1.1.2 - Details of syllabus revision was carried out during the year

B.Tech Agricultural Engineering

S.No	Course Code	Course Name	% of Change
1.	22AGC14	Soil and Water Conservation Engineering	20%
2.	22AGP07	CAD for Agricultural Engineers	24%
3.	22MAN10R #	Communication and Quantitative Reasoning	100%
4.	22AGC17	Renewable energy Sources	100%
5.	22AGP10	Rural Agricultural Work Experi ent	100%
6.	22AGX28	Building Materials, Estimation a d Costing	80%
7.	22AGX05	Hydraulic Drives and Controls	100%
8.	22AGX06	Precision Farming Equipment	100%
9.	22AGX12	Waste and By-Product Utilizatio	100%
10.	22AGX13	Solar Energy Engineering	100%
11.	22AGX14	Wind Energy Engineering	100%
12.	22AGX15	Alternate Energy Sources	100%
13.	22AGX16	Energy Storage Systems	100%
14.	22AGX17	Energy Auditing and Managemen	100%
15.	22AGX18	Carbon Capture and Storage	100%
16.	22AGX35	Processing of Fruits and Vegetables	100%
17.	22AGX36	Food, Plant Design and Management	100%
18.	22AGX37	Food Quality and Safety	100%
19.	22AGX38	Dairy Technology	100%
20.	22AGX42	Entrepreneurship Development	100%
21.	22AGX43	Agricultural Marketing, Trade and Prices	100%
22.	22AGX45	Commercial Agriculture	100%
23.	22AGX46	Agricultural Finance, Banking and Co-operation	100%
24.	22AGX56	Instrumentation and Control Engineering	100%
25.	22AGX57	IoT in Agriculture	100%
26.	22AGX58	Artificial Intelligence and Machine Learning for Agriculture	100%
		Average	**93.33%**

Head of the Department
Department of Agriculture Engineering
Nandha Engineering College,
(Autonomous)
Erode - 638 052.

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]

July 2024

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# / 22MAN07R##	Soft / Analytical Skills - III	MC	-	3	1	0	2	0
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 # / 22MAN08R##	Soft/Analytical Skills – IV	MC	-	3	1	0	2	0
10	22GED01	Personality and Character Development	MC	-	0	0	0	1	0
				TOTAL	**33**	**18**	**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 Sources	PCC	-	3	3	0	0	3
2	22AGC18	Food and Dairy Engineering	PCC	-	3	3	0	0	3
3	EM1	Elective - Management (ABM)	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(OEC)	OEC	-	3	3	0	0	3
PRACTICAL									
7	22AGP09	Food and Dairy Engineering Laboratory	PCC	-	4	0	0	4	2
8	22AGP10	Rural Agricultural Work Experiment	EEC	-	2	0	0	2	1
				TOTAL	**24**	**18**	**0**	**6**	**21**

SEMESTER: VII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22GEA01	Human Values and Ethics	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(PEC)	PEC	-	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 (ABM)	HSMC	-	3	3	0	0	3
6.	22GEA01	Human Values and Ethics	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 Agricultural 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 Sources	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 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
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

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	3	6	21
VII	2				2	9	3	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%**	**9.20%**	**7.36%**	**5.52%**	**9.82%**

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

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**

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	

22AGP10 - RURAL AGRO INDUSTRY WORK EXPERIMENT (RAIWE)				
	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

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 3rd 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									3	
4					2									3
5	3					2	2							3
CO(W.A)	3	2	3	2	2	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**

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	

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	

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			1		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

22AGX42 - ENTREPRENEURSHIP 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**

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**

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