact of information technology on communication and how effective control can lead to improved productivity and organizational performance.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key management theories and practices to real-world business scenarios, demonstrating the ability to implement management functions.	Ap	20%
CO2	Analyze human resource management practices, evaluating how recruitment, training, performance appraisal, and employee relations contribute to organizational success.	An	30%
CO3	Evaluate strategic decisions and their impacts on organizational performance,the effectiveness of communication strategies and the use of information technology in facilitating efficient and effective communication within organizations.	E	30%
CO4	Create comprehensive strategic plans and organizational policies and design control systemsto ensure continuous improvement in productivity and organizational performance.	C	20%
CO5	Engage in independent study as a member of a team and develop higher-order thinking skills that are crucial for effective management and leadership in complex organizational settings with assignments or case studies.	Ap	Internal Assessment

UNIT I -INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	**(9)**
Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers -managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization-Organization culture and Environment - Current trends and issues in Management.	
UNIT II -PLANNING	**(9)**
Nature and purpose of planning - planning process - types of planning - objectives - setting objectives - policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.	

UNIT III -ORGANISING	(9)
Nature and purpose - Formal and informal organization - organization chart - organization structure - types - Line and staff authority - departmentalization -delegation of authority - centralization and decentralization -Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management	
UNIT IV - DIRECTING	**(9)**
Foundations of individual and group behaviour - motivation -motivation theories - motivational techniques - job satisfaction - job enrichment - leadership - types and theories of leadership -communication - process of communication - barrier in communication - effective communication -communication and IT.	
UNIT V - CONTROLLING	**(9)**
System and process of controlling - budgetary and non-budgetary control techniques - use of computers and IT in Management control - Productivity problems and management - control and performance -direct and preventive control -reporting.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrichand Mark V. Cannice"Essentials of Management: An International, Innovation, and Leadership Perspective", 11th Edition, Tata McGraw-Hill Education, 2021.
2. J.A.F. Stoner, R.E. Freeman, and Daniel R. Gilbert "Management", 6th Edition, Pearson Education, 2018.

REFERENCES:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Robert Kreitner&MamataMohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3										3			
2		3									3			
3										3				
4			3							3				
5											3	3		
CO (W.A)	3	3	3							3	3	3		

22GEA03 - TOTAL QUALITY MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To Recognize the importance of quality councils and strategic planning in TQM. • To Explore the elements and historical development of TQM. • To Foster employee involvement through motivation, empowerment, teamwork, and recognition. • To Implement continuous process improvement methods like Juran's Trilogy, PDSA Cycle, 5S, and Kaizen. • To Conduct quality audits and understand the introduction to other ISO standards like ISO 14000, IATF 16949, TL 9000, IEC 17025, ISO 18000, ISO 20000, ISO 22000, and ISO 21001.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Describe the elements and principles of Total Quality Management (TQM).	Ap	30%
CO2	Apply continuous process improvement methodologies such as Juran's Trilogy, PDSA Cycle, 5S, and Kaizen.	Ap	20%
CO3	Apply various quality tools and techniques in both manufacturing and service industry.	Ap	20%
CO4	Develop strong supplier partnerships and understand supplier selection,rating, and relationship development.	An	20%
CO5	choose appropriate quality standards and implement them in the respective industry App.	E	10%

UNIT – I QUALITY CONCEPTS AND PRINCIPLES	**(9)**
Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review – Leadership – Qualities / Habits - Quality Council - Quality Statements, Strategic Planning – Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation – Cases with TQM Success and Failures.	
UNIT – II TQM-PRINCIPLES AND STRATEGIES	**(9)**
Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran's Trilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development, Performance Measures – Purpose – Methods - Cases.	
UNIT – III CONTROL CHARTS FOR PROCESS CONTROL	**(9)**
Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study- Introduction to Six Sigma.	
UNIT – IV TQM-MODERN TOOLS	**(9)**
New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), Total Productive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case Studies.	

UNIT – V QUALITY SYSTEMS	(9)
Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, UrdhwareshеHemant, UrdhwareshеRashmi "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

1. SubburajRamasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012.
3. David Goetsch& Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8thEdition,Pearson, 2017.

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													
4		3												
5	3				2									
CO (W.A)	3	3			2									

22GEA04 - PROFESSIONAL ETHICS				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To develop students' ability to identify, analyse, and resolve ethical dilemmas in engineering contexts, fostering a commitment to professional responsibility, integrity, and ethical decision-making. • To provide engineering students with a comprehensive understanding of ethical principles and practices in the engineering profession. • To Familiarize students with key ethical theories, principles, and frameworks that guide ethical decision-making in professional practice. • To Foster the ability to communicate ethical concerns and collaborate effectively with diverse stakeholders, including colleagues, clients, and the public. • To Encourage students to uphold integrity, honesty, and accountability in their professional activities, fostering a culture of trust and reliability.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply ethical reasoning to evaluate and resolve these issues.	Ap	30%
CO2	Apply ethical principles and reasoning to analyze real-world case studies in engineering.	Ap	30%
CO3	Analyze the importance of ethics in professional practice.	An	20%
CO4	Develop the ability to make informed and ethical decisions in engineering practice.	An	10%
CO5	Recognize the importance of continuous learning and professional development in maintaining ethical standards.	E	10%

UNIT I: INTRODUCTION TO PROFESSIONAL ETHICS	**(9)**
Definition and Importance of Ethics,Ethical Theories and Principles,Ethics vs. Morals vs. Values, Role of Ethics in Engineering.	
UNIT II: PROFESSIONAL RESPONSIBILITY AND CODES OF CONDUCT	**(9)**
Professional Responsibility and Accountability, Codes of Conduct in Engineering (e.g., IEEE, NSPE),Conflicts of Interest and Whistleblowing, Case Studies.	
UNIT III: ETHICAL DECISION-MAKING AND PROBLEM-SOLVING	**(9)**
Ethical Decision-Making Models,Tools and Frameworks for Ethical Analysis,Resolving Ethical Dilemmas,Case Studies	
UNIT IV: LEGAL AND REGULATORY ASPECTS	**(9)**
Legal Frameworks Governing Engineering Practice, Intellectual Property Rights, Health, Safety, and Environmental Regulations, Case Studies.	
UNIT V: SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	**(9)**
Social Responsibility of Engineers, Sustainable Engineering Practices, Impact of Engineering on Society and Environment,Case Studies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins,"Engineering Ethics: Concepts and Cases" 6th edition, 2018.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering" 5thEdition 2010.
3. by M. Govindarajan, S. Natarajan, and V. S. SenthilKumar,"Professional Ethics and Human Values",Ist Edition 2006.

REFERENCES:

1. Stephen H. Unger, "Engineering Ethics: Real-World Case Studies"
2. Online Ethics Center for Engineering and Science - www.onlineethics.org
3. National Society of Professional Engineers (NSPE) - www.nspe.org

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		3												
4		3												
5								3						
CO (W.A)	3	3						3						

22AGZ01 - FUNDAMENTALS OF FARM MACHINERY AND MANAGEMENT				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To acquire the knowledge on basic principles and parts of tractors and operations of tractors and tiller • To enhance the overall productivity and production with the lowest cost of production.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the working mechanisms of tractors, plows, harvesters, seeders, and other essential farm equipment.	Ap	20%
CO2	Apply practical skills in the operation, adjustment, and calibration of farm machinery.Learn maintenance practices to ensure the longevity and efficient functioning of farm equipment.	Ap	20%
CO3	Evaluate the environmental impact of farm machinery and adopt practices to minimize negative effects..	An	20%
CO4	Analyze the cost-effectiveness and economic considerations of using different types of farm machinery Develop skills in planning and managing machinery fleets for optimal farm productivity.	An	20%
CO5	Apply the principles of sustainable farming practices and how machinery can be used to support them. Stay updated with the latest innovations in farm machinery and their applications in modern agriculture.	Ap	20%

UNIT I – FARM MACHINERY	**9**
Selection of farm machinery, size selection, timeliness of operation, selection of proper power level and problem related to it- Cost and Reliability of agricultural machinery - Replacement of farm machinery and inventory control of spare parts.	
UNIT II – TRACTOR AND POWER TILLER	**9**
Testing and Evaluation of agricultural tractors – Performance of agricultural tractors - Testing and evaluation of tractor implements- Power tiller - types, application, - need for testing and evaluation of power tiller- maintenance and repair of tractors and power tillers tractor tests and performance.	
UNIT III - TILLAGE AND SOWING	**9**
Tillage- forces acting on a tillage tool- Testing and evaluation of Tillage machinery - hitch systems and hitching of tillage implements- - construction and operation of manual, animal and power operated equipment for tillage - sowing equipment.	

UNIT IV - PLANT PROTECTION AND HARVESTING MACHINERY	9
Planting - Plant protection equipment - sprayer - types - duster - types –Testing and evaluation of manually operated sprayer and duster - weeders - fertilizer application- mowing - chaff cutting - Rice transplanter - Combine harvester - thresher - harvesting and threshing calculation of performance	
UNIT V - FARM MACHINERY MANAGEMENT	**9**
Farm Management - performance of power – operator and cost of operations - economic performance of machinery - field capacity, field efficiency and factors affecting field efficiency- operator comfort and safety- human engineering and safety considerations in agricultural implements.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Donnell Hunt. "Farm power and machinery management", Scientific International Pvt. Ltd., New Delhi, 2013.
2. Metha, M. L., Verma, S. R., Mishra, K. and Sharma, V. K. "Testing and Evaluation of Agricultural Machinery", National Agricultural Technology Information Centre, Ludhiana-141001, 1995.

REFERENCES:

1. Kepner R. A., Roy Barger and Barger, E. L. "Principles of Farm Machinery", CBS Publisher Delhi.
2. Michal, A. M. and Ojha, T. P., "Principles of Agricultural Engineering", Jain Brothers, Vol I., New Delhi.
3. Liljedahl, J. B., Turnquist, P. K., Smith, D. W. and Hoki, M. "Tractors and their power units", CBS Publishers and Distributers, Fourth Edition, Delhi, 2004.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											2	2	2
2	3											2		
3		2				2	2							
4		2											2	
5							2							2
CO (W.A)	3	2				2	2					2	2	2

22AGZ02 - PLANT PROTECTION EQUIPMENTS				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To provide comprehensive knowledge on the mechanization of various farm operations to improve agricultural productivity and efficiency. • To develop the ability to select and utilize appropriate farm machinery and implements for different agricultural tasks.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge of sowing and fertilizing equipment to select and calibrate appropriate devices for specific crops and planting methods	Ap	20%
CO2	Utilize different types of harvesting machinery effectively, considering the specific requirements for crops like paddy, sugarcane, maize, and root vegetables, ensuring proper care and maintenance of the equipment.	Ap	20%
CO3	Analyze the objectives and benefits of farm mechanization and differentiate between primary and secondary tillage implements.	An	20%
CO4	Evaluate the construction, operation, and application of various primary and secondary tillage implements, including mould board ploughs, disc ploughs, and subsoiler ploughs.	E	20%
CO5	Assess various weeding and plant protection equipment, understanding their types, classification, and operational maintenance.	E	20%

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 and semi mounted implements - Field capacity.	
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-Cage wheel.	
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 .	

UNIT IV –WEEDING AND PLANT PROTECTION EQUIPMENT	(9)
Weeding equipment – hand hoe – long handled weeding tools – dryland star weeder – wetland conoweeder and rotary weeder - Sprayers –types-classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control- Dusters - types - care and maintenance.	
UNIT V – HARVESTING MACHINERY	(9)
Harvesting - types of harvesting machinery, - Combine harvester - paddy, sugarcane, maize - grains harvester - thresher - multi crop thresher - digger - tapioca, potato, onion - cotton picker, groundnut harvester - fruit harvesting equipment, balers, threshers.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. JagdishwarSahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.,2010.
2. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005 3. Ojha T.P. and A.M. Michael. 2018. Tenth edition. Principles of Agricultural Engineering, Vol – 1. Jain Brothers, New Delhi.

REFERENCES:

1. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.
2. Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.

Mapping of COs with POs / PSOs

	Pos												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3			2									3	
2	1				3								1	
3		3												3
4				3										
5			3											1
CO (W.A)	**2**	**3**	**3**	**3**	**3**								**2**	**2**

22AGZ03 - WASTE WATER MANAGEMENT AND RECYCLING				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To examine the sources, constituents and environmental concerns of waste water and treatment methods.. • To appraise various physical and chemical treatment processes. • To understand various biological treatment processes. • To explore various advanced treatment process and Zero Liquid Discharge systems. • To know the problems and recycle and reuse concepts.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the constituents and environmental concerns of waste water and treatment methods.	An	20%
CO2	Comprehend various physical and chemical treatment processes.	Ap	20%
CO3	Analyze various biological treatment processes.	An	20%
CO4	Assess the various advanced treatment process and Zero Liquid Discharge systems..	Ap	20%
CO5	Find the recycling and reuse of water technologies in global	An	20%

UNIT I – INTRODUCTION TO WASTE WATER TREATMENT	**(9)**
Wastewater Sources and types, physical and chemical properties - Constituents in waste water – Impact of wastewater -Health and Environment Concerns in waste water and environmental regulations, thermal treatment processes, Wastewater Reclamation and reuse	
UNIT II – PHYSICAL AND CHEMICAL TREATMENT PROCESSES	**(9)**
Physical and chemical properties of wastewater, Physical Unit Operations –Screening, Equalization, Flocculation, sedimentation, Clarification, Filtration, Flotation and Aeration Systems. Chemical Unit Process – Chemical Coagulation, Precipitation, Oxidation and Neutralization	
UNIT III – BIOLOGICAL TREATMENT PROCESS	**(9)**
Microbial metabolism – Bacterial growth– Aerobic and Anaerobic biological oxidation – Activated Sludge process – Trickling filters – Rotating biological contactors – Combined treatment processes – Chemical reactors and filters.	

UNIT IV – ADVANCED TREATMENT PROCESS	(9)
Need for Advanced Wastewater Treatment - Technologies used in advanced treatment – Depth Filtration – Surface Filtration – Membrane Separation Process- Absorption – Ion Exchange – Advanced oxidation process – ZLD Concept	
UNIT V – 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	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. "Industrial Waste Water Management, Treatment and Disposal-MOP FD-3", Water Environment Federation, 3rd Edition, Tata McGraw Hill Professional Publishing Company, New York, 2019.
2. Metcalf, Eddy and Tchobanoglous G., "Waste Water Engineering Treatment and Reuse", Tata McGraw Hill Company, 2nd Edition, NewYork, 2017.

George Tchobanoglous, Franklin Louis Burton, Metcalf and Eddy, H. David Stense, "Waste water Engineering: Treatment and Reuse", McGraw-Hill, 2012.

REFERENCES:

1. Arceivala S. J., "Wastewater Treatment for Pollution Control", 3rd Edition, McGraw-Hill, 2009.
2. Eckenfelder W. W., "Industrial Water Pollution Control", 2nd Edition, McGraw-Hill, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2	3													2
3			3					1						
4												1		
5				3								1	3	
CO (W.A)	3	3	3	3				1				1	3	2

22AGZ04 - BAKING AND CONFECTIONERY TECHNOLOGY				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To learn about the equipments to operate in the baking industry

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the fundamental raw materials vital in bakery units	An	20%
CO2	Detect the basic functions used in bakery and confectionery technology	Ap	20%
CO3	Assess the equipments used for baking	An	20%
CO4	Analyze processing of different confectionary products and its packaging requirements	An	20%
CO5	Evaluate the promotions of entrepreneurship development	An	20%

UNIT I- INTRODUCTION TO BAKING	**(9)**
Classification of bakery products. Bakery ingredients and their functions-Essential ingredients Flour, yeast and sour dough, water, salt- Other ingredients Sugar, color, flavor, fat, milk, milk powder and bread improvers. Leaveners and yeast foods. Shortenings, emulsifiers and antioxidants.	
UNIT II – EQUIPMENTS	**(9)**
Introduction to utensils and equipments used in bakery industry with their purpose. Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, and laminating-Fermentation enclosures and brew equipment - Ovens and Slicers.	
UNIT III - BREAD MAKING PROCESS	**(9)**
The Chemistry of dough Development. Bread making methods- Straight dough/bulk fermentation Sponge and dough- Activated dough development- Chorley wood bread process- Dough retarding and freezing-emergency No time process.	
UNIT IV -BAKERY PRODUCTS	**(9)**
Production of cakes and cookies/biscuits. Types of biscuit dough's - Developed dough, short dough's, semi-sweet, enzyme modified dough‘s and batters. Cake making Ingredients and their function Structure builders. Production process for Wafers.	

UNIT V – CONFECTIONERY PRODUCTS	(9)
Social responsibility of business. Morals and ethics in enterprise management- SWOT analysisGovernment schemes and incentives for promotions of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Matz, Samuel, A., "Bakery Technology and Engineering", 3rd Edition, Chapman and Hall, London, 1992.
2. Cauvain, Stanley, P., and Young, Linda S., "Technology of Bread Making, Springer, 2007.

REFERENCES:

1. Edwards W.P., "Science of bakery products", RSC, UK, 2007.
2. Samuel A. Matz., "Equipment for Bakers", Pan Tech International Publication., 1988.
3. Jackson, E. B., "Sugar Confectionery manufacture (Ed)", 2nd Edition, Blackie Academic and Professional, Glasgow,1995.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2				3								2
2	3													2
3		2				3								
4				2										
5				2			3							2
CO (W.A)	**3**	**2**		**2**		**3**	**3**							**2**

22AGM01 - PRODUCTION TECHNOLOGY OF FIELD CROPS				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To apply knowledge for identification, classification, and cultivation of major field crops. • To develop skills in crop management and assess the economic and ecological value of crops.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge to differentiate major cereal crops and perform cultivation practices and nursery raising techniques for cereals.	Ap	20%
CO2	Apply classification criteria to distinguish types of millets and implement appropriate cultivation practices for each type.	Ap	20%
CO3	Analyze the cultivation practices of major pulse crops and evaluate their economic importance in agricultural systems.	An	20%
CO4	Implement suitable cultivation techniques for oilseed and fiber crops and assess their contribution to farm productivity.	An	20%
CO5	Apply knowledge to identify and cultivate fodder and green manure crops and evaluate their role in improving soil health and livestock nutrition.	Ap	20%

UNIT I – PRODUCTION TECHNOLOGY OF CEREALS	**(9)**
Rice, wheat, Maize – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield.	
UNIT II – PRODUCTION TECHNOLOGY OF MILLETS	**(9)**
Major millets- Sorghum, Pearl millet (Cumbu) and Finger millet (Ragi) Minor millets- Fox tail millet (Tenai), Little millet (Samai), Kodo millet (Varagu), Barn yard millet (Kudiraivali) and Proso millet (Pani varagu) - Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and Yield.	
UNIT III - PRODUCTION TECHNOLOGY OF PULSES	**(9)**
Pigeon pea (Red gram), Black gram (Urd bean), Green gram (Mung bean) and Cowpea : Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices(from land preparation to harvest) and Yield.	
UNIT IV - PRODUCTION TECHNOLOGY OF OIL SEEDS AND FIBRE CROPS	**(9)**

Oil Seeds - Groundnut, Sesame, and Castor- Fibre crops - Cotton and Jute - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices(from land preparation to harvest) and Yield

UNIT V - PRODUCTION TECHNOLOGY OF FODDER CROPS AND GREEN MANURES	**(9)**
Fodder crops - Fodder sorghum , Fodder cumbu, Cumbu Napier grass, guinea grass - Fodder cowpea - Green manures - Sunnhemp, Kolinji - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and Yield	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Rajendra Prasad, "Text book on Field Crop production", Indian Council of Agricultural Research, New Delhi, 2004.
2. "Hand Book of Agriculture", Indian Council of Agricultural Research ICAR, New Delhi, 2006.

REFERENCES:

1. "Crop production Guide", Directorate of Agriculture, Chennai and TNAU, 2005.
2. Ahlawat, I.P.S., Om Prakash and Saini, G.S., "Scientific Crop production in India", Rama publishing House, Meerut, 1998.
3. Chidda Singh, "Modern Techniques of raising Field crops", Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, 1997.

Mapping of COs with POs / PSOs

COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		2				3								
2	3													
3		2				3								
4				2										
5							3							
CO (W.A)	**3**	**2**		**2**		**3**	**3**							

22AGM02 - BASIC HORTICULTURE				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To impart knowledge on fundamental concepts and practices in horticulture including classification, climate, and soil requirements. • To develop practical skills in propagation, training, pruning, pollination, and use of growth regulators in horticultural crops.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge to classify horticultural crops based on horticultural and botanical criteria, and evaluate suitable climate and soil conditions.	Ap	20%
CO2	Demonstrate propagation techniques such as cutting, layering, and grafting, and apply principles of orchard establishment.	An	20%
CO3	Implement appropriate training and pruning methods and analyze their effects on plant growth and productivity.	An	20%
CO4	Analyze pollination processes, identify effective pollinizers and pollinators, and explain concepts like fertilization and parthenocarpy.	An	20%
CO5	Perform practical experiments and assignments on the use of plant growth regulators and record observations relevant to horticultural practices.	Ap	Internal Assessment

UNIT I – BASIC CONCEPTS OF HORTICULTURE	**(9)**
Horticulture - Its definition and branches, importance and scope. Horticultural and botanical classification. Climate and soil for horticultural crops.	
UNIT II – PROPAGATION METHODS AND STRUCTURES	**(9)**
Plant propagation-methods like cutting, layering, grafting and propagating structures. Seed dormancy, Seed germination, principles of orchard establishment.	
UNIT III - TRAINING AND PRUNING	**(9)**
Principles and methods of training and pruning, juvenility and flower bud differentiation, unfruitfulness.	
UNIT IV – POLLINATION	**(9)**
Pollination, Pollinizers and Pollinators. Fertilization and Parthenocarpy. Medicinal and Aromatic plants.	

UNIT V - GROWTH REGULATORS	(9)
Growth regulators - Importance of plant bio-regulators in horticulture – Auxin – Gibberellins – Cytokinin – Ethylene – role of Growth regulators in horticultural crops.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Jitendra Singh, "Basic Horticulture", Kalyani Publishers, New Delhi, 2011.
2. Peter, K.V., "Basics Horticulture", New India Publishing Agency, 2009.

REFERENCES:

1. Kausal Kumar Misra and Rajesh Kumar, "Fundamentals of Horticulture", Biotech Books, 2014.
2. Chadha, K. L., "Hand book of Horticulture ", ICAR, NewDelhi, 2002.
3. Christopher, E. P., "Introductory Horticulture", Biotech Books, New Delhi, 2001.
4. Adams C. R., Bradford K. H., and Early M. P., "Principles of Horticulture", CBS Publishers and Distributors, New Delhi, 1996.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3				3										
4	3													
5					2	2						2		
CO (W.A)	3	3		**3**	**2**	**2**						**2**		

22AGM03 - FARM MECHANIZATION				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To provide fundamental knowledge on farm mechanization, tillage practices, and machinery used in various agricultural operations. • To develop skills in the application, maintenance, and evaluation of agricultural machinery with focus on safety, efficiency, and economic feasibility.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge to explain the scope, evolution, and importance of farm mechanization and identify various sources of power used in agriculture.	Ap	20%
CO2	Analyze types of tillage operations and assess the challenges and emerging technologies in farm mechanization.	An	20%
CO3	Classify and demonstrate the use of various primary and secondary tillage implements and seeding equipment.	Ap	20%
CO4	Identify and describe the functions of harvesting, plant protection, and post-harvest handling equipment used in agriculture.	An	20%
CO5	Demonstrate practical understanding of machinery safety, routine maintenance, and cost-effectiveness through hands-on tasks and documentation.	Ap	Internal Assessment

UNIT I – FARM MECHANIZATION	**(9)**
Farm mechanization – Definition and scope of farm mechanization - Importance and benefits of mechanization in agriculture - history of farm mechanization in India - Different Sources of Power in agriculture – tractors - History of Development of farm tractors in India – current trends of farm mechanization	
UNIT II – TILLAGE AND CHALLENGES IN FARM EQUIPMENT USAGE	**(9)**
Introduction to Tillage and Farm Mechanization - Importance of tillage in agriculture - Types of Tillage - Applications - Benefits and Challenges of Farm Mechanization - Issues in Farm Mechanization - Emerging technologies in farm mechanization	
UNIT III - IMPLEMENTS USED IN FARMING OPERATIONS	**(9)**
Introduction to Agricultural Implements - Types of implements based on usage – primary and secondary implements – types - Mould board plough- Disc plough- animal drawn ploughs. Planting and seeding machinery – types and their functions	
UNIT IV - HARVESTING AND POST-HARVEST HANDLING EQUIPMENTS	**(9)**

Different kinds of crop harvesting machinery – combine harvesters - functions and applications - plant protection machinery - Basics of knapsack sprayers, - power sprayers, and dusters - Handling and processing equipment - threshers - Storage facilities and techniques for maintaining crop quality	
UNIT V - ECONOMICS AND SAFETY MAINTENANCE OF FARM MECHANIZATION	**(9)**
Safety precautions for operating farm machinery - Maintenance and servicing for agricultural equipment - Economic considerations in machinery selection and utilization	
TOTAL = 45 PERIODS	

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.
3. Farm Machinery and Equipment" by Harry L. Field and William D. Clay, New delhi

REFERENCES:

1. Kepner, R.A., et al, "Principles of farm machinery", CBS Publishers and Distributers, Delhi -99, 1997.
2. Harris Pearson Smith et al, "Farm machinery and equipment", Tata McGraw-Hill pub., New Delhi, 1996.

Mapping of COs with POs / PSOs

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3											
4	3													
5					2	2						3		
CO (W.A)	3	3	**3**		**2**	**2**						**3**		

22AGM04 SOIL CONSERVATION AND WATER HARVESTING TECHNOLOGY				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand the principles of water and wind erosion, their causes, effects, and control measures. • To develop the ability to plan, design, and evaluate soil conservation structures, water harvesting systems, and watershed management techniques			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge to identify types, causes, and factors of water and wind erosion and evaluate their impacts using models like USLE.	Ap	20%
CO2	Analyze the design and function of soil erosion control structures using open channel hydraulics and energy dissipation principles.	An	20%
CO3	Design and evaluate short- and long-term water harvesting structures based on site-specific considerations and sustainability	Ap	20%
CO4	Develop watershed management plans integrating biological and engineering approaches for soil and water conservation..	An	20%
CO5	Demonstrate practical skills in estimating soil loss, runoff, and evaluating conservation methods through experimental and analytical tasks.	Ap	Internal Assessment

UNIT I –CONCEPTS OF WATER EROSION	**(9)**
Problems of soil erosion - Geological and Accelerated erosion, Factors affecting water erosion, Types of water erosion - Splash, sheet and rill, Gully, stream bank and road erosion and ravines, Universal Soil Loss Equation (USLE) & soil loss tolerance, Rainfall Erosion Index, Soil erodibility Index, Slope, slope length and topographical factors, Crop management for soil erosion 'C' factor, Conservation practice factor 'P', Measurement of runoff and soil loss - Multislot divisor unit - Coshocton rotating wheel sampler - Rainfall simulation and simulator - Sediment yield and sedimentation, Wind erosion mechanics - Methods of estimation of wind erosion - Desertification, deforestation and shifting cultivation.	

UNIT II – EROSION CONTROL STRUCTURES	**(9)**
Introduction; classification of structures, functional requirements of soil erosion control structures; flow in open channels-types of flow, state of flow, regimes of flow, energy and momentum principles, specific energy and specific force; hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy; runoff measuring structures-parshall flume, H - flume and weirs	

UNIT III – WATER HARVESTING TECHNIQUES	(9)

Water harvesting principles for rural and urban – classification based on source, storage and use; Short-term and micro-level harvesting techniques for runoff – terracing and bunding – rock and ground catchments; Long-term and macro-level harvesting techniques for runoff – farm ponds – percolation ponds and nala bunds; Design considerations – site selection – selection of system and components – optimization for sustainable operation – cost estimation.

UNIT IV – WATERSHED MANAGEMENT	(9)

Watershed – concept – planning, Principles – Components of watershed development – Watershed management plan - Biological. Watershed management plan – Engineering.

UNIT V – WATER HARVESTING	(9)

Land use capability classification; grassed water ways and their design; introduction to water harvesting techniques, Farm pond, Dry farming techniques for improving crop production.

TOTAL = 45 PERIODS

TEXT BOOKS:

1. Suresh, R., "Soil and Water Conservation Engineering", Standard Publishers & Distributors, New Delhi., 2012.
2. Bhagu, R., Chahar, "Groundwater Hydrology", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017.

REFERENCES:

1. Das, M., "Open Channel Flow", Prentice Hall of India Pvt. Ltd., New Delhi, 2008 .
2. "Agriculture in the Dry Areas", CRC Press, Taylor and Francis Group, London, 2012.
3. Michael, A.M., Ojha T.P., "Principles of Agricultural Engineering-Volume II, 4th Edition", Jain Brothers, New Delhi, 2003.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3											
4	3													
5					2	2						3		
CO (W.A)	**3**	**3**	**3**		**2**	**2**						**3**		

22AGM05 RENEWABLE POWER SOURCES				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To provide foundational knowledge of renewable energy sources and their role in sustainable development. • To develop analytical and practical skills in various renewable energy systems including biomass, solar, wind, hydro, and ocean energy.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of renewable energy and evaluate the availability and social implications of renewable energy sources in India and globally.	Ap	20%
CO2	Analyze biomass, biogas, and biofuel systems in terms of characterization, construction, working principles, and applications	An	20%
CO3	Estimate solar radiation and demonstrate the operation of various solar energy systems and devices.	Ap	20%
CO4	Evaluate the components and classification of wind energy conversion systems	An	20%
CO5	Demonstrate the ability to assess hydro and ocean thermal energy systems through practical understanding of mechanics, design, and challenges.	Ap	Internal Assessment

UNIT I – INTRODUCTION OF RENEWABLE POWER SOURCES	**(9)**
Principles of renewable energy; energy and sustainable development, fundamentals and social implications - worldwide renewable energy availability- renewable energy availability in India - brief descriptions on renewable power sources- Introduction to Internet of energy (IOE).	
UNIT II – BIOMASS , BIOGAS AND BIOFUEL	**(9)**
Characterization of biomass; types, construction, working principle, Biomass Combustion Technology, Biomass Gasification - Biogas technology, Biogas plants types- Bio-Fuels and characteristics - Importance of Biofuels	
UNIT III - SOLAR ENERGY	**(9)**
Fundamentals - Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces - Solar radiation Measurements- Pyrometer - Sunshine Recorder - Solar Thermal systems - Flat plate collector - Solar distillation - Solar pond electric power plant.	
UNIT IV - WIND ENERGY	**(9)**

Properties of wind - availability of wind energy in India - major problems associated with wind power - Basic components of wind energy conversion system (WECS) - Classification of WECS- Horizontal axis- single, double and muliblade system.

UNIT V - HYDRO AND OCEAN THERMAL ENERGY CONVERSION **(9)**

Tides and waves as energy suppliers and their mechanics- fundamental characteristics of tidal power - harnessing tidal energy - advantages and limitations - Principle of working - OTEC power stations in the world - problems associated with OTEC.

TOTAL = 45 PERIODS

TEXT BOOKS:

1. Widell, J.T and Weir, T, "Renewable Energy Resources" .
2. Paul Matthews, "Introducing Renewable Energy: A simple, practical guide to small scale solar, wind and hydro-electric micro power".

REFERENCES :

1. Garg, H. P., "Treatise on Solar Energy, Vol.: Fundamentals of solar energy", John Wiley & sons Ltd.
2. John, A., Duffie and William A. Beckman, "Solar Engineering of Thermal Processes", 4th Edition, John Wiley and Sons Ltd, 2013. (ISBN: 978-0-470-87366-3)
3. Hall, D. D. and Grover, R. P., "Biomass Regenerable Energy" .
4. Garg, H. P., "Advances in Solar Energy Technology Volume 2, Industrial Applications of Solar Energy", Springer Publications. 1987. (ISBN: 978-94-010-8188-7 (Print)).

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2	3													
3			3											
4				3										
5							2					3		
CO (W.A)	**3**	**3**	**3**	**3**			**2**					**3**		

22AGM06 ENVIRONMENTAL POLLUTION MANAGEMENT				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To understand sources, types, and impacts of environmental pollutants across air, water, soil, and noise domains.. • To develop knowledge and skills in pollution monitoring, quality assessment, and control technologies.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply classification methods to identify types, sources, and impacts of environmental pollutants.	Ap	20%
CO2	Apply control techniques for air pollutants and interpret air quality data based on standards.	Ap	20%
CO3	Apply unit processes in wastewater treatment and assess water quality using standard parameters.	Ap	20%
CO4	Apply noise measurement techniques and propose control strategies based on guidelines.	Ap	20%
CO5	Demonstrate soil pollution analysis and suggest suitable mitigation strategies through field-based evaluation.	Ap	Internal Assessment

UNIT I – BASIC CONCEPTS IN ENVIRONMENTAL POLLUTION	**(9)**
Introduction, Objectives-Definition and types of environmental pollution-Types of pollutants-Source classification-Concept of standards, guidelines.	
UNIT II – AIR POLLUTION AND QUALITY AND ITS CONTROL	**(9)**
Introduction, Objectives-Control Measures for Particulate Pollutants-Control measures for Volatile Organic Compounds- Control measures for Gaseous emissions. Monitoring of Air Quality-Air quality standards-Air Quality Index-Indoor air pollution.	
UNIT III – WATER POLLUTION AND QUALITY AND ITS CONTROL	**(9)**
Introduction, Objectives-Physical Unit Processes-Chemical Unit Processes-Biological Unit Processes-Sludge Management-Design of a waste water treatment plant-Advanced water treatment processes. Water Quality And Its Impact-Concept of water quality-Water quality parameters-Water quality standards and guidelines.	
UNIT IV – NOISE POLLUTION AND ITS CONTROL	**(9)**

Introduction, Objectives-The Concept of Noise-Measurement of Noise-Sources of Noise Pollution-Guidelines and Standards of Noise Pollution-Impacts of Noise Pollution-Control of Noise Pollution.

UNIT V – SOIL QUALITY AND ITS POLLUTION	**(9)**

Introduction, Objectives- Characteristics of Soil- Different kinds of Soil- Soil pollution- Soil Pollution and Agriculture- Mining and Soil Pollution- Effects of Soil Pollution.

TOTAL = 45 PERIODS

TEXT BOOKS:

1. "Industrial wastewater management, treatment & disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008.
2. Soli. J. Arceivala, Shyam, R. Asolekar and Tata Mcgraw Hill, "Waste water Treatment for pollution control and reuse", 2007.

REFERENCES:

1. "MEV-015 ENVIRONMENTAL POLLUTION, CONTROL AND MANAGEMENT"
2. Noel de Nevers, "Air Pollution Control Engg", McGraw Hill, New York, 2016.
3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc., 2000.
4. Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, 2004.

Mapping of COs with POs / PSOs

CO's	PO's												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2	3													
3			3											
4				2										
5						2	2					3		
CO (W.A)	3	3	3	2		2	2					3		

22AGM07 PRINCIPLES OF FOOD SCIENCE AND PRESERVATION				
	L	T	P	C
	3	0	0	3
PRE - REQUISITE : NIL				
Course Objective:	• To impart knowledge on various food preservation methods and their significance in reducing post-harvest losses • To enable learners to apply and evaluate thermal and non-thermal food preservation techniques and analyze their effectiveness in extending shelf life.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply traditional and modern preservation techniques to reduce perishability of food products.	Ap	20%
CO2	Apply appropriate methods for handling and low-temperature storage of plant and animal products.	Ap	20%
CO3	Analyze thermal processing methods and evaluate their suitability for different food types.	Ap	20%
CO4	Evaluate drying and freezing methods using psychrometric properties and design parameters	Ap	20%
CO5	Evaluate non-thermal preservation technologies for their efficiency and applicability in various food systems.	Ap	Internal Assessment

UNIT I – FOOD PRESERVATION AND ITS IMPORTANCE	**(9)**
Introduction to food preservation, Wastage of processed foods; shelf life of food products; types of food based on its perishability, Traditional methods of preservation	
UNIT II – METHODS OF FOOD HANDLING AND STORAGE	**(9)**
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.retort pouch packing, Aseptic packaging.	
UNIT III – THERMAL METHODS	**(9)**
Newer methods of thermal processing; batch and continuous; In container sterilization- canning; application of infra-red microwaves; ohmic heating; control of water activity; preservation by concentration and dehydration; osmotic methods.	
UNIT IV – DRYING PROCESS FOR TYPICAL FOODS	**(9)**

Rate of frying for food products; design parameters of different type of dryers; properties of air-water mixture, Psychrometric chart, freezing and cold storage, freeze concentration, dehydro-freezing,freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages

UNIT V – NON-THERMAL METHODS	**(9)**

Super Critical Technology for Preservation – Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology,

TOTAL = 45 PERIODS

TEXT BOOKS:

1. Karnal, Marcus and Lund, D.B., "Physical Principles of Food Preservation", Rutledge, 2003.
2. VanGarde, S.J. and Woodburn. M., "Food Preservation and Safety Principles and Practice", Surbhi Publications, 2001.
3. Sivasankar, B., "Food Processing and Preservation", Prentice Hall of India, 2002.

REFERENCES:

1. Rahman, M. Shafiur, " Handbook of Food Preservation", Marcel and Dekker, 2006.
2. Zeuthen, Peter and Bogh-Sarensen, Leif., "Food Preservation Techniques", CRC / Wood Head Publishing, 2003.
3. Ranganna, S., "Handbook of Canning and Aseptic Packaging", Tata McGraw-Hill, 2000.

Mapping of COs with POs / PSOs

CO's	PO's												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3											
4	3													
5						2	2					2		
CO (W.A	3	3	3			2	2					2		

22AGM08 BIOMASS WASTE TO ENERGY				
	L	T	P	C
	3	0	0	3

PRE - REQUISITE : NIL

Course Objective:	• To provide knowledge on characterization of wastes and their potential as energy sources. • To enable students to apply and analyze thermal and chemical waste-to-energy technologies and assess their efficiency and environmental impacts.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply methods to characterize and classify various waste types for energy potential.	Ap	20%
CO2	Apply incineration and gasification techniques for converting waste to energy..	Ap	20%
CO3	Analyze pyrolysis processes and assess syngas utilization systems.	An	20%
CO4	Evaluate solid waste densification and strategies for improving energy recovery efficiency.	An	20%
CO5	Evaluate the performance and environmental impact of plastic-to-energy systems and gas cleanup methods through case studies, field visits, or technical reviews	Ap	Internal Assessment

Unit I - Waste Characterization and Classification	**(9)**
Introduction to waste-to-energy-Classification and types of solid and liquid wastes-Physical and chemical characterization of wastes-Assessment of energy potential	
UNIT II – Incineration and Gasification for Energy Production	**(9)**
Principles of incineration, Combustion process and energy recovery, Introduction to gasification, Reactor types and energy output comparison	
UNIT III – Pyrolysis and Syngas Utilization	**(9)**
Pyrolysis principles and reactor types, Products of pyrolysis and their energy potential, Syngas composition, cleaning, and utilization, Integration with gas engines and turbines	
UNIT IV – Densification and Power Plant Efficiency	**(9)**
Densification methods for solid waste (briquetting, pelletizing),Impacts on combustion efficiency, Efficiency improvement strategies in power plants, Waste plastic energy recovery techniques	

UNIT V – Waste Plastics and Gas Cleanup	(9)
Conversion of waste plastics into fuel, Thermal depolymerization, catalytic cracking, Gas cleanup techniques and emission control. Environmental and economic considerations	
TOTAL = 45 PERIODS	

TEXT BOOKS:

1. Rogoff, M.J. and Screve, F., "Waste-to-Energy: Technologies and Project Implementation", Elsevier Store.
2. Young G.C., "Municipal Solid Waste to Energy Conversion processes", John Wiley and Sons.

REFERENCES:

3. Harker, J.H. and Backhusrt, J.R., "Fuel and Energy", Academic Press Inc.
4. Paul T. Williams wrote Waste Treatment and Disposal, published by John Wiley & Sons in 2005 (2nd Edition).
5. EL-Halwagi, M.M., "Biogas Technology- Transfer and Diffusion", Elsevier Applied Science.
6. Hall, D.O. and Overeed, R.P.," Biomass - Renewable Energy", John Willy and Sons.
7. Mondal, P. and Dalai, A.K. eds., 2017. Sustainable Utilization of Natural Resources. CRC Press.

Mapping of COs with POs / PSOs

CO's	PO's												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			3											
4	3													
5						2	2					2		
CO (W.A)	3	3	3			2	2					2		

22GEZ01- Entrepreneurship Development				
	L	T	P	C
	2	0	2	3

PRE REQUISITE : Nil

Course Objective:	• Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship • Apply process of problem –opportunity identification and validation through human centred approach to design thinking in building solutions as part of engineering projects. • Analyze market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product. • Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise. • Prepare and present an investible pitch deck of their practice venture to attract stakeholders

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze different types of entrepreneurs and their impact on emerging economies through case studies of successful and failed engineering entrepreneurs	An	20%
CO2	Apply concepts related to societal problems, generate and validate ideas, and assess business opportunities by studying emerging markets and their potential	Ap	20%
CO3	Develop prototypes using various methods and tools, understand their importance in the entrepreneurial process, and iterate based on feedback to enhance their designs	C	20%
CO4	Apply the Lean Canvas to develop business models and craft effective pitches that engage investors and customers	Ap	20%
CO5	Analyze the entrepreneurial ecosystem, including its components, financing models, and stakeholder networks through interactive activities such as visits and interactions with startup founders	Ap	20%

MODULE–I: ENTREPRENEURIAL MINDSET	(6+6)
Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economics–Developing and Understanding an Entrepreneurial Mindset– Importance of Technology Entrepreneurship – Benefits to the Society. Case Analysis: Study cases of successful & failed engineering entrepreneurs - Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks.	
MODULE– II: OPPORTUNITIES	(6+6)

Problems and Opportunities–Ideas and Opportunities–Identifying problems in society– Creation of opportunities – Exploring Market Types – Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities.

Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation – Analyse feedback to refine the opportunity.

MODULE–III: PROTOTYPING & ITERATION	(6+6)

Prototyping – Importance in entrepreneurial process – Types of Prototypes - Different methods – Tools & Techniques. Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.

MODULE– IV: BUSINESS MODELS & PITCHING	(6+6)

Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest assumptions to Business Models – Using Business Model Canvas as a Tool – Pitching Techniques :Importance of pitching-Types of pitches-crafting a compelling pitch –pitch presentation skills - using storytelling to gain investor/customer attention.

Activity Session: Develop a business model canvas for the prototype; present and receive feedback from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback.

MODULE–V:ENTREPRENEURIAL ECOSYSTEM	(6+6)

Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models–equity, debt, crowd funding, etc, Support from the government and corporate. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network.

Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or maker space or interact with startup founders).

TOTAL(L:30,P:30) = 60 PERIODS

REFERENCES:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGraw Hill, 11th Edition.

2. Ries,E.(2011).The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.

3.Blank, S.G.,& Dorf,B.(2012).The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch.

4. Roy, R.(2017).Indian Entrepreneurship: Theory and Practice New Delhi: Oxford University Press.

5. Osterwalder,A.,& Pigneur, Y.(2010).Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.

Mapping of COs with POs / PSOs														
Cos	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3							3	3		3		
2		3	3				2		3	3		3		
3			3		3				3	3		3		
4									3	3	3	3		
5									3	3	3	3		
CO (W.A)		**3**	**3**		**3**		**2**		**3**	**3**	**3**	**3**