MAHENDRA ENGINEERING COLLEGE

(Autonomous)

Accredited by NAAC 'A' Grade & NBA Tier-I(WA) UG: CSE,ECE,EEE

Mahendhirapuri, Mallasamudram, Namakkal Dt. - 637 503.

CURRICULUM

REGULATION-2022

CHOICE BASED CREDIT SYSTEM (CBCS)

B.Tech –AGRICULTURAL ENGINEERING

DEPARTMENT OF AGRICULTURE ENGINEERING
MAHENDRA ENGINEERING COLLEGE
(AUTONOMOUS)
MALLASAMUDRAM WEST, TAMIL NADU 637503

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM
Regulation 2022

I-Semester

Sl.No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22MA12101	Engineering Mathematics- I	BS	3	1	0	4
2	22EN11001	Communicative English	HS	3	0	0	3
3	22CY12001	Chemistry for Engineering	BS	3	0	0	3
4	22GE13001	Engineering Graphics and Design	ES	3	0	2	4
5	22AG14101	Principles and Practices of Crop Production	PC	3	0	0	3
6	22HS11001	Heritage of Tamils	MC	0	0	0	1
7.		Induction program	MC	0	0	0	0
PRACTICAL							
8	22CY22001	Chemistry Laboratory	BS	0	0	3	1.5
9	22GE23101	Engineering Practices Laboratory	ES	0	0	4	2
10	22EN21001	Personality Development Practice Laboratory	HS	0	0	2	1
Total				**15**	**1**	**11**	**22.5**

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II-Semester

Sl.No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22MA12201	Engineering Mathematics - II	BS	3	1	0	4
2	22PY12001	Engineering Physics	BS	3	0	0	3
3	22CS13001	Problem Solving Techniques Using C	ES	3	0	0	3
4	22GE13201	Engineering Mechanics	ES	3	0	0	3
5	22EE13101	Basics of Electrical and Electronics Engineering	ES	2	0	2	3
6.	22HS110	Tamils and Technology					1
PRACTICAL							
6	22PY22001	Physics Laboratory	BS	0	0	3	1.5
7	22CS23001	Problem Solving Techniques Using C Laboratory	ES	0	0	3	1.5
8	22AG24201	Crop Husbandry Laboratory	PC	0	0	3	1.5
Total				**15**	**1**	**9**	**21.5**

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III-Semester

Sl.No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22MA12303	Differential equations and Numerical Methods	BS	3	1	0	4
2	22AG14301	Strength of Materials for Agricultural Engineering	PC	3	0	0	3
3	22AG14302	Fluid Mechanics and Hydraulics	PC	3	0	0	3
4	22AG14303	Surveying	PC	3	0	0	3
5	22AG14304	Soil Science and Soil Mechanics	PC	3	0	0	3
6		Open Elective – I	OE	2	1	0	3
7	22SH11006	Universal Human Values	HS	2	1	0	3
PRACTICAL							
8	22AG24301	Surveying Laboratory	PC	0	0	3	1.5
9	22AG24302	Fluid mechanics and Hydraulics Laboratory	PC	0	0	3	1.5
TOTAL				**19**	**3**	**6**	**25**

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IV-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22AG14401	Unit Operations in Agricultural Processing	PC	3	0	0	3
2	22AG14402	Tractor and Power Units	PC	3	0	0	3
3	22AG14403	Building Materials and Estimation	PC	3	0	0	3
4		Professional Elective – I	PE	3	0	0	3
5		Open Elective –II	OE	2	1	0	3
6		Open Elective – III	OE	3	0	0	3
7	22CY11001	Environmental Science and Engineering	HS	3	0	0	0
PRACTICAL							
8	22AG24401	Soil Science and Soil Mechanics Lab	PC	0	0	3	1.5
9	22AG24402	Strength of Materials Laboratory	PC	0	0	3	1.5
10	22EN60001	Professional Communication Skills	HS	0	1	2	2
TOTAL				**20**	**2**	**8**	**23**

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM
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V-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22AG14501	Design of Agricultural machinery	PC	3	0	0	3
2	22AG14502	Post-Harvest Technology	PC	3	0	0	3
3		Professional Elective – II	PE	3	0	0	3
4		Open Elective –IV	OE	3	0	0	3
5		Open Elective – V	OE	3	0	0	3
6	22MBAT6S06	Managerial Skills & Quality Management	EEC	3	0	0	3
PRACTICAL							
7	22AG24501	Post Harvest Engineering laboratory	PC	0	0	3	1.5
8	22AG24502	CAD for Agricultural Machinery	PC	0	0	3	1.5
9	22EN60002	Interview Skills and Soft Skills	HS	0	1	2	2
10	22AG56501	In-plant Training	EEC	0	0	0	1
TOTAL				**18**	**1**	**8**	**24**

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CHOICE BASED CREDIT SYSTEM
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VI-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22AG14601	Farm Power and Machinery Management	PC	3	0	0	3
2	22AG14602	Irrigation Equipment Design	PC	3	0	0	3
3	22AG14603	Solar and wind energy engineering	PC	3	0	0	3
4	22AG14604	Food and Dairy Processing Engineering	PC	3	0	0	3
5	22AG14605	Energy Audit and Management	PC	3	0	0	3
6		Professional Elective – III	PE	3	0	0	3
7	22MC60001	Constitution of India	MC	3	0	0	0
PRACTICAL							
8	22AG24601	Bio-Energy Laboratory	PC	0	0	3	1.5
9	22AG24602	Food and Dairy engineering laboratory	PC	0	0	3	1.5
10	22AG24603	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	3	1.5
TOTAL				**21**	**0**	**9**	**22.5**

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CHOICE BASED CREDIT SYSTEM
Regulation 2022

VII-Semester

Sl.No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22AG14701	Remote Sensing and GIS in Agriculture	PC	3	0	0	3
2	22AG14702	Field Crop Machinery	PC	3	0	0	3
3	22AG14703	Soil and water Conservation Engineering	PC	3	0	0	3
4	22AG14704	Testing and Evaluation of Farm Machinery	PC	3	0	0	3
5		Professional Elective - IV	PE	3	0	0	3
PRACTICAL							
7	22AG24701	Remote Sensing and Geological Information System Laboratory	PC	0	0	3	1.5
8	22AG36702	Project Work (Phase –I)	EEC	0	0	6	3
9	22AG56703	In-plant Training	EEC	0	0	0	1
TOTAL				**15**	**0**	**9**	**20.5**

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM
Regulation 2022

VIII-Semester

Sl.No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1		Professional Elective - V	PE	3	0	0	3
2		Professional – VI	PE	3	0	0	3
PRACTICAL							
3	22AG36801	Project Work (Phase –II)	EEC	0	0	12	6
TOTAL				**6**	**0**	**12**	**12**

TOTAL CREDITS: 171

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SUMMARY

CREDITS AS PER SEMESTER

SI.No	SUBJECT AREA	Credits Per Semester								CREDITS
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	5	1	3	2	2				13
2.	BS	8.5	8.5	4						21
3.	ES	6	10.5							16.5
4.	PC	3	1.5	16.5	12	9	18	13.5		73.5
5.	PE				3	3	3	3	6	18
6.	OE			3	6	6				15
7.	MC									
8.	EEC					4		4	6	14
9.	TOTAL	22.5	21.5	26.5	23	24	21	20.5	12	171

HUMANITIES AND SOCIAL SCIENCES (HS)

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SI.No.	Course Code	Course Title	Category	L	T	P	C
1	22EN11001	Communicative English	HS	3	0	0	3
2	22EN21001	Personality Development Practice Laboratory	HS	0	0	2	1
3	22SH11006	Universal Human Values	HS	2	1	0	3
4	22CY11001	Environmental Science and Engineering (MC Non Credit Course)	HS	3	0	0	0
5	22EN60001	Professional Communication Skills	HS	0	1	2	2
6	22EN60002	Interview Skills and Soft Skills	HS	0	1	2	2

BASIC SCIENCES (BS)

SI.No.	Course Code	Course Title	Category	L	T	P	C
1	22MA12101	Engineering Mathematics- I	BS	3	1	0	4
2	22CY12001	Chemistry for Engineering	BS	3	0	0	3
3	22CY22001	Chemistry Laboratory	BS	0	0	3	1.5
4	22MA12201	Engineering Mathematics - II	BS	3	1	0	4
5	22PY12101	Engineering Physics	BS	3	0	0	3
6	22PY12001	Physics Laboratory	BS	0	0	3	1.5
7	22MA12303	Differential equations and Numerical Methods	BS	3.	1	0	4

ENGINEERING SCIENCES (ES)

SI.No.	Course Code	Course Title	Category	L	T	P	C
1	22EE13101	Basics of Electrical and Electronics Engineering	ES	3	0	0	3
2	22GE13001	Engineering Graphics and Design	ES	3	0	0	3
3	22GE23101	Engineering Practices Laboratory	ES	0	0	3	1.5
4	22CS13001	Problem Solving Techniques in C	ES	3	0	0	3
5	22GE13201	Engineering Mechanics	ES	3	0	0	3
6	22CS23001	Problem Solving Techniques	ES	0	0	3	1.5

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		Using C Lab					

Mandatory Course (MC)

SI.No.	Course Code	Course Title	Category	L	T	P	C
1		Induction program	MC	0	0	0	0
2	22MC60001	Constitution of India	MC	3	0	0	0

PROFESSIONAL CORE (PC)

SI.No.	Course Code	Course Title	Category	L	T	P	C
1.	22AG14201	Principles and Practices of Crop Production	PC	3	0	0	3
2.	22AG24201	Crop Husbandry Laboratory	PC	0	0	3	1.5
3.	22AG14301	Strength of Materials for Agricultural Engineering	PC	3	0	0	3
4.	22AG14302	Fluid Mechanics and Hydraulics	PC	3	0	0	3
5.	22AG14303	Surveying	PC	3	0	0	3
6.	22AG14304	Soil Science and Soil Mechanics	PC	3	0	0	3
7.	22AG24301	Surveying Laboratory	PC	0	0	3	1.5
8.	22AG24302	Fluid Mechanics Laboratory	PC	0	0	3	1.5
9.	22AG14401	Unit Operations in Agricultural Processing	PC	3	0	0	3
10.	22AG14402	Tractor and Power Units	PC	3	0	0	3
11.	22AG14403	Building Materials and Estimation	PC	3	0	0	3
12.	22AG24401	Soil Science and Soil Mechanics Lab	PC	0	0	3	1.5
13.	22AG24402	Strength of Materials Laboratory	PC	0	0	3	1.5
14.	22AG14501	Design of Agricultural Machinery	PC	3	0	0	3
15.	22AG14502	Post-Harvest Technology	PC	3	0	0	3
16.	22AG24501	Post-Harvest Engineering	PC	0	0	3	1.5

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		laboratory					
17.	22AG24502	CAD for Agricultural Machinery	PC	0	0	3	1.5
18.	22AG14601	Farm Power and Machinery Management	PC	3	0	0	3
19.	22AG14602	Irrigation Equipment Design	PC	3	0	0	3
20.	22AG14603	Solar and Wind Energy Engineering	PC	3	0	0	3
21.	22AG14604	Food and Dairy Process Engineering	PC	3	0	0	3
22.	22AG14605	Energy Audit and Management	PC	3	0	0	3
23.	22AG24601	Bio-Energy Laboratory	PC	0	0	3	1.5
24.	22AG24602	Food and Dairy Engineering Laboratory	PC	0	0	3	1.5
25.	22AG24603	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	3	1.5
26.	22AG14701	Remote Sensing and GIS in Agriculture	PC	3	0	0	3
27.	22AG14702	Field Crop Machinery	PC	3	0	0	3
28.	22AG14703	Soil and Water Conservation Engineering	PC	3	0	0	3
29.	22AG14704	Testing and Evaluation of Farm Machinery	PC	3	0	0	3
30.	22AG24701	Remote Sensing and Geological Information System Laboratory	PC	0	0	3	1.5

PROFESSIONAL ELECTIVES (PE) - IV SEMESTER

SI.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15401	Hydrology and Water Resource Engineering	PE	3	0	0	3
2	22AG15402	Municipal Solid Waste Management	PE	3	0	0	3
3	22AG15403	Groundwater, Wells and Pumps	PE	3	0	0	3
4	22AG15404	Farm Drainage System Design	PE	3	0	0	3
5	22AG15405	Modeling in Integrated Water Resources Management	PE	3	0	0	3
6	22AG15507	Biochemical and Thermochemical Conversion of	PE	3	0	0	3

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		Biomass					

PROFESSIONAL ELECTIVES (PE) - V SEMESTER

SI.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15501	Irrigation and Drainage Engineering	PE	3	0	0	3
2	22AG15502	Biofuels and Engineering	PE	3	0	0	3
3	22AG15503	Biomass Management for Fodder and Energy	PE	3	0	0	3
4	22AG15504	Seed Production Technology	PE	3	0	0	3
5	22AG15505	Refrigeration and Air Conditioning for Agricultural Engineers	PE	3	0	0	3
6	22AG15506	Applications of IT In Agricultural System	PE	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - VI SEMESTER

SI.No.	Course Code	Course Title	Category	L	T	P	C
1.	22AG15601	Heat Transfer, Refrigeration and Air conditioning	PE	3	0	0	3
2.	22AG15602	Food processing plant design and layout	PE	3	0	0	3
3.	22AG15603	Food Quality standards and Safety Engineering	PE	3	0	0	3
4.	22AG15604	Food Packaging Technology	PE	3	0	0	3
5.	22AG15605	Advanced Food Processing Engineering	PE	3	0	0	3
6.	22AG15606	Food Plant Design, Food Safety And Management	PE	3	0	0	3

PROFESSIONAL ELECTIVES (PE) – VII SEMESTER

SI.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15701	Storage and Packaging Technology	PE	3	0	0	3
2	22AG15702	Post Harvest Engineering of Horticulture Crops	PE	3	0	0	3
3	22AG15703	Design of Farm Structures	PE	3	0	0	3

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4	22AG15704	Climate Change and Adaptation	PE	3	0	0	3
5	22AG15705	Systems Analysis in Agricultural Engineering	PE	3	0	0	3
6	22AG15706	Landscape Architecture	PE	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - VIII SEMESTER

SI.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15801	Design of greenhouse Structures	PE	3	0	0	3
2	22AG15802	Extension Methodologies and Transfer of Agricultural Technology	PE	3	0	0	3
3	22AG15803	Agricultural Finance, Banking and cooperation	PE	3	0	0	3
4	22AG15804	Human Engineering and safety in Agriculture	PE	3	0	0	3
5	22AG15805	Supply Chain management	PE	3	0	0	3
6	22AG15807	Utility management	PE	3	0	0	3

OPEN ELECTIVES (OE)

SI.No.	Course Code	Course Title	Category	L	T	P	C
1		Quantitative Aptitude and Problem Solving Skills	OE	2	1	0	3
2		Professional Communication Skills	OE	0	1	2	2
3		Interpretation, Analysis and CriticalThinking Skills	OE	2	1	0	3
4		Numerical, Logical and Visual Reasoning Skills	OE	2	1	0	3
5		Interview Skills and Soft Skills	OE	0	1	2	2
6		Systems Analysis and Soft Computing In Agricultural Engineering	OE	3	0	0	3
7		Renewable Energy Technology	OE	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SI.No.	Course Code	Course Title	Category	L	T	P	C

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1	22AG66501	Managerial Skills & Quality Management	EEC	3	0	0	3
2	22AG56501	In-plant Training	EEC	0	0	0	1
3	22AG56703	In-plant Training	EEC	0	0	0	1
4	22AG36702	Project Work (Phase–I)	EEC	0	0	6	3
5	22AG36801	Project Work (Phase–II)	EEC	0	0	6	6

Verticals 1 Farm Machinery and Energy Engineering

SINo.	Course Code	Course Title	L	T	P	C
1	22AG15101	Mechanics of Tillage and Traction	3	0	0	3
2	22AG15102	Energy conservation in Food Processing Industry	3	0	0	3
3	22AG15103	Landscape Design and Site Planning	3	0	0	3
4	22AG15104	Industrial Safety Management	3	0	0	3
5	22AG15105	Precision Farming Equipment	3	0	0	3
6	22AG15106	Waste and By Product Utilization	3	0	0	3
7	22AG15107	Refrigeration and Cold Storage	3	0	0	3

Verticals 2 Water Management and Protected Cultivation

SI.No.	Course Code	Course Title	L	T	P	C
1	22AG15201	Automation in Irrigation	3	0	0	3
2	22AG15202	Disaster Management	3	0	0	3
3	22AG15203	Protected Cultivation and Precision Farming	3	0	0	3
4	22AG15204	Organic Farming Technology	3	0	0	3
5	22AG15205	Irrigation Water Quality and Waste Water Management	3	0	0	3
6	22AG15206	Sustainable Agriculture and Food Security	3	0	0	3
7	22AG15207	Agricultural Business Management	3	0	0	3

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM
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V-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1.	22AG14501	Design of Agricultural Machinery	PC	3	0	0	3
2.	22AG14502	Post-Harvest Technology	PC	3	0	0	3
3.		Professional Elective II	PE	3	0	0	3
4		Open Elective –IV	OE	3	0	0	3
5		Open Elective – V	OE	3	0	0	3
6	22MBAT6S06	Managerial Skills & Quality Management	EEC	3	0	0	3
PRACTICAL							
7	22AG24501	Post Harvest Engineering laboratory	PC	0	0	3	1.5
8	22AG24502	CAD for Agricultural Machinery	PC	0	0	3	1.5
9	22EN60002	Interview Skills and Soft Skills	HS	0	1	2	2
10	22AG56501	In-plant Training	EEC	0	0	0	1
TOTAL				**18**	**1**	**8**	**24**

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MAHENDRA ENGINEERING COLLEGE
(Autonomous)

Syllabus

Department	Agricultural Engineering	Programme Code	1111

V- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14501	DESIGN OF AGRICULTURAL MACHINERY	3	0	0	3	100

Objective(s)

- To apply failure theories in evaluating strength of machine elements and analyze machine components subjected to static and variable loads..
- To analyze the various transmission systems.
- To design the shafts, couplings and keys.
- To impart the knowledge on the energy storing elements that is springs and levers.
- To draw the design terminology of gears and design of bearings.

UNIT-I **TRACTOR AND POWER TILLER** **9 + 3**

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

UNIT-II **DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS** **9 + 3**

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

UNIT-III **DESIGN OF SHAFTS AND COUPLINGS** **9 + 3**

Design of solid and hollow shafts based on strength and rigidity- Keys and coupling –Introduction, types of keys, sunk keys, saddle keys, tangent keys, round keys, splines, forces acting on sunk keys, strength of sunk key. Effect of key ways, shaft couplings, types of shaft couplings, muff coupling, design of flange coupling. Design of keys, keyways and splines- Design of rigid and flexible couplings - knuckle and cotter joints.

UNIT-IV **DESIGN OF ENERGY STORING ELEMENTS** **9 + 3**

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs. Levers –Introduction, application of levers in engineering practice, design of lever hand levers, foot lever, cranked lever.

UNIT-V **DESIGN OF GEARS AND BEARINGS** **9 + 3**

Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation. - Failure of gear teeth. Design of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – calculation of bearing dimensions.

Total hours to be taught **(L:45+T:15)=60 PERIODS**

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

Outcomes:

- Explain the customers' need, formulate the problem and draw the design specification and the concepts of principal stresses, theories of failure, stress concentration and fatigue loading
- Illustrate design all types of keys, cotters and knuckle joints including riveted and bolted joints.
- Discuss the basic concept of shaft and design open and crossed belt pulley drives.
- Design couplings and gears and analyze the pressure distribution and design journal bearings.
- Design belts, springs, brakes, clutches and engine parts.

TEXT BOOK :

1	Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house, 2005.
2	Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.
3	Maleev and Hartman. (1978). Mechanical Design of Machines. CBS Publications, New Delhi.

REFERENCES:

1	Norton R.L, Machine Design – An Integrated Approach, Pearson Publications, 3rd Edition, 2006.
2	Srivastava A.K., Goering.C.E. and Rohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993
3	Gary Krutz, Lester Thompson and Paul Clear., "Design of Agricultural Machinery", John Wiley and Sons, New York, 1984

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	Programme Code	1111

V- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14502	POST HARVEST TECHNOLOGY	3	0	0	3	100

Objective(s)

- To understand the fundamental knowledge in engineering properties of agricultural materials, different post harvest operations and processing.
- To learn the physiology, biochemistry and various technologies involved relevant to shelf life extension.
- To explain the different types of machines available for material handling.
- To develop knowledge on post harvest processing of cereals, pulses, and oilseeds.
- To express the importance of proper post harvest handling techniques to maintain the quality of fruits and vegetables.

UNIT-I	INTRODUCTION OF POST HARVEST TECHNOLOGY	9

Introduction to post harvest technology of agricultural produce; Status of Production, Losses, Need, Scope and Importance, various post harvest operations such as Primary Processing Operation Vs. Secondary Operation, goals of post harvest handling,

UNIT-II	CLEANING, GRADING AND DRYING	9

Principles – types - air screen cleaners, cylinder separator, spiral separator, magnetic separator, colour sorter - effectiveness of separation and performance index – graders and types - drying: principles and theory of drying, thin layer and deep bed drying, hot air drying – dryers and types.

UNIT-III	MATERIAL HANDLING AND STORAGE	9

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

UNIT-IV	POST HARVEST TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS	9

Post harvest losses of cereals, pulses and oilseeds, Paddy processing: parboiling of paddy, methods, merits and demerits, dehusking of paddy: methods, merits and demerits; rice polishers: types, constructional details, layout of modern rice mill, Wheat milling, pulse milling, Oil seed processing. Principles and operation: maize sheller, groundnut decorticator.

UNIT-V	POST HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES	9

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Post harvest treatment to increase shelf life, Physical and thermal properties of fruits and vegetables, maturity indices for fruits, Post harvest losses in fruits and vegetables, handling of Fruits and Vegetables, cleaning and grading of fruits and vegetables. Electronic colour sorting of fruits and vegetables..	
Total hours to be taught	**(L:45+T:15)=60 PERIODS**

Outcomes:

- Describe the objectives, importance and methods of post harvest engineering.
- Delineate the principles and adjustments of cleaning, grading and drying machineries.
- Classify the different types of machines available for material handling.
- Acquire knowledge on post harvest processing of cereals, pulses, and oilseeds.
- Indicate the importance of proper post harvest handling techniques to maintain the quality of fruits and vegetables.

TEXT BOOK :

1	Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house, 2005.
2	Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.
3	Maleev and Hartman. (1978). Mechanical Design of Machines. CBS Publications, New Delhi.

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2	Srivastava A.K., Goering.C.E. and Rohrbach R.P. Engineering Principles of Agricultural Machines. Revised Printing by American Society of Agricultural Engineers. 1993
3	Gary Krutz, Lester Thompson and Paul Clear., "Design of Agricultural Machinery", John Wiley and Sons, New York, 1984

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Department	Agriculture Engineering	Programme Code	1111

V Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22MBAT6S06	Managerial Skills and Quality Management	3	0	0	3	100

Objective(s)	• To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context; • To understand and apply a variety of management and organizational theories in practice • To facilitate the understanding of Quality Management principles and process

UNIT-I	**INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS**	**9**

Definition - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

UNIT-II	**PLANNING AND ORGANISING**	**9**

Nature and purpose of planning - Planning process - Types of plans – Objectives - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making

UNIT-III	**BASICCONCEPTSOFQUALITY MANAGEMENT**	**9**

Introduction - Need for quality - Evolution of quality - Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM-TQM Framework-Contributions of Deming , Juran and Crosby -Barriers to TQM-Quality statements-Customer focus-Customer orientation, Customer satisfaction, Customer complaints, Customer retention- Costs of quality

UNIT-IV	**TQM PRINCIPLES**	**9**

Leadership - Strategic quality planning, Quality Councils – Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal-Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership- Partnering, Supplier election, Supplier Rating.

UNIT-V	**QUALITY SYSTEMS**	**9**

NeedforISO9000- ISO9001-2008 Quality System - Elements, Documentation, Quality Auditing-QS9000-ISO14000-Concepts, Requirements and Benefits- TQM Implementation in manufacturing and service sectors.

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	Total hours to be taught	**45 PERIODS**
Outcome(s)	• Understand what is meant by management and managerial effectiveness • Identify the roles which are fulfilled while working as a manager • Identify managerial activities that contribute to managerial effectiveness • Identify a cause of stress in managerial life from a range covering mismatches between capabilities and role, player-manager tension and everyday stressors • Understand time pressures and the need for time management.	
TEXT BOOK :		
1.	Dale H. Besterfiled, et at., "Total Quality Management", Third Edition, Pearson Education Asia, Indian Reprint 2006.	
2.	Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.	
REFERENCES:		
1.	James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.	
2.	Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.	
3.	Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.	

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MAHENDRA ENGINEERING COLLEGE (AUTONOMOUS) REGULATION 2022						R 2022
SEMESTER - V						
Course Code	**Course Name**	**Hours / Week**			**Credit**	**Maximum Marks**
		L	**T**	**P**	**C**	
22EN60002	**INTERVIEW SKILLS AND SOFT SKILLS** (Common to all B.E./B.Tech. Degree Programmes)	0	1	2	2	100
Objectives	➢ To improve the learners reading fluency skills through extensive reading ➢ To encourage the students to enrich their writing skills for academic and professional purposes ➢ To help the learners obtain speaking skills in both formal and informal situation. ➢ To equip them with presentation skills needed for academic as well as workplace contexts. ➢ To make them acquire interview skills to face challenges in the career aspects					
UNIT I						**9 Hrs**
Reading Comprehension - Reading Passages for Aptitude Exam - Reading for Gist, Sentence Correction, Paragraph Writing – Narrative, Descriptive, Expository, Persuasive, Content Writing.						
UNIT II						**9 Hrs**
Job Application – Cover Letter and Resume, Etiquette – E-mail and Telephone, Listening Comprehension, Listening Dialogues – Workshop.						
UNIT III						**9 Hrs**
Self Introduction and Introducing others, Greeting, Apologies, Request – Formal and Informal, Group Discussion – Useful Phrases, Do's and Don'ts, Mock Group Discussion, Role Play, Situational based dialogues.						
UNIT IV						**9 Hrs**
Presentation Skills – PPT Preparation, Importance of Verbal and Non-verbal Communication, Extempore, Public Speaking, Stage Presentation – Mock Presentation.						
UNIT V						**9 Hrs**
Interview skills – Face to Face interview, Telephonic Interview, Mock Interview – Frequently Asked Interview Questions. Soft Skills – Creative Thinking, Critical Thinking, Importance of Body Language, SWOT Analysis, Team Work, Interpersonal and Intrapersonal Skills, Time Management						
					Total Hours	**45**
Outcomes	**At the end of the course, the learners will be able to :** ➢ Analyse the content and apply knowledge and skills efficiently wherever necessary. ➢ Create profile and other essential documents. ➢ Demonstrate speaking skills effectively in academic and career contexts. ➢ Apply suitable formats and presentation skills professionally. ➢ Demonstrate soft skills effectively at the time of interview and workplace.					
Textbook:						
1	Murphy, Raymond, *English Grammar in Use*, Fifth Edition. Cambridge University Press, New Delhi, 2019					
References:						

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	**MATHEMATICS**	**Open Elective for All B.E./B.Tech. Programmes**

V Semester

Course Code	**Course Name**	**Hours / Week**			**Credit**	**Maximum Marks**
		L	**T**	**P**	**C**	
22MA12501	**Interpretation, Analysis and Critical Reasoning Skills**	2	1	0	3	100

Objectives

To enable the students to:

- To develop the students logical thinking skills and apply it in the real life scenarios.
- To learn the strategies of solving Quantitative ability problems.
- To enrich the verbal ability of the students.
- To strengthen the basic programming skills of placements
- Develop the skill of computation with sequences and series

UNIT I	**VERBAL ABILITY**	**9 Hrs**

Attention to details – Verbal Reasoning test – Types of image interpretation – Relationship – Classification - Solved Problems.

UNIT II	**LOGICAL REASONING**	**9 Hrs**

Sentence Completion and Para Jumbles – Logical connectives - Types of Logical Relationship – Types of Syllogism – Logical Deductions using Venn diagram.

UNIT III	**DATA INTERPRETATION AND DATA SUFFICIENCY**	**9 Hrs**

Ages – Problems on Ages – Concepts and basics – Set Theory– Set Operation – types of sets – solved problems – Calendars – Odd days – Leap year – counting of odd days, finding exact date – Data interpretation – Tabulation – Bar graphs – Pie charts – Line graphs – Data sufficiency based on problems.

UNIT IV	**CRITICAL REASONING**	**9 Hrs**

Surface area – Cuboids – Cube – Cylinder – Cone – Sphere – Hemisphere – Alligation – Mean Price – Rule of Alligation - Boats and Streams - Speed in Down Stream and upstream - Stream in still water - Rate of Stream - Critical Reasoning – Solved Problems.

UNIT V	**ARITHMETICAL ABILITY**	**9 Hrs**

Indices and Surds – Law's of Indices - Law's of Surds - Pipes and Cisterns – Problems based on In-let and Out-let, Part of tank filled, Time based problems - Permutation and Combination – Factorial – Number of Permutation – Number of Combination – Solved Problems.

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	Total Hours	**45**
Outcomes	At the end of the course the students will be able to: • Identify the techniques to solve Image interpretation and Relationship. • Use Techniques to solve Logical Reasoning questions • Interpret data, manipulate and summarize the information in order to answer Critical questions. • Identify the core skills associated with Critical Thinking. • Apply the basic concepts to solve problems on Surds, Pipes, Cisterns, Permutation and Combination.	
Textbook:		
1	"Quantitative Aptitude" – R.S.Aggarwal, S.Chand and Company Ltd, New Delhi – 110055.	
References:		
1	Test of Reasoning for Competitive Examinations, 4th Edition by Edgar Thorpe, Tata McGraw Hill Publication, 2010.	
2	Quantitative Aptitude for Competitive Examinations 4th Edition by Abhijit Guha, Tata McGraw Hill Publication (2010).	

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agriculture Engineering	Programme Code	1111

V –Semester

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG24501	POST HARVEST ENGINEERING LABORATORY	0	0	3	1.5	100

Objective(s)

- To determine various engineering properties of grains
- To determine test and evaluate different post harvesting machineries.
- To test of groundnut decorticator & maize sheller & evaluate of thin layer drier and L.S.U. drier

LIST OF EXPERIMENTS

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

Total hours to be taught **45 PERIODS**

Outcome(s)

- Students will acquire knowledge on post harvest management tools and novel packaging techniques.

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	• Apply appropriate concepts of post-harvest physiology and technology • Identify and evaluate various causes of post harvest losses & Analyze the value chain of produce after harvesting.

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Syllabus

Department	Agricultural Engineering	Programme Code	1111

V- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG24502	CAD FOR ARICULTURAL MACHINERY	0	0	3	1.5	100

Objective(s)	• To draft the agricultural engineering related machineries • To design structures manually and also by computer aided methods. • To Plan and layout of underground pipes, post harvesting units and check dams.

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 and Create a two dimensional sketch diagrams of simple machine components
3.	Design and Drawing of Underground pipeline system
4.	Design and Drawing of Check dam
5.	Design and Drawing of Mould board plough.
6.	Design and Drawing of Disc plough
7.	Design and Drawing of Post harvest technology units (threshers and winnowers)
8.	Design and Drawing of Biogas plant.
9.	Introduction & demonstration on solid modeling
10.	Introduction & demonstration on Pro e

Total hours to be taught	**45 PERIODS**

Outcomes:

- Learn the various important tools involved in the CAD modeling software.
- Plan and layout of underground pipes, post harvesting units and check dams.
- Design and draw the components using computer aided methods

Reference:

1	Michael, A.M. "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 1999
2	Rai, G.D. "Nonconventional Sources of Energy", Khanna publishers, New Delhi, 1995
3	Srivastava, A.C."Elements of Farm Machinery", Oxford and IBH Publications Co., New Delhi, 1990

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Department	Agriculture Engineering	Programme Code	1111

V Semester

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG56501	Inplant - Training (Two Weeks)	0	0	0	1	100

Objective(s)	To train the students in field work by attaching to any industry / organization so as to have a firsthand knowledge of practical problems in Agricultural Engineering. To gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.
	The students individually undertake training in reputed engineering companies / Govt organizations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

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PROFESSIONAL ELECTIVES (PE) - V SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15501	Irrigation and Drainage Engineering	PE	3	0	0	3
2	22AG15502	Biofuels and Engineering	PE	3	0	0	3
3	22AG15503	Biomass Management For Fodder And Energy	PE	3	0	0	3
4	22AG15504	Seed Production Technology	PE	3	0	0	3
5	22AG15505	Refrigeration And Air Conditioning For Agricultural Engineers	PE	3	0	0	3
6	22AG15506	Applications of IT In Agricultural System	PE	3	0	0	3

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Department	Agriculture Engineering	Programme Code	1111

V –Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15501	Irrigation and Drainage Engineering	3	0	0	3	100

Objective(s)

The students would be exposed to fundamental knowledge on

- Different methods of irrigation including canal irrigation.
- Different types of water control and diversion structures for planning the irrigation system.
- Furnish knowledge about canal, tank irrigation and command area development.
- Acquired knowledge on planning, design and management of land drainage works in field areas

UNIT-I	WATER RESOURCES AND IRRIGATION REQUIREMENT	9

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

UNIT-II	METHODS OF IRRIGATION	9

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

UNIT-III	DIVERSION AND IMPOUNDING STRUCTURES	9

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

UNIT-IV	CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT	9

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Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlet, Escapes – Lining and maintenance of canals - Command area - Concept, Components of CADP - On Farm Development works, Farmers committee - its role for water distribution and system operation - rotational irrigation system.		
UNIT-V	**AGRICULTURAL DRAINAGE**	**9**
Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy‟s law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation		
	Total hours to be taught	**(L:45): 45 PERIODS**

Outcome(s)	At the end of this course, the student will be able to • Estimate the irrigation efficiency and water requirements of the irrigation system. • Design the advance automation irrigation system. • Identify the suitable diversion and water control structures for agricultural land • Design the canal irrigation system and command area development • Construct the advanced drainage system with components.

TEXT BOOK :

1	Dilip Kumar Majumdar., “Irrigation Water Management”, Prentice-Hall of India, New Delhi, 2008.
2	Michael, A.M., “Irrigation Engineering”, Vikas Publishers, New Delhi, 2008
3	Garg, S.K., “Irrigation Engineering,” Laxmi Publications, New Delhi, 2008
4	Ritzema, H.P., “Drainage Principles and Applications”, Publication No. 16, International Institute of Land Reclamation and Improvement, Netherlands, 1994

REFERENCES

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

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Department	**Agriculture Engineering**	**Programme Code**			**1111**	
V Semester						
Course code	**Course Name**	**Hours/week**			**Credit**	**Maximum marks**
22AG15502	**BIO - FUELS AND ENGINEERING**	**L**	**T**	**P**	**C**	**100**
		3	0	0	3	

Objective(s)	• To understand the basic principles of biofuels and bioenergy systems. • To identify various biofuels from different biomass sources. • To understand the current state of technical issues related to bioconversion of biomass to liquid biofuels. • To understand the concepts of second and third generation ofbiofuels conversion process from biomass feedstock • To design a biofuels conversion systems related components
Outcome(s)	Students completing this course will be able to: • Analyze biofuels and bioenergy manufacturing, distribution and integration issues • Evaluate biofuel production from various biomass using bioenergy technologies • Compare the biofuels with commercial fuels • Summarize the standard of biofuels

UNIT-I	**ASPECTS OF BIOFUELS**	**9**

Biomass Potential - Biofuel Policies: Market Barriers of Biofuels, Biofuel Standardization. International Trade of Biofuels: Trade of Biodiesel and Related Products, Trade of Bioethanol. Life Cycle- Energy Balance Methodologies, Biofuel Emissions: Greenhouse Gas Emissions, Vehicle Emission Standards- Sustainability of Biofuels- Economy of Biofuels.

UNIT-II	**TYPES OF BIOFUELS**	**9**

Terms and units in biofuels. Types of biofuel – Biomethane, Bioethanol, lipid derived biofuels,btU fuel, biohydrogen Biomethane -Biomethane Production.Digestion Process**,** Digester Types-Economy of Biomethane-Biohydrogen**:**Biohydrogen Processing. Use of Biohydrogen**.**

UNIT-III	**BIOETHANOL**	**9**

Bioethanol: Feedstock Production: Sugar Crops, Starch Crops, Cellulosic Feedstock. Bioethanol Production- Sugar-to-Ethanol Process, Starch-to-Ethanol Process, Cellulose-to-Ethanol Process, Distillation and Dehydration Process. Properties of Bioethanol. Technology Applications for Bioethanol: Spark Ignition Engines, Compression Ignition Engines, Fuel Cells. Standardization of Bioethanol, Energy Balance of Bioethanol, Economy of Bioethanol.

UNIT-IV	**LIPID DERIVED BIOFUELS**	**9**

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Feedstock Production- Oilseed Crops, Microalgae, Animal Fats, Waste Oils. Fuel production- Oil Extraction, Oil Refining and Transesterification. Properties and Use of Lipid Biofuels- Properties of Pure Plant Oil (PPO), Properties of Biodiesel. Technology Applications - Standardization - Energy Balance- Emissions- Sustainability- Economy. BtL Fuels Production.		
UNIT-V	**FUTURE OF BIOFUELS**	**9**
1st and 2ndGeneration Biofuels- Advantage and disadvantages- Barriers for the technology-Integrated Refining Concepts-Strategies for New Vehicle Technologies – recent research in biofuels-NREL procedure for biofuel production-Case study.		
	Total hours to be taught	**(L:45): 45 PERIODS**
Outcome(s)	• Analyze biofuels and bioenergy manufacturing, distribution and integration issues • Evaluate biofuel production from various biomass using bioenergy technologies • Compare the biofuels with commercial fuels • Summarize the standard of biofuels	

TEXT BOOK :	
1	Rai G.D,Non conventional sources of Energy, Khanna publishers, New Delhi, 1995
2	Bouley James .E & David Follis - Biochemical Engineering Fundamentals Mc Graw-Hill publishing company, Tokyo.1986.
REFERENCES:	
1	Anju Dahiya , Bioenergy:Biomass to Biofuels, ISBN: 9780124079090
2	Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986
3	Dr. Rainer Janssen and Dominik Rutz, Biofuel Technology Handbook, WIP Renewable Energies ,2008

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Syllabus

Department	**Agricultural Engineering**	**Programme Code**	**1111**

V Semester

Course code	**Course Name**	**Hours/week**			**Credit**	**Maximum marks**
		L	**T**	**P**	**C**	
22AG15503	**BIOMASS MANAGEMENT FOR FODDER AND ENEGRY**	3	0	0	3	**100**

Objective(s)	• To understand the biomass management and fodder crops • To understand the processing of fodder crops • To analysis the energy extraction from various processing of biomass	
UNIT-I	**Biomass resource and management**	9
Introduction to biomass management, biomass resource assessment management techniques/supply chains.		
UNIT-II	**Densification Processes: Extrusion, briquetting and pelleting.**	9
Processing of paddy straw, densification- Extrusion process,Briquettes and cubes- pellets, mills and cubers, Bailing-classification, uses- residue management for surface mulch and soil incorporation.		
UNIT-III	**Paddy Straw choppers and spreaders**	9
Paddy Straw choppers and spreaders as an attachment to combine Harvester, Mulch seeder, Paddy Straw Chopper-cum-Loader, Balar for collection of straw.		
UNIT-IV	**Processing and uses of straw for animal use and cushioning material**	9
Processing of straw- fodder for animal use- Agricultural and horticultural use- Cushioning material for fruits and vegetable.		
UNIT-V	**Mulching and composting**	9
Mulching and Composting- Paper and cardboard manufacturing- Straw as a fuel.		
Total hours to be taught		(L:45): 45 PERIODS
Outcome(s)	• Apply the various conversion technologies to convert biomass into fuels • Compare the raw material with densification of biomass • Knowledge and skills on bio energy source technology • Understanding of important of biomass in agriculture fields. • Knowledge on alcohol and ethanol production and energy and environment management and skill about residue management in agriculture fields.	

TEXT BOOK :

1	Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2	Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.

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REFERENCES	
1	Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.

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Department	Agricultural Engineering	Programme Code	1111

V - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15504	SEED PRODUCTION TECHNOLOGY	3	0	0	3	100

Objective(s)

To enable the students to

- Expose the scope and importance of good quality seed production.
- Acquaint with the principles and special techniques used in the process of good quality Seed production.
- Understand components of seed processing and testing.
- Familiarize with planning, development and organization of seed programmes.
- Gain knowledge on principles and techniques used for seed production of horticulture crops.

UNIT-I	SEED CHARACTERS	9

Seed - Definition, characteristics, difference between seed & grain , good quality features; Importance of seed in successful crop production; Floral biology - self and cross pollination; Seed dormancy- methods of Dormancy breaking; Methods of genetic improvement of crop plants , selection, hybridization, mutation, polyploidy; Seed Act and rules- new policy and importance.

UNIT-II	SEED PRODUCTION AND CERTIFICATION	9

Seed Multiplication - systems, classes of seed, multiplication ratio, field selection, planting ratio, isolation needs and rouging; Harvest and extraction of seed; Methods of hybrid seed production; Genetic deterioration during crop production cycles; Seed certification process - Phases of seed certification, legal basis, prerequisites for applicability, description of the specific steps of the certification process

UNIT-III	SEED PROCESSING AND TESTING	9

Seed processing - Principle, components; Processing plant Layout- Types; Processing steps-preliminary cleaning , basic cleaning and grading, equipment used in each steps; Seed drying & treatment; Seed testing- sampling, methods, Types, procedures, specific tests conducted for different purposes (service, certification and seed law enforcement); Standards prescribed for different crops.

UNIT-IV	DEVELOPING SEED PROGRAMMES	9

Seed programmes - Types of organizations (public, quasi-governmental, private and cooperative),objectives and features; Organizational set up of a seed company; Steps involved in planning and developing a seed programme; Seed marketing activities and distribution system - analysis of seed demand and supply; Promotional activities; Costing and pricing strategies; Economics of production of different crop seed; Seed packaging; Export procedures and formalities; Seed/plant quarantine methods

UNIT-V	SEED PRODUCTION IN SPECIFIC CROPS	9

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Seed production techniques for selected crops - Rice, Maize, Black gram, Groundnut, Sunflower, Cotton, Tomato, Brinjal and Onion

Total	**45 Periods**

Outcomes:

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

- acquire basic knowledge of seed production technologies.
- know the different methods of seed production.
- gain knowledge in processing and testing of seed.
- have knowledge on planning and management of different seed programmes
- earn seed production technologies of important crops.

TEXT BOOK :

1	Singh,S.P.,"Commercial Vegetable Seed Production",KalyaniPublishers,Chennai,200I.
2	Agarwal,R.L.,"SeedTechnology",OxfordIBHPublishingCo.,NewDelhi,1995.'

REFERENCES:

1	SubirSen and Ghosh,N.,"Seed Science", Kalyani Publishers,Chennai,1999.
2	Dahiya,B.S., and Rai,K.N.,"Seed Technology", Kalyani Publishers, Chennai, 1997.
3	George, Raymond,A.T.,"Vegetable Seed Production", Longman Orient Press, London and New York,1985.

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Department	Agricultural Engineering	Programme Code	1111

- V -Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15505	**REFRIGERATION AND AIR CONDITIONING FOR AGRICULTURAL ENGINEERS**	3	0	0	3	**100**

Objective(s)

- To acquire knowledge on principles of refrigeration
- To understand the components and working of refrigerator
- To understand the properties of refrigerant
- To understand working and application of air conditioning system
- To know the application of refrigeration in agriculture

UNIT-I	**R**EFRIGERATION -VAPOUR COMPRESSION SYSTEM	**9**

Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - simple vapour compression cycle – T-S diagram – p-h chart- vapour compression system-different types-solving problems.

UNIT-II	REFRIGERATION COMPONENTS	**9**

Refrigeration components – compressor – classification - principle and working – condensers -types - construction, principle and working. Evaporators – types-principle and working. Expansion device – types construction, principle and working.

UNIT-III	REFRIGERANTS AND VAPOUR ABSORPTION CYCLE	**9**

Refrigerants – properties – classification – comparison and advantages – chloroflouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants - vapour absorption cycle – simple and practical vapour absorption system- advantages- ideal vapour absorption system- Electrolux refrigerator – Lithium-bromide refrigeration-construction and principles.

UNIT-IV	AIR CONDITIONING SYSTEM	**9**

Air conditioning systems-equipments used-classification-comfort and Industrial air conditioning system-Winter, summer and year- round air conditioning system- unitary and central air conditioning system-application of refrigeration and air conditioning-domestic refrigerator-refrigerated trucks- ice manufacture.

UNIT-V	APPLICATION OF REFRIGERATION IN AGRICULTURE	**9**

Cold chain concept to minimize post harvest losses. Role and importance of refrigerator vehicle. Design of cold storage.

Total	**45 Periods**

Outcomes:

- Able to explain refrigeration cycle
- Able to detect problems in refrigerator

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- Able to select suitable refrigerant for effective refrigeration without environmental pollution
- Abel to apply air conditioning according to weather
- Able to design refrigerator vehicle and cold storage

TEXT BOOK :

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

REFERENCES:

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

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V - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15506	APPLICATIONS OF IT IN AGRICULTURAL SYSTEM	3	0	0	3	100

Objective(s)

To enable students

- acquire acquaintance of IT in precision agriculture.
- furnish knowledge about environmental control systems in agriculture.
- expose agricultural system management for optimizing the use resources.
- know the weather prediction models and their application in seasor climate forecasts.
- introduce E-governance in agriculture systems for the benefits of farmi society

UNIT-I	IT IN PRECISION AGRICULTURE	9

IT - Scope & importance in agriculture; Precision agriculture - use of IT; Remote sensing & sensors - use of GPS & GIS ; Mapping software, crop area estimation, yield estimation, biotic and abiotic stress mapping.

UNIT-II	ENVIRONMENT CONTROL SYSTEMS	9

IT in controlled environment cultivation - Artificial light systems for cropping; Greenhouse management - for irrigation management, for cooling & heating, for simulation of CO2 consumption, for on-line measurement of plant growth; Models of plant production - Expert systems and crop doctors.

UNIT-III	AGRICULTURAL SYSTEMS MANAGEMENT	9

Agricultural systems - Managerial overview, reliability of agricultural systems; Simulation of crop growth - crop simulation models, prioritizing field operations; Optimizing the use of resources - Linear programming; Project scheduling - Artificial intelligence and Decision Support Systems (DSS).

UNIT-IV	WEATHER PREDICTION MODELS	9

Weather & Climate - Climate variability & climate change, Importance of climate variability; Forecasting - importan ce in agriculture, medium term & long term (seasonal) forecasting; Forecasting - statistical, dynamical; Climate prediction - Understanding world's climate system, global climatic models, regional climate models, seasonal climate forecasting, climate projection;

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Climate smart agriculture.		
UNIT-V	E-GOVERNANCE IN AGRICULTURAL SYSTEMS	**9**
Agricultural and biological databases - e-commerce, e-business systems & applications; Technology enhanced learning systems and solutions - e-learning; On-line and Off- line information for the society; Rural development and information society; Internet application tools and web technology.		
	Total	**45 Periods**

Outcomes:

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

- possess sufficient knowledge ofIT application like Remote sensing, GPS and GIS.
- have acquaintance on Environmental control systems in agriculture.
- identify agricultural system management for optimizing the use of resources.
- familiar with weather prediction models and their application in seasonal climate forecasts.
- implement E-governance in agriculture systems for the benefits of farming society

TEXT BOOK :

1	National Research Council, "Precision Agriculture in the 21st Century", National Academies Press, Canada, I997.
2	H. Krug, Liebig, H.P. "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", I989.

REFERENCES:

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

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM
Regulation 2022

VI-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22AG14601	Farm Power and Machinery Management	PC	3	0	0	3
2	22AG14602	Irrigation Equipment Design	PC	3	0	0	3
3	22AG14603	Solar and wind energy engineering	PC	3	0	0	3
4	22AG14604	Food and Dairy Process Engineering	PC	3	0	0	3
5	22AG14605	Energy Audit and Management	PC	3	0	0	3
6		Professional Elective - III	PE	3	0	0	3
7	22MC60001	Constitution of India	MC	3	0	0	0
PRACTICAL							
7	22AG24601	Bio-Energy Laboratory	PC	0	0	3	1.5
8	22AG24602	Food and Dairy engineering laboratory	PC	0	0	3	1.5
9	22AG24603	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	3	1.5
TOTAL				**21**	**0**	**9**	**22.5**

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Syllabus

Department	Agricultural Engineering	Programme Code	1111

VI- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14601	FARM POWER AND MACHINERY MANAGEMENT	3	0	0	3	100

Objective(s)

- To identify various farm machinery and its applications.
- To differentiate different components and systems within the machinery.
- To select, recommend and manage machinery based on different needs.
- To identify factors that influence production timelines, and improvements that can be made by machine usage.
- To identify and communicate key aspects associated with machinery usage.

UNIT-I **INTRODUCTION TO FARM POWER AND DESIGN CRITERIA** **9**

Role of Mechanization in Indian Agriculture- Farm Power Availability and Productivity in India- Agricultural Mechanization Policy Objectives and Recommendations- Farm Mechanization Index- Reliability criteria in design and its application.

UNIT-II **SELECTION OF OPTIMUM MACHINERY** **9**

Selection of tractors and matching farm equipment-Maintenance and scheduling of operations. Replacement of old machines, repair and maintenance of agricultural machinery, inventory control of spare parts. First order Markov chains and their applications in sales forecasting and in problems of inventory control and modeling of workshop processes and quality control.

UNIT-III **IoTs FOR FARM MACHINERY** **9**

Sensors and data loggers, data processing, GPS system in farm machinery management and application of programming techniques to the problems of farm power and machinery selection.

UNIT-IV **PLANNING OF MACHINERY** **9**

Man-machine task system in farm operations, planning of work system in agriculture. Software application in selection of power units and to optimize mechanization system.

UNIT-V **ECONOMIC ANALYSIS** **9**

Energy conservation - performance and power analysis - cost analysis of machinery - fixed cost and variable costs, effect of inflation on cost; selection of optimum machinery and replacement criteria- Break-even analysis, reliability and cash flow problems.

Total hours to be taught **(L:45): 45 PERIODS**

Outcomes:

- To know the importance of Farm Power and its design criteria.

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- To select the proper power required machinery
- Understand the importance of IoTs in Farm Machinery.
- Effectively planning of machinery management.
- To make it convenient for farmers in terms of economically.

TEXT BOOK :

1.	Bainer, R. Kepner, R.A. and Barger, E.L. 1978. Principles of farm machinery. John Wileyand Sons. New York.
2.	Liljedahl, B: Tumquist, PK: Smith, DW; and Hoki, M. 1989. Tractor and its Power Units. Van Nostrand Reinhold
3.	Agricultural Informatics, ISBN:9781119768845,Wiley Publications 2021.

REFERENCES:

1	Culpin, C. 1978. Farm Machinery. Granada Publishing Ltd., London.
2	Kepner, R.A., Bainer, R. and Barger, E.L. 1987. Principles of Farm Machinery. C.S.B. Publishers and distributors, New Delhi.
3	Smith, H.P. and Wilkes, L.H. 1979. Farm Machinery and Equipment. Tata McGraw-Hill Publishing Co. Ltd., New Delhi

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VI-Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14602	IRRIGATION EQUIPMENT DESIGN	3	0	0	3	100

Objective(s)	• To expose the students to the fundamental knowledge in Pumps for Irrigation use • To introduce the concept of micro-irrigation • To design a Sprinkler & Drip irrigation system
Outcome(s)	• At the completion of course the student will get the knowledge on concepts of micro irrigation. • The students shall able to design drip and sprinkler irrigation system.

UNIT-I	**WATER LIFTS AND PUMPS**	**8**
Pump – Components of a Pumping System - pump classification - Variable displacement pumps–Centrifugal pump- Submersible pump- Vertical Turbine pumps mixed flow – Jet and Airlift pumps- Pump selection and installation- Pump troubles and Remedies.		
UNIT-II	**PUMP VALVE**	7
Types of valves- Pressure relief valve- Gate valve-Isolated valve- Non return valve- Butterfly valve-Solenoid valves- ball valve – piston valve - Automated control valve- selection, repair and maintenance		
UNIT-III	**MICRO IRRIGATION CONCEPT AND APPLICATIONS**	10
Micro irrigation- Government of India Financial Assistance for Promotion of Micro Irrigation in India - Merits and demerits of micro-irrigation system, Types and components of micro irrigation system- Scope and potential problem of micro irrigation - Gravity fed micro irrigation - Care and maintenance of micro-irrigation System- Automation in micro-irrigation - Greenhouse irrigation system.		
UNIT-IV	**DRIP IRRIGATION DESIGN**	10
Drip irrigation - Components- Dripper- types and equations governing flow through drippers- Wetting pattern- Design Considerations - Pump capacity-Installation- Operation and maintenance of Drip irrigation system. - Design of surface and sub-surface drip irrigation.		
UNIT-V	**SPRINKLER IRRIGATION DESIGN**	10
Sprinkler irrigation- Classification and Components of Sprinkler Systems - Design of Sprinkler Irrigation System - Sprinkler selection and spacing- Capacity of sprinkler system - types - Sprinkler performance- Multipurpose and Special Applications - Operation and Maintenance of Sprinkler System		
	Total hours to be taught	**(L:45): 45PERIODS**
Outcome(s)	• Classify different types of pumps used in the agriculture. • Distinguish the various types of valves and its maintenance.	

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	• Discover the knowledge on concepts and applications of micro irrigation. • Plan and design of drip irrigation system and sprinkler irrigation and its types.
TEXT BOOK :	
1	Suresh, R., "Principles of Micro-Irrigation Engineering", Standard Publishers Distributors,New Delhi, 2010.
2	Michael, A.M., "Irrigation Theory and Practice", Vikas Publishers, New Delhi, 2002.
REFERENCES	
1	Modi, P.N., and Seth, S.M., "Hydraulics and Fluid Mechanics", Standard Book House, NewDelhi, 1991.
2	Jack Keller and Rond Belisher., "Sprinkler and Trickle Irrigation", Vannistrand Reinhold,New York, 1990.
3	Sivanappan R.K., "Sprinkler Irrigation", Oxford and IBH Publishing Co., New Delhi, 1987.
4	Keller.J and D. Karmeli, "Trickle Irrigation Design", Rainbird sprinkler Irrigation Manufacturing Corporation, Glendora, California, USA.

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VI-Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14603	SOLAR AND WIND ENERGY ENGINEERING	3	0	0	3	100

Objective(s)	• The student will be exposed to Solar energy and its applications, • To get knowledge in wind energy and its applications • To aware of renewable energy resources	
UNIT-I	**ENERGY SOURCES**	**9**
Energy- Potential and production – resources – renewable and non renewable - advantage and disadvantage. Share of renewable energy - Introduction to renewable energy systems: Ocean energy, Tidal energy, Wave energy, Geothermal energy, Nuclear energy, Biomass energy, Fuel cell. National policies on solar and wind energy.		
UNIT-II	**SOLAR THERMAL COLLECTORS AND CONCENTRATORS**	**9**
Solar radiation - radiation measurement – solar geometry- transmittance - absorptance – τα product - flat plate collectors – types and their performance -heat transfer - efficiency - absorber plate – types - selective surfaces. Solar dryers – types – heat and mass transfer - performance of solar dryers – agro industrial applications - solar stills - types - solar pond - performance – characteristics – applications. Concentrating collectors–types–reflectors-heliostats – solar thermal power plant.		
UNIT-III	**PV TECHNOLOGY**	**9**
Fundamentals of solar cells: types of solar cells- photovoltaic effect - Solar cell properties and design – load estimation- NREL efficiency charts - emerging technologies in solar photovoltaics. Standalone power system- grid tie electrical system - batteries – invertors – operation - system controls. PV powered water pumping –solar water heating system - solar refrigeration – hybrid system - solar technologies in green buildings.		
UNIT-IV	**WIND MAPPING ANALYSIS AND CHARACTERISTICS OF WIND**	**9**
Wind energy potential - Nature of wind – wind structure and measurement - wind power laws - basics of wind aerodynamics -velocity and power duration curves - windmill – wind turbines- classification – factors affecting wind turbines - torque and power characteristics– Betz coefficient - Upwind and downwind systems.		
UNIT-V	**WIND MILL DESIGN AND APPLICATIONS**	**9**

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Wind energy conversion systems - transmission rotors – pump - generators - standalone system - grid system – batteries. Wind energy storage - wind farms - wheeling and banking - testing and certification procedures- solar wind hybrid systems	
Total hours to be taught	**(L:45): 45 PERIODS**
Outcome(s)	• To know the energy demand of world, nation and available resources to fulfill the demand • To know about the conventional energy resources and their effective utilization • To acquire the knowledge of modern energy conversion technologies • To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively • Students will have through knowledge in solar and wind energy production and transportation process

TEXT BOOK :

1	Rai., G.D. "Solar Energy Utilization*"* Khanna publishers, New Delhi, 2002
2	More, H.S and R.C. Maheshwari, " Wind Energy Utilization in India" CIAE Publication – Bhopal, 1982
3	Rao. S and B.B. Parulekar. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, Delhi, 2000.

REFERENCES

1	Mathew Buresch, Photovoltaics Energy Systems. McGraw-Hill Book Company, London, 1986.
2	Jui Sheng Hsieh. Solar Energy Engineering, Prentice Hall, London, 1986
3	Tany Burtar, Hand book of wind energy. John Wiley and Sons, 2001,
4	J.G.Mc Gowan, Manwell, J.F. and A.L.Rogers. Wind Energy Explained – Theory Design and Application, John Wiley and Sons Ltd, 2004.
5	John Twidell. A guide to small wind energy conversion system, Cambridge University press. UK, 1987
6	Rai. G.D. "Non Conventional Sources of Energy", Khanna Publishers, New Delhi, 2002

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Syllabus

Department	Agriculture Engineering	Programme Code	

VI - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14604	FOOD AND DAIRY PROCESS ENGINEERING	3	0	0	3	100

Objective(s)

- To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products , sanitation and effluent treatment in dairy industry
- .To expose the students to the fundamental knowledge of food, its properties and different methods of food processing.
- To gain knowledge on theory, methods and equipment for the various unit operations of dairy industry
- To impart knowledge on unit operations of dairy products
- To choose suitable techniques for the food processing operation

UNIT-I **PROPERTIES AND PROCESSING OF MILK** **9**

Dairy Industry – importance and status – Milk Types – Composition and properties of milk - Production of high quality milk - Method of raw milk procurement and preservation - Processing – Staining - Filtering and Clarification - cream separation – Pasteurization – Homogenization - sterilization, UHT processing and aseptic packaging – emulsification - Fortification

UNIT-II **DAIRY PRODUCTS** **9**

Manufacture of Milk Powder - Processing of Milk Products - Condensed Milk - Skim milk - Butter milk - Flavoured Milk, whey, casein, yoghurt and paneer - Manufacture of Butter - Cheese Ghee, ice creams and frozen desserts - standards for milk and milk products - Packaging of Milk and Milk Products - Cleaning and Sanitation - Dairy effluent treatment and disposal

UNIT-III **FOOD AND ITS PROPERTIES, REACTION AND KINETICS** **9**

Constituents of food - thermal processing of foods - cooking, blanching, sterilization, pasteurization, canning - Interaction of heat energy on food components, reaction kinetics, Arrhenius equation, TDT curves - water activity, sorption behaviour of foods – isotherm models - monolayer value, BET isotherms, Raoult‟s law, Norrish, Ross, Salwin - Slawson equations.

UNIT-IV **PROCESSING AND PRESERVATION OF FOODS** **9**

Coffee, Tea processing - Concentration of foods, freeze concentration - osmotic and reverse osmotic concentration - drying and dehydration of food - Tray, tunnel, belt, vacuum and freeze dryers - rehydration of dehydrated foods - Fat and oil processing, sources, extraction, methods and equipment, refining of oils, hydrogenation, manufacture of margarine - Food preservation methods - preservation by irradiation, microwave and dielectric heating of food

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

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Non-thermal and other alternate thermal processing in Food processing - Nanotechnology: History-fundamental concepts - tools and techniques Nanomaterials - applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology.	
Total	**45 Periods**

Outcomes:

- Students will gain knowledge about dairy and food process engineering
- Produce a better idea behind manufacture technology of different dairy products
- Understand the process of manufacturing of dairy products and thermal processing of food
- Students will understand the importance of quality control and food preservation and packaging
- Produce a thorough understanding on the working principle of various techniques used in nonthermal food preservation methods

TEXT BOOK :

1	Chandra Gopala Rao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad, 2006.
2	Walstra. P., Jan T. M. Wouters., Tom J. Geurts "Dairy Science and Technology", CRC press, 2005.
3	Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi, 1999.

REFERENCES:

1	Subbulakshmi.G., and Shobha A. Udipi, Food Processing and Preservation, New Age International Publications, New Delhi, 2007.
2	Toledo, R.T., "Fundamentals of Food Process Engineering", CBS Publishers and Distribution, New Delhi, 1997.
3	Tufail Ahmed., "Dairy Plant Engineering and Management", Kitab Mahal Publishers, Allahabad, 1997.
4	V. Chelladurai, and Digvir S. Jayas. Nanoscience and nanotechnology in foods and beverages. CRC Press, 2018.

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VI Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14605	**ENERGY AUDIT AND MANAGEMENT**	3	0	0	3	**100**

Objective(s)	• Energy audit provides the vital information base for overall energy conservation • To get knowledge in energy utilization analysis and evaluation of energy conservation measures. • To formulate energy strategies, plan energy supply on short term, mid-term and long term basis to ensure adequate supply of various forms of secondary (usable) energy to various consumers.

UNIT-I	**GENERAL ASPECTS OF ENERGY**	9

Energy Scenario – primary and secondary energy – Commercial energy and non commercial energy Renewable and non –renewable energy – Global and Indian energy scenario-energy pricing in India – energy sector reforms – energy security, Conservation and strategy for future global environmental concerns-global warming – climate change- problems and challenges- Energy conservation Act 2001 and its important features.

UNIT-II	**ENERGY MANAGEMENT - PROCEDURES AND TECHNIQUES**	9

Principles of energy management –objectives– strategy-energy audit – types and methodology-reporting format, Energy audit approach: understanding energy costs- bench marking and performance- fuel and energy substitution- Role of Energy inspectors and Auditors in energy management - energy audit Instruments- material and energy balance-Basic principles - need and importance- Sankey Diagram and its Use

UNIT-III	**PROJECT IMPLEMENTATION**	9

Introduction on project management- scope of project - basic elements of project management-project management life cycle - technical design, financing, contracting, implementation and project planning techniques- performance monitoring

UNIT-IV	**MONITORING AND CASE STUDY**	9

Definition- setting targets- Monitoring and targeting- elements of monitoring and targeting-Rationale for Monitoring, Targeting and Reporting - Data and information analysis- techniques energy consumption, production- cumulative sum of difference (CUSUM), Review and evaluation-relating energy consumption and production-case study

UNIT-V	**FINANCIAL ANALYSIS**	9

Principles of financial analysis-Investment needs, appraisal and criteria, sources of funds – Techniques- Simple payback – Return on Investment- Net Present value - Internal Rate of Return - -

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sensitivity and risk analysis- Financing options- Energy performance contracts and role of ESCOs.	
Total hours to be taught	(L:45): 45 PERIODS
Outcome(s)	Students can assess present pattern of energy consumption in different cost centers of operations • Relating energy inputs and production output • Identifying potential areas of thermal and electrical energy economy. • Highlighting wastage in major areas • Carry out modifications, retrofitting or replacement of existing plant/machinery so as to save energy

TEXT BOOK :	
1	General aspects of energy management and energy audit. Bureau of energy efficiency publication
2	Energy audit and management for the Indian industry. The institute of chartered accountants of india – published by Dr. B. Chakravarthy, Director (CPE)
3	Energy Management: W.R.Murphy, G.Mckay (Butterworths)
REFERENCES	
1	Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley Interscience Publication)
2	Energy Economics -A.V.Desai (Wieley Eastern)
3	Industrial Energy Conservation : D.A. Reay (Pergammon Press)
4	Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
5	Energy Conservation guide book Patrick/Patrick/Fardo (Prentice Hall)

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22MC60001	CONSTITUTION OF INDIA	3	0	0		100

Objective(s)

- To know about the salient features of the Constitution of India.
- To gain knowledge about structure and functions of Union Government.
- To learn about the structure and functions of State Government.
- To understand about amendments in Indian Constitution, Judicial review.
- To study in detail about the Indian society

UNIT-I	INTRODUCTION ABOUT INDIAN CONSTITUTION	9

Historical Background – Constituent Assembly of India – Role and salient features - Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT-II	STRUCTURE AND FUNCTION OF UNION GOVERNMENT	9

Parliamentary system – Legislature, Executive. Union Government – Structures of the Union Government. Functions and Responsibilities of President – Vice President – Prime Minister – Cabinet – Council of Ministers, Union Territories.

UNIT-III	STRUCTURE AND FUNCTION OF STATE GOVERNMENT	9

State Legislature - State Government – Structure and Functions – Governor – Chief Minister – Cabinet – Special Provisions (Article 370. 371, 371J) for some States. Judicial System in States – High Courts and other Subordinate Courts, Judicial review.

UNIT-IV	CONSTITUTION FUNCTIONS, AMENDMENTS AND REVIEW	9

Indian Federal System – Centre-State Relations – President's Rule – Assessment of working of the Parliamentary System in India - Constitutional Amendments – Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73, 74, 75, 86, and 91, 94, 95, 100, 101, 118. Savior of the Constitution – The Supreme Court of India – The Hon'ble Chief Justice of India and Hon'ble Judges of the Supreme Court. Judicial Review of Parliamentary and Executive functions.

UNIT-V	INDIAN SOCIETY	9

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Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections - Special Constitutional Provisions for SC & ST, OBC, Special Provision for Women, Children & Backward Classes.	
Total hours to be taught	**(L:45): 45 PERIODS**
Outcome(s)	• Summarize the features of the Indian Constitution and observe the fundamental duties, rights and responsibilities. • Explain the functioning of Indian parliamentary system at the Center and the responsibilities of important functionaries. • Describe the functioning of State Government and important functionaries. • Recognize Amendments in Indian Constitution and Judicial review. • Illustrate the composition and features of Indian society.

TEXT BOOK :	
1	Rai., G.D. "Solar Energy Utilization*"* Khanna publishers, New Delhi, 2002
2	More, H.S and R.C. Maheshwari, " Wind Energy Utilization in India" CIAE Publication – Bhopal, 1982
3	Rao. S and B.B. Parulekar. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, Delhi, 2000.
REFERENCES	
1	Mathew Buresch, Photovoltaics Energy Systems. McGraw-Hill Book Company, London, 1986.
2	Jui Sheng Hsieh. Solar Energy Engineering, Prentice Hall, London, 1986
3	Tany Burtar, Hand book of wind energy. John Wiley and Sons, 2001,
4	J.G.Mc Gowan, Manwell, J.F. and A.L.Rogers. Wind Energy Explained – Theory Design and Application, John Wiley and Sons Ltd, 2004.
5	John Twidell. A guide to small wind energy conversion system, Cambridge University press. UK, 1987
6	Rai. G.D. "Non Conventional Sources of Energy", Khanna Publishers, New Delhi, 2002

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Semester-VI

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG24601	BIO ENERGY LABORATORY	0	0	3	1.5	100

Objective(s)	• To get hands on experience on various renewable energy equipments and appliances

1.	Characterisation of biomass
2.	Design and drawing of KVIC model biogas plant/ Deena bandhu model biogas plant
3.	Study on briquetting and Stoichiometric calculations
4.	Study on biogas appliances and utilization of biogas for engine running
5.	Performance evaluation of agro residue gasifier
6.	Study on pyrolysis plant
7.	Testing of solar water heater
8.	Design of rotor blade for horizontal axis wind mill
9.	Performance evaluation of solar dryer
10.	Testing of solar water pumping
11.	Visit to biomass power plant, solar power plant and wind mill
	Total hours to be taught **45 PERIODS**

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VI-Semester

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG24602	FOOD AND DAIRY ENGINEERING LABORATORY	0	0	3	1.5	100

Objective(s)

- To get basic knowledge on various properties of food
- To get hands on experience in food process technology
- To determine the properties of various food materials

1.	Preparation of flavored milk/drink and dahi
2.	Preparation of paneer and condensed milk
3.	Preparation of whey drink
4.	Determination of cooking properties of parboiled and raw rice
5.	Experiment on microwave heating of food materials
6.	Experiments on cream separator to determine the separation efficiency
7.	Experiments on construction and operation of butter churn and butter working accessories
8.	Preparation of value added products.
9	Experiment on expansion and Oil absorption characteristic of snacks on frying
10	Estimation of microbial load in food materials.
11	Study on extruder cooking
12	Visit to Dairy product manufacturing plant
	Total hours to be taught — **45 Periods**

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IV-Semester

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG24603	OPERATION AND MAINTENANCE OF FARM MACHINERY LABORATORY	0	0	3	1.5	100

Objective(s)

- The students are provided with different farm machineries on field to experience and understand the field operations i.e.
- Tillage, sowing and plant protection,
- Harvesting and threshing; care and maintenance

1.	Identification of major systems of a tractor and general guidelines on preliminary check measures before starting a tractor - procedure for starting, running and stopping the tractor.
2.	Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller
3.	Construction, working and maintenance of mould board and disc plough.
4.	Construction, working and maintenance of harrow and cultivator.
5.	Field practice on hitching of agricultural implements and trailers.
6.	Construction, working and maintenance of seed drill and planter.
7.	Construction and working of different plant protection equipments.
8.	Problems on field efficiency of tillage implements, seed drill, planter and sprayers.
9	Construction and working of mowers and reapers
10	Construction and working of combine harvester and determination of field losses.
11	Study on performance and evaluation of crop threshers.
12	Studies on methods of repair, maintenance and off-season storage of farm equipment.
13	Construction and operation of laser leveler and bulldozer.
14	Study on UAV Sprayers and IoTs in Farm Machinery.
15	Visit to Farm Machinery manufacturing plant.
	Total hours to be taught **45 PERIODS**

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PROFESSIONAL ELECTIVES (PE) - VI SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15601	Heat Transfer, Refrigeration and Air conditioning	PE	3	0	0	3
2	22AG15602	Food processing plant design and layout	PE	3	0	0	3
3	22AG15603	Food Quality standards and Safety Engineering	PE	3	0	0	3
4	22AG15604	Food Packaging Technology	PE	3	0	0	3
5	22AG15605	Advanced Food Processing Engineering	PE	3	0	0	3
6	22AG15606	Food Plant Design, Food Safety And Management	PE	3	0	0	3

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15601	HEAT TRANSFER, REFRIGERATION AND AIR CONDITIONING	3	1	0	4	100

Objective(s)

- To understand the mechanisms of heat transfer under steady and transient conditions
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.
- To understand the underlying principles of operation in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems

UNIT-I — **Methods and Laws of Heat transfer** — **9**

Heat transfer mechanism and types. Conduction; Fourier's law, heat transfer trough various geometries, steady state uni directional flow, insulation. Convection; natural and forced convection. Radiation; Stefan Boltzmann's law, Krichoff's law and Plank's law. Concepts of black body and grey body. Emissivity; shape factor

UNIT-II — **Application of Heat transfer in food processing** — **9**

Heat exchangers; parallel, counter and cross flow. Logarithmic mean temperature difference. Condensation heat transfer. Introduction to mass transfer, Fick's law of diffusion, steady state diffusion of gases and liquid through solids, Equimolal diffusion. Convective mass transfer, Analogy between heat, mass and momentum transfer, Application of mass transfer phenomena in food processing.

UNIT-III — **Refrigeration** — **9**

Principles of refrigeration, second law of thermodynamics applied to refrigeration, carnot cycle, reversed carnot cycle, coefficient of performance, unit of refrigeration. Refrigeration in food industry, types of refrigeration system, mechanical vapour compression, vapour absorption system, components of mechanical refrigeration, refrigerant, desirable properties of ideal refrigerant.

UNIT-IV — **Systems of Refrigeration** — **9**

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Centrifugal and steam jet refrigeration systems, thermoelectric refrigeration systems, vortex tube and other refrigeration systems, ultra low temperature refrigeration, cold storages, insulation material, design of cold storages, defrosting. Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wetbulb temperature and its measurement, psychometric chart and its use, elementary, psychometric process.		
UNIT-V	**Air conditioning**	**9**
Air conditioning – principles- Type and functions of air conditioning, physiological principles in air conditioning, air distribution and duct design methods, fundamentals of design of complete air conditioning systems – humidifiers and dehumidifiers – cooling load calculations, types of air conditioners –applications		
	Total hours to be taught	**(L:45): 45PERIODS**
Outcome(s)	• Learn the basic concept of modes of heat transfer and apply empirical correlations for both forced and free convection for determine the value of convection heat transfer coefficient. • Analyze the thermal analysis and sizing of Heat exchangers and to understand the mode of mass transfer. • Understand the air refrigeration, vapour compression refrigeration, different type of refrigerants, vapour absorption and steam jet refrigeration system. • Apply the knowledge of psychrometry to various psychrometric processes. • Develop and design AC system and evaluate different expansion and control devices.	

TEXT BOOK :

1	Ballaney, P.L. (1980). Refrigeration and Air Conditioning. Khanna Publishers, Delhi- 6. P 765.
2	Arora, C.P. (1981). Refrigeration and Air Conditioning. . Tata- McGraw Hill Publishing Co., New Delhi. P.710
3	Arora, S.C and Domkundwar, S. (1984). A Course in Heat & Mass Transfer (3 ed.). Dhanpat Rai & Sons, Delhi.
4	Ballalny,P.L. (1980). Thermal Engineering (14 ed.). Khanna Publishing, Delhi.
5	Geankoplis, C.J. (1997). Transport Processes and Unit Operations. Prentice Hall of India, New Delhi.
6	Holman,J.P. (1989). Heat Transfer S.I. Metric Edition. McGraw Hill Book Company Ltd., New Delhi.

REFERENCES

1	Jordoan and Prister. (1973). Refrigeration and Air Conditioning. Prentice- Hall of India, New Delhi.
2	Kapoor, H.R. (1983). Thermal Engineering (Vol. 1). Tata McGraw Hill Pub. Co. Ltd., New Delhi
3	Khurmi R. S. and Guptha J. K. (2004). A text book of Refrigeration & Air conditioning. Eurasia Publishing house (P) Ltd. New Delhi

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15602	FOOD PROCESSING PLANT DESIGN AND LAYOUT	3	0	0	3	100

Objective(s)	• To educate the students regarding selection parameters for the location of food processing industry. • To enable the students to design layout of various types of food processing industries
Outcome(s)	• The students will learn regarding the selection parameters for the location of food processing industry. • The students will learn to design layout of various types of food processing industries

UNIT-I	**INTRODUCTION**	**9**
Introduction to plant design - special features of food process industry-types of processing machineries-Manufacturing processes-concept -types-special features for fruit, vegetable, bakery & milk products - Characteristics of an efficient layout		
UNIT-II	**SELECTION OF PLANT LOCATION**	**9**
Plant location, location theory and models, Plant location factors-plant site selection-estimation of series- peak and critical load-Economic plant size-plantlayout objectives-classical and practical layout.		
UNIT-III	**DEVELOPMENTOF THE LAYOUT**	**9**
Development and presentation of the layout, selection of site and Location of plant, General points of considerations for designing food plant, floor plant types of layouts Food building planning, - preparation of machinery layout for fruit, vegetables and meat-size reduction machinery layout		
UNIT-IV	**EVAPORATION AND DRYING PLANT LAYOUT**	**9**
Evaporation plant layout-single, multiple, vacuum and film evaporators-types and concepts, drying plant layout, drying process, drier types, selection of driers		
UNIT-V	**PROCESSING PLANT LAYOUT**	**9**
Baking oven and frying plant-types, concepts and layout. Filling closing and labeling plant layout. Organization and trends in plant layout - sample layout, installation procedure for food processing plant.		
Total hours to be taught	**(L:45+T:0):45 PERIODS**	

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TEXT BOOK :	
1	James, M.More, “Plant Layout and Design”. MacMillian Publishing Co., New York 1976.
REFERENCES	
1	American Society of Heating, “Refrigerating and Air-Conditioning Engineers”, Ashrae Handbook, Fundamentals. ASHRAE, Atlanta, Georgia 1981
2	Hall,H.S and Y.Rosen, “Milk plant layout” (F.A.O. Publication) 1976.

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22AG15603	**FOOD QUALITY STANDARD AND SAFETY ENGINEERING**	3	0	0	3	**100**

Objective(s)	• To acquaint and equip the students with the latest standards to maintain food quality as well as to study HACCP protocol.

UNIT-I	**INTRODUCTION TO FOOD SAFETY STANDARDS**	**9**

Introduction to Food Safety, Food Contaminants **(**Microbial, Chemical, Physical), Food Adulteration **(**Common adulterants). Salient features of Food Safety and Standards Act, 2006, Structure of FSSAI. Licensing and registration, Licenses to be granted by Central Licensing Authority, Documents/ Format required for Registration/ Licensing

UNIT-II	**STANDARDS FOR ADDITIVES, PACKAGING & LABELLING**	**9**

Food Additives **(**functional role, safety issues), Food Packaging and labelling **(**Packaging types, understanding labelling rules and Regulations, Nutritional labelling, labelling requirements for pre-packaged food as per CODEX.

UNIT-III	**STANDARDS FOR FOOD INDUSTRY**	**9**

Process equipment and machinery auditing, consideration of risk, environment consideration, and mechanical quality control – personnel hygienic standards – preventative pest control, cleaning and disinfesting system, biological factors underlying food safety

UNIT-IV	**GMP, SSOP & HACCP**	**9**

Good manufacturing practices **(**GMP) and standard sanitation and operating procedures **(**SSOP) – principles – applications in food industry – hygienic plant design and sanitation – safe process design and operation – hazard analysis and critical control point **(**HACCP) – Principles, establishment of hazards, significance and control, preparation of HACCP plan, application of HACCP in Food industries

UNIT-V	**NATIONAL STANDARDS**	**9**

National Standards – FPO, PFA, AGMARK, BIS - National Standards ISO 9001 and ISO 22,000 Standards – APEDA, CFR, Codex Alimentarius Commission Standards – Impact of Food Safety on world trade issues

Total hours to be taught	**(L:45): 45 PERIODS**

OUTCOME	• The students will have a through knowledge on the various safety standards and regulation which is applied in the food industries for the betterment.

TEXT BOOK :

1	Chesworth, N. 1997. Food Hygiene Auditing. Blackie Academic Professional, Chapman and

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	Hall.
2	David A.Shapton and Norah F. Shapton. 1991. Principles and Practices for the Safe Processing of Foods. Butterworth-Heinemann Ltd, Oxford,
3	Jacob,M. 2004. Safe Food Handling. CBS Publishers and Distributors, New Delhi.
REFERNCES:	
1	Jose M. Concon. 1988. Food Toxicology, Part-A-Principles and concepts Part B-Contaminants and Additives, Marrcel Dekkar Inc. Newyork and Brazil.
2	Nteaz Ali. 2004. Food Quality Assurance: Principles and Practices. CRC Preess. New York.
3	Sara Mortimore and Carol Wallace. 1997. HACCP-A practical approach. Chapman and Hall.

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VI Semester						
Course code	**Course Name**	**Hours/week**			**Credit**	**Maximum marks**
		L	**T**	**P**	**C**	
22AG15604	**FOOD PACKAGING TECHNOLOGY**	3	0	0	3	**100**
Objective(s)	• To educate and equip students with latest food packaging technologies for adoption in food industry.					

UNIT-I	**INTRODUCTION**	**9**

Definitions and functions of packaging - factors affecting packaging - standard properties of packaging materials - factors controlling shelf life of food. Food packaging materials - rigid and flexible materials- rigid containers - glass, wooden boxes, crates, plywood and wire bound boxes, corrugated and fibre board boxes, textile and paper sacks - starch and protein based edible films, nano composites in packaging materials and biodegradable packaging materials.

UNIT-II	**SPECIAL TYPE OF PACKAGING TECHNOLOGIES**	**9**

Shrink packaging, aseptic packaging, active packaging and biodegradable packaging Food packages, bags, types of pouches, wrappers, carton and other traditional package; retortable pouches - sealing machines – form fill seal machine, high pressure impulse sealing machines– construction and operation -canning line. Introduction-active packaging absorbing system- releasing system- active packaging-intelligent and smart packaging.

UNIT-III	**VAP , MAP AND MICROWAVABLE PACKS**	**9**

Vacuum packaging- MAP - gases used in MAP – MAP application for respiring and non-respiring products- basics of microwave heating mechanism- microwavable packaging materials – microwave /food/ packaging interaction

UNIT-IV	**SHELF LIFE STUDY OF PACKED FOODS**	**9**

Aseptic packaging- Basic concept of shelf life- factors affecting shelf life of packaged foods- food factors affecting shelf life- kinetics of food deterioration- shelf life models- ASLT.

UNIT-V	**PACKAGING AND THEIR APPLICATIONS**	**9**

Retail packaging for fresh and processed horticultural produce - packaging for edible oils, vanaspathy, shortenings and margarines - packaging for bakery products - bread, biscuits, cookies and crackers - packaging for fried, extruded, puffed and confectionary products - packaging for sugar, coffee, tea and spices - packaging for liquid foods, carbonated beverages and drinking water.

Total hours to be taught	**(L:45): 45 PERIODS**
OUTCOME:	• At the end students will have indepth knowledge on latest food packaging

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	technologies for adoption in food industry.
TEXT BOOK :	
1	Robertson L. Gordon. 1993. Food Packaging – principles and practices. Marcel decker Inc. New York.
2	Sacharow, S. and R.C.Grittin. 1980. Principles of food packaging. AVI Publishers Co., USA.
3	NIIR, Board of Food and Technologists. 2005. Hand book on Modern Packaging Industries. Asia Pacific Business press Inc., Delhi – 7.
REFERNCES:	
1	Paine and Paine.1983. Hand book of food packaging. Blackie and Son Ltd., London.
2	Palling, S.J.**(**ed) 1980. Developments in Food Packaging. Applied Science Publishers Ltd., London.

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Syllabus

Department	**Agricultural Engineering**	**Programme Code**	**1111**

VI Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15605	**ADVANCED FOOD PROCESSING ENGINEERING**	3	0	0	3	**100**

Objective(s)	• To acquaint and equip the students with the latest advanced food processing

UNIT-I	**INTRODUCTION TO MEMBRANE TECHNOLOGY**	**9**

Introduction to pressure activated membrane processes, Types of membrane and configuration, Membrane Processes: Micro- filtration, UF, NF, RO and Electro-dialysis and their industrial applications in Food Industry. Supercritical fluid extraction.

UNIT-II	**FREQUENCY PROCESSING**	**9**

Dielectric and Ohmic heating of Foods, ISM frequencies, Microwave and Radio Frequency Processing: Definition, Advantages, Mechanism of Heat Generation, Applications in Food Processing, Limitations. Solar Energy and its use in Food Processing Operations.

UNIT-III	**HIGH PRESSURE PROCESSING**	**9**

High Pressure processing: Concept, equipments for HPP treatment, mechanism of microbial inactivation and its application in food processing.

UNIT-IV	**ULTRASONIC PROCESSING**	**9**

Properties of Ultrasonics, Application of Ultrasonics as Processing Techniques. Newer Image Processing Techniques and their applications in Food Processing, Use of Computers and Robotics in Food Processing Industry. Electronic Sorting, Grading and Packaging devices.

UNIT-V	**PROPERTIES OF FOODS**	**9**

Rheological, Structural and Textural properties of Foods and their measurement. Correlation between Textural food Attributes. Texture Profile analysis of foods. Hurdle technology: Concept of hurdle technology, Types of Hurdles and their applications.

Total hours to be taught	**(L:45): 45 PERIODS**

OUTCOME	• The students will have a thorough knowledge on the various advanced food processing which is applied in the food industries for the betterment.

TEXT BOOK :

1	Barbosa-Canovas 2002. Novel Food Processing Technologies. CRC.
2	Dutta AK & Anantheswaran RC.1999. Hand Book of Microwave Technology for Food Applications.

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3	Cheryan M. 1998. Ultra-filtration and Micro-filtration Handbook. Technomic Publ.
REFERNCES:	
1	Glasbey CA. 2004. Image Analysis for Biological Sciences.
2	Moskowitz 1999. Food Texture. AVI Publ.

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Department	**Agricultural Engineering**	**Programme Code**	**1111**

- VI Semester

Course code	**Course Name**	**Hours/week**			**Credit**	**Maximum marks**
		L	**T**	**P**	**C**	
22AG15606	**FOOD PLANT DESIGN, FOOD SAFETY AND MANAGEMENT**	3	0	0	3	**100**

Objective(s)	• To impart knowledge on selection of plant layout for industry • To learn the basic principles of Industrial safety and safety performance • To learn the basic knowledge about the Accidents happening in the industry • To know about the basic knowledge about the food safety • To impart knowledge on Food quality management system.	
UNIT-I	SELECTION OF PLANT LAYOUT	**9**
Introduction and classification of food plants, Site selection of plant. Plant location factors plant lay out advantages types of layout-characteristics of an efficient layout. Techniques of plant layout. General requirements and considerations for construction, materials and floors. Drains and drain layout. Ventilation, fly control, mould prevention, illumination in food plants.		
UNIT-II	INDUSTRIAL SAFETY AND SAFETY PERFORMANCE	**9**
Process industries, potential hazards, toxic chemicals and physical safety analysis. Safety Appraisal, effective steps to implement safety procedures, periodic inspection and safety procedures; proper selection and replacement of handling equipments, personal protective equipments.		
UNIT-III	ACCIDENTS	**9**
Industrial accidents – accident costs – identification of accident spots, remedial measures, identification and analysis of causes of injury to men and machines – accident prevention -Fire prevention and fire protection.		
UNIT-IV	CONTEMPORARY FOOD SAFETY STRATEGIES	**9**
Principles and Need for quality control and safety – Strategy and criteria for food safety- Consumer lifestyle and demand- Issues in Food safety. Impact of food safety on world trade issues.		
UNIT-V	FOOD QUALITY MANAGEMENT SYSTEM	**9**

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International Scenario on Food Safety , FSSAI Functions, duties & responsibilities of food safety regulators, Food safety and standards for food products. Advances in Food Safety & Quality Management, Food Safety Audit. ISO 22000. FSSC 22000	
Total	**45 Periods**

Outcomes:

- Analyze and apply the suitable plant layout for an industry.
- Appraise the industrial safety performance and safety procedures
- To identify and apply the suitable prevention methods for accidents
- Analyze and apply the suitable Food safety measures
- Understand the fundamental of concept of food quality management system.

TEXT BOOK :

1	Handley William, ―Industrial Safety Hand Book‖, 2nd Edition, McGraw Hill, New York, 1969
2	Da-Wen Sun., "Handbook of Food Safety Engineering", John Wiley & Sons, New Jersey, 2011.

REFERENCES:

1	Heinrich H.W., Dan Peterson P.E. and Nester Rood, ―Industrial Accident Prevention‖, 2nd Edition, McGraw-Hill Book Co., 1980
2	Blake R.P., ―Industrial Safety‖, 3rd Edition, Prentice Hall Inc., New Jersey, 1993.
3	Ronald H. Schmidt, and Gary E. Rodrick., "Food Safety Handbook", John Wiley & Sons, New Jersey, 2005.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM
Regulation 2022

VII-Semester

Sl.No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	22AG14701	Remote Sensing and GIS in Agriculture	PC	3	0	0	3
2	22AG14702	Field Crop Machinery	PC	3	0	0	3
3	22AG14703	Soil and water Conservation Engineering	PC	3	0	0	3
4	22AG14704	Testing and Evaluation of Farm Machinery	PC	3	0	0	3
5		Professional Elective - IV	PE	3	0	0	3
PRACTICAL							
7	22AG24701	Remote Sensing and Geological Information System Laboratory	PC	0	0	3	1.5
8	22AG36702	Project Work (Phase –I)	EEC	0	0	6	3
9	22AG56703	In-plant Training	EEC	0	0	0	1
TOTAL				**15**	**0**	**9**	**20.5**

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Syllabus

Department	Agriculture Engineering	Programme Code	1021

VII -Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14701	REMOTE SENSING AND GIS IN AGRICULTURE	3	0	0	3	100

Objective(s)

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

UNIT-I	CONCEPTS OF REMOTE SENSING AND SATELLITES	9

Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs;

UNIT-II	DATA PRODUCTS AND IMAGE ANALYSIS	9

Image interpretation- interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing.

UNIT-III	CONCEPTS OF GIS	9

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

UNIT-IV	DATA INPUT AND ANALYSIS	9

different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties, Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay)

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in GIS,		
UNIT-V	**APPLICATION OF RS AND GIS**	**9**
Agriculture and Forestry-Crop Type Mapping, Crop Monitoring and Damage Assessment, Mapping of Forest Resources and Species Identification and Forest Fire Mapping. Land Use and Land Cover Mapping and Change Detection. Soil Mapping and Soil Erosion Estimation. Water Resources and Flood Damage Assessment - Water Resources and Water Quality Detection and Flood Inundation-Delineation and Damage Assessment, Rainfall and runoff modeling. Application of remote sensing and GIS for the management of land and water resources.		
	Total	**45 Periods**

Outcomes:

- To introduce the principles and basic concepts of Remote Sensing and GIS
- To introduce the remote sensing systems, data products and analysis
- To introduce concepts of GIS 9 Map and their influences
- To introduce the spatial data models, analysis and presentation techniques
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources

TEXT BOOK :

1	Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2	Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3	Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.

REFERENCES:

1	Floyd F.Sabins. 2005. "Remote Sensing: Principles and Interpretation", III edition. Freeman and Company New York.
2	Jensen, J.R., 2004. "Introductory Digital Image Processing: A Remote Sensing Perspective". Prentice – Hall. New Jersey.
3	Duggal. S.K., 2006, Surveying Vol.I, Tata McGraw-Hill pub. Co, New Delhi,

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Syllabus

Department	Agricultural Engineering	Programme Code	1111

VII-Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14702	FIELD CROP MACHINERY	3	0	0	3	100

Objective(s)

- To understand the working principles of farm machineries.
- To expose the students to farm mechanization benefits and constraints.
- To understand and make decision for suitable machinery selection and utilization.
- To equip the students with better repair and maintenance knowledge.

UNIT-I	FARM MECHANIZATION AND TILLAGE	9

Farm mechanisation – objectives. Tillage - objectives - methods – primary tillage implements -secondary tillage implements - animal drawn ploughs - construction. Types of farm implements – trailed, mounted. Field capacity - forces acting on tillage tool.

UNIT-II	PRIMARY AND SECONDARY TILLAGE IMPLEMENTS	9

Mould board plough- attachments – mould board shapes and types. Disc plough – force representation on disc – Types of disc ploughs – Subsoiler plough - Rotary plough. Cultivators - types - construction. Disc harrows - Bund former - ridger – leveller. Basin lister-Wetland preparation implements.

UNIT-III	SOWING AND FERTILIZING MACHINERY	9

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

UNIT-IV	WEEDING AND PLANT PROTECTION MACHINERY	9

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

UNIT-V	HARVESTING MACHINERY	9

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

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Total hours to be taught	**(L:45): 45 PERIODS**
Outcome(s)	• To have a brief knowledge in farm mechanization and tillage. • To study about the construction and working of tillage implements. • To study about the construction and working of sowing and fertillizing implements. • To study about the construction and working of weeding and plant protection implements. • To study about the construction and working of harvesting machinery.

TEXT BOOK :	
1	Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors,Delhi 6., 2010.
2	Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005
REFERENCES	
1	Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997
2	Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., NewDelhi., 1996.
3	Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.

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Syllabus

Department	Agriculture Engineering	Programme Code	1111

VII - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14703	SOIL AND WATER CONSERVATION ENGINEERING	3	0	0	3	100

Objective(s)	• To impart the fundamental knowledge and basic concepts of Erosion, types of erosion and control measures • To understand the necessity of watershed management and water harvesting structures to conserve the soil and water

UNIT-I	**SOIL EROSION**	**9**

Problems of soil erosion - Geological and Accelerated erosion, Factors affecting water erosion, Types of water erosion - Splash, sheet and rill, Gully, stream bank and ravines, Universal Soil Loss Equation (USLE), Rainfall Erosion Index, Soil erodibility Index, Slope, slope length and topographical factors, Crop management for soil erosion 'C' factor, Conservation practice factor 'P', Measurement of runoff and soil loss - Multislot divisor unit - Coshocton rotating wheel sampler - Rainfall simulation and simulator, Wind erosion mechanics - Methods of estimation of wind erosion - Desertification, deforestation and shifting cultivation.

UNIT-II	**EROSION CONTROL**	**9**

Erosion control measures, Contour bunds and Graded bunds, Broad based terraces, Random tie ridging, basin listing and mulching, Bench terraces, stone walls and contour trenches, - Contour cultivation-strip cropping, mixed cropping, crop rotation for erosion control, Afforestation - Diversion drains and Grassed water ways.

UNIT-III	**GULLY CONTROL STRUCTURES**	**9**

Gully control and control of landslides, Temporary gully control measures, Permanent Gully Control Structures - Wind erosion control - wind breaks and shelter belts.

UNIT-IV	**WATER HARVESTING**	**9**

Water harvesting methods, Farm pond – Types, components, design- Site selection, Pond capacity and design of embankment, protection and maintenance of pond. Percolation pond – Site selection.

UNIT-V	**SEDIMENTATION**	**9**

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

Total hours to be taught	**(L:45): 45 PERIODS**

Outcome(s)	• Understand the concepts of soil erosion and measurement of soil loss. • Discuss with the different concepts of gully control structures • Apply the soil and water conservation measures.

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	• Analyze the site selection for water harvesting and performance of water harvesting • Understand the sedimentation process and mechanics of sediment transport in reservoir.

TEXT BOOK :	
1	Gurmel Singh et al. 1996. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
2	Michael, A.M. and Ojha, T.P. 1980. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.
3	Suresh, R. 1997. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
REFERENCES	
1	Murthy, V.V.N., "Land and Water Management Engineering", Kalyani Publishers, Ludhiana, 1998.
2	Gurmail Singh, "A Manual on Soil and Water Conservation", ICAR Publication, New Delhi, 1982.
3	Mal, B.C., "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, New Delhi, 2002.

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Department	Agriculture Engineering	Programme Code	1111

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG14704	TESTING AND EVALUATION OF FARM MACHINERY	3	0	0	3	100

Objective(s)	• To acquaint and equip with the procedure of testing and performance evaluation of farm machinery as per test standards • To acquaint and equip with the latest machinery management in the field of Farm mechanization	
UNIT-I	**TESTING AND EVALUATION OF AGRICULTURAL TRACTOR**	**9**
Testing and evaluation system in India - Agricultural machinery situation – Mechanization policy – future prospectus – standardization efforts - type of testing systems - General regulations – terminology – basic measurements, speed, fuel consumption, smoke density and power measurement – test items, specifications checking - PTO performance test - Engine test, drawbar performance test - field test – testing procedure – interpretation of results		
UNIT-II	**TESTING AND EVALUATION OF TILLAGE AND SOWING EQUIPMENT**	**9**
Testing and evaluation of Tillage machinery – Laboratory test (hardness testing, chemical analysis) – field test(rate of work, quality of work, draft measurement, fuel consumption) - seed drill – laboratory test (seed drill calibration) – field checking and field test		
UNIT-III	**TESTING AND EVALUATION OF INTERCULTURAL EQUIPMENTS**	**9**
Testing and evaluation of weeders – types of test for weeder - types of pesticide application equipments – terminology – types of test for sprayers – testing methods – types of test for duster - testing methods		
UNIT-IV	**TESTING EVALUATION OF HARVESTER**	**9**
Types of grain combines – combine systems – test items – procedure for laboratory testing – material for field test – observations during field test – sample analysis – data analysis – summary of performance parameters – analysis of field test		
UNIT-V	**SAFETY TESTING OF AGRICULTURAL MACHINERY**	**9**
Types of agricultural machinery accidents - causes of agricultural machinery accidents – technical measurements for ensuring safety - methods of safety testing – ROPS and FOPS – safety precautions		
	Total hours to be taught	**(L:45): 45 Periods**
Outcome(s)	• To identify the need of timely harvesting of crops in India. Also equip the	

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	students with technical knowledge and skills required for the operation, maintenance and evaluation of harvesting, threshing and land preparation (heavy) machinery needed for agricultural farms. • To abreast the students with mathematical, experimental and computational skills for solving different field problems. • To develop skills in the students required to develop and modification of indigenous harvesting machines/methods as per the need of the area and farmers Also to give a brief introductory idea of importance of testing of agricultural machines and tractors.

TEXT BOOK :	
1	Metha M.L., SR.Verma, K Mishra and V.K. Sharma. 1995. Testing and Evaluation of Agricultural Machinery, National Agricultural Technology Information Centre, Ludhiana.
2	Indian standard test codes related to tractors, power tillers and agricultural implements
REFERENCES	
1	Metha M.L., SR.Verma, K Mishra and V.K. Sharma. 1995. Testing and Evaluation of Agricultural Machinery, National Agricultural Technology Information Centre, Ludhiana.
2	Anonymous, 1983. RNAM test code & Procedures for Farm Machinery. Technical series 12.
3	Nebraska Tractor Test code for Testing Tractor, Nebraska, USA
4	Indian standard test codes related to tractors, power tillers and agricultural implements

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Syllabus

Department	Agriculture Engineering	Programme Code	1111

VII Semester

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG24701	Remote Sensing and Geological Information System Laboratory	0	0	3	1.5	100

Objective(s)	To introduce the principles and basic concepts of Remote Sensing and GIS through hands on training..

1.	Measurement of relief displacement using parallax bar.
2.	Stereoscopic vision test
3.	Aerial photo interpretation - visual
4.	Satellite images interpretation – visual
5.	Introduction to GIS
6.	Geo-referencing of images
7.	Supervised classification practice
8.	Unsupervised classification practice
9.	Database Management Systems
10.	Spatial data input and editing - Digitizing
11.	Raster analysis problems – Database query
12.	GIS applications in DEM and its analysis
13.	GIS application in watershed analysis
14.	GIS application in rainfall-runoff modelling
15.	GIS application in soil erosion modeling
	Total hours to be taught **45 Periods**

OUTCOME :

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

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VII Semester

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG36702	Phase – I Project	0	0	6	3	100
Objective(s)	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.					
Outcome(s)	On completion of the project work, students will be in a position to take up any challenging practical problem and find solution by formulating proper methodology.					
	Students in a group of 3 or 4 shall work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on three reviews by the review committee constituted by the Head of the Department. The project 75 work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.					
					Total hours to be taught	45 Periods

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COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
22AG56703	Inplant Training (Two Weeks)	0	0	0	1	100
Objective(s)	To train the students in field work by attaching to any industry / organization so as to have a firsthand knowledge of practical problems in Agricultural Engineering. To gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.					
	The students individually undertake training in reputed engineering companies / Govt organizations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.					

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PROFESSIONAL ELECTIVES (PE) – VII SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15701	Storage and Packaging Technology	PE	3	0	0	3
2	22AG15702	Post Harvest Engineering of Horticulture Crops	PE	3	0	0	3
3	22AG15703	Design of Farm Structures	PE	3	0	0	3
4	22AG15704	Climate Change and Adaptation	PE	3	0	0	3
5.	22AG15705	Systems Analysis in Agricultural Engineering	PE	3	0	0	3
6.	22AG15707	Integrated Farming System	PE	3	0	0	3

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15701	STORAGE AND PACKAGING TECHNOLOGY	3	0	0	3	100

Objective(s)	• To understand the underlying principles of spoilage and storage • To provide knowledge on different storage methods and packaging techniques.
Outcome(s)	• The students will have a clear understanding on various methods of storage and different packaging techniques for food and their applications.

UNIT-I	**SPOILAGE AND STORAGE**	**9**
Direct damages, Indirect damages of perishable and durable commodities – control measures -factors affecting storage – types of storage – Losses in storage and estimation of losses.		
UNIT-II	**STORAGE METHODS**	**9**
Improved storage methods for grain-modern storage structures-infestation-temperature and moisture changes in storage structures-CAP storage-CA storage of grains and perishables construction operation and maintenance of CA storage facilities		
UNIT-III	**FUNCTIONS OF PACKAGING MATERIALS**	**9**
Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.		
UNIT-IV	**FOOD PACKAGING MATERIALS AND TESTING**	**9**
Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength.		
UNIT-V	**SPECIAL PACKAGING TECHNIQUES**	**9**
Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.		
	Total hours to be taught	**(L:45): 45 PERIODS**

TEXT BOOK :

1	Sahay, K.M. and K.K.Singh. 1996. Unit operations of agricultural processing. Vikas Publishing House Pvt. Ltd., New Delhi.
2	Robertson L. Gordon. 1993. Food Packaging – principles and practices. Marcel decker Inc. New York.
3	Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.

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4	Pandey, P.H.2002. Post harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.
REFERNCES:	
1	Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2	Chakaraverty, A. 2000. 3rd edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	**T**	**P**	**C**	
22AG15702	**POST HARVEST ENGINEERING OF HORTICULTURAL CROPS**	3	0	0	3	**100**

Objective(s)	• To educate and equip students with equipments and unit operations involved in processing of horticultural crops

UNIT-I	**Introduction & Processing of Fruits And Vegetables**	**9**

Harvesting of fruits and vegetables – pre-cooling – importance, methods, pretreatments and advantages- minimal processing of fruits and vegetables, advantages - quick freezing preservation - commercial canning of fruits, vegetables - hurdle technology of preservation and techniques. Equipments - Precooler, cleaners, graders, vegetable washer, blanchers, sterilizer, freezer and cold storage.

UNIT-II	**Processing of Major Spices**	**9**

Spices –stage of harvesting and harvesting methods – Processing of major spices - pepper, cardamom, chilli, turmeric, ginger, vanilla - unit operations involved-equipments-principle and construction.

UNIT-III	**Processing of Minor Spices and Specifications for Spices**	**9**

Spices –stage of harvesting and harvesting methods – Processing of minor spices – clove, nutmeg and mace, fenugreek, cumin, fennel, coriander, mustard, cinnamon - unit operations involved — equipments – principle and construction - grading specifications – Agmark, ASTA, ESA specifications for spices.

UNIT-IV	**Processing of Plantation Crops**	**9**

Processing of plantation crops – processing of coffee, tea, cocoa, coconut, oil palm, arecanut, cashew nut – harvesting and stages of harvest - unit operations and equipments involved – value added products.

UNIT-V	**Processing of Medicinal Crops**	**9**

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Processing of medicinal crops – unit operations involved - equipments used - principles and operations – active principles in various medicinal plants – application and uses - extraction methods.	
Total hours to be taught	**(L:45): 45 PERIODS**
OUTCOME:	• At the end students will have in depth knowledge on principles and technologies involved in processing of horticultural crops
TEXT BOOK :	
1	J.S.Pruthi. 1998. Major spices of India – Crop Management and Post Harvest Technology. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. PP. 514.
2	J.S. Pruthi. 1980. Spices and Condiments: Chemistry, Microbiology and Technology. First Edition. Academic Press Inc., New York, USA.
3	Sudheer K. P. and V. Indra.2007. Post harvest Technology of Horticultural Crops. New India Publishing Company, New Delhi.
4	L.R.Verma and V.K.Joshi. 2000. Post Harvest Technology of Fruits and Vegetables – handling, Processing, Fermentation and waste management. Indus Publishing company, New Delhi.
REFERNCES:	
1	AmalenduChakraverty, Arun S. Mujumdar, G.S.VijayaRaghavan and Hosahalli S.Ramasamy. 2010. Handbook of Postharvest Technology – Cereals, Fruits, Vegetables, tea and Spices. Marcel Dekker Inc. New York. Basel.
2	Handbook of Agricultural Engineering. Directorate of Knowledge Management in Agriculture. Indian Council of Agricultural Research. KrishiAnusandhanBhavan I, New Delhi
3	Humberto vega and Gustavo v Barbosa. 1996. Dehydration of foods. Springer Science, Business Media, Chapman&Hall Publishers, U.K.

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15703	DESIGN OF FARM STRUCTURES	3	0	0	3	100

Objective(s)	• To understand the application of RCC in various farmstead structures and solve problems including sewage disposal structures. • To gain the knowledge on the design of different types and components of farm structures. • To impart knowledge on design and construction of farm structures.
Outcome(s)	• Able to design the poultry house, dairy barn and aquaculture systems. • Able to design the different types of farm feed and storage structures. • Able to describe the components of farm fencing.

UNIT-I	**FARMSTEAD PLANNING AND FARM HOUSES**	**9**

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

UNIT-II	**FARM FEED AND GRAIN STORAGE STRUCTURES**	**9**

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

UNIT-III	**FARM FENCING AND ROADS**	**9**

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

UNIT-IV	**WATER SUPPLY AND SEWAGE DISPOSAL**	**9**

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

UNIT-V	**DESIGN OF RCC STRUCTURES**	**9**

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Properties of Reinforced concrete - Basic assumptions - Modular ratio - Singly reinforced beam - fundamental assumptions - Equivalent area of R.C.C. section - Design of Singly reinforced beam - main reinforcement - vertical stirrups. Design of one way slabs - main and distribution reinforcement calculation and construction	
Total hours to be taught	**(L:45): 45 PERIODS**
TEXT BOOK :	
1	T.P.Ojha and A.M.Michael, Principles of Agricultural Engineering, Vol-1, Jain brothers, New Delhi,2006
2	H.N. Van Lier, CIGR Handbook of Agricultural Engineering, Vol. I- Land and Water Management Engineering ASAE, USA. 1999
3	E. H. Bartali and W.Frederick, CIGR Handbook of Agricultural Engineering, Vol. IIAnimal Production and Aquaculture Engineering ASAE, USA. 1999
REFERENCES	
1	M.Raghupathi, Design of steel structures Tata McGraw Hill Pub. Com. New Delhi 110 006 2005
2	B.C.Punmia, Reinforced concrete structures Vol. I Laxmi publications, 7/21, Ansari Road, Dhryaganj, New Delhi 110 002, 2005
3	6. Christian Von Zabeltitz and W.O.Baudoin,"Green houses and shelter structures for tropical regions", FAO plant production and protection paper, Rome,1999

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15704	CLIMATE CHANGE AND ADAPTATION	3	0	0	3	100

Objective(s)	• To know the basics, importance of global warming • To know the concept of mitigation measures against global warming • To learn about the global warming and climate change.

UNIT-I	**EARTH'S CLIMATE SYSTEM**	**9**

Role of ozone in environment - ozone layer - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Hydrological Cycle - Green House Gases and Global Warming – Carbon Cycle.

UNIT-II	**ATMOSPHERE AND ITS COMPONENTS**	**9**

Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability - Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion

UNIT-III	**IMPACTS OF CLIMATE CHANGE**	**9**

Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes

UNIT-IV	**OBSERVED CHANGES AND ITS CAUSES**	**9**

Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India

UNIT-V	**CLIMATE CHANGE AND MITIGATION MEASURES**	**9**

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Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.	
Total hours to be taught	**(L:45): 45 PERIODS**
TEXT BOOK :	
1	Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
REFERENCES	
1	Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006
2	Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006
3.	Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM
Regulation 2022

VIII-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1		Professional Elective - V	PE	3	0	0	3
2		Professional - VI	PE	3	0	0	3
PRACTICAL							
3	22AG36801	Project Work (Phase –II)	EEC	0	0	12	6
TOTAL				**6**	**0**	**12**	**12**

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PROFESSIONAL ELECTIVES (PE) - VIII SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	22AG15801	Design of greenhouse Structures	PE	3	0	0	3
2	22AG15802	Extension Methodologies and Transfer of Agricultural Technology	PE	3	0	0	3
3	22AG15803	Agricultural Finance, Banking and cooperation	PE	3	0	0	3
4	22AG15804	Ergonomics And Safety In Agriculture	PE	3	0	0	3
5	22AG15805	Supply Chain management	PE	3	0	0	3
6	22AG15806	Utility management	PE	3	0	0	3

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15801	DESIGN OF GREEN HOUSE STRUCTURES	3	0	0	3	100

Objective(s)	• To understand the types and its design criteria calculations of green house • To gain knowledge about green house covering and utilization of solar radiation in green houses

UNIT-I	**INTRODUCTION**	**9**
History and types of greenhouse- Function and features of greenhouse- Scope and development of greenhouse technology- Location, planning and various components of greenhouse		
UNIT-II	**DESIGN CRITERIA AND CALCULATIONS**	**9**
Criteria For The Design Of Plastic Film Greenhouses, Design Criteria In Areas With A Mediterranean Climate, Design Criteria In Humid Tropical Climates, Greenhouses For Other Climate Conditions, Design Load Calculations : Part I, Design Load Calculations: Part II, Construction materials , and methods of construction, Covering material and characteristics		
UNIT-III	**GREENHOUSE COVERING**	**9**
Introduction- Factors To Be Considered While Selecting Greenhouse Coverings- Types Of Greenhouse Coverings, Maintenance Of Greenhouse Coverings		
UNIT-IV	**SOLAR RADIATION IN GREEN HOUSES**	**9**
Solar heat transfer- Solar fraction for greenhouse- Steady state analysis of greenhouse, Greenhouse Heating, Cooling, Shedding and Ventilation System, Carbon dioxide generation and monitoring and lighting systems, Instrumentation and & computerized environmental control systems, Watering, fertilization, root substrate and pasteurization, Containers and benches		
UNIT-V	**PLANT TISSUE CULTURE**	**9**
Plant nutrition, Alternative cropping systems- Plant tissue culture Chemical growth regulation- Disease control, integrated pest management, Post Production Quality and Handling, Cost analysis of greenhouse Production- Application of greenhouse & its repair & maintenance		
Total hours to be taught		**(L:45): 45 PERIODS**

TEXT BOOK :

1	Paul V. Nelson. 1991. Green house operation and management. Ball publishing USA.
2	Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.

REFERENCES:

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

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15802	EXTENSION METHODOLOGIES AND TRANSFER OF AGRICULTURAL TECHNOLOGY	3	0	0	3	100

Objective(s)	• To expose the students to different extension methods for communication to take the work from lab to field
Outcome(s)	• After completion of this course, the students will be familiar with various extension methods, communication gadgets. Be trained in capacity building techniques

UNIT-I	**Communication**	**9**
Communication – meaning, definition, types; Communication models (Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers & Shoemaker) – elements and their characteristics; Barriers in communication		
UNIT-II	**Extension Teaching Methods**	**9**
Extension teaching methods – meaning, definition, functions, classification (individual, group, mass contact methods), merits and demerits; Audio aids, Visual aids and Audio-Visual aids – definition, classification, purpose, planning, selection, combination, use.		
UNIT-III	**e-Extension**	**9**
e-Extension – Community Radio, Internet, cyber cafes, video and teleconferencing, Agri portals, Information Kiosks, Kisan Call Centre (KCC), Expert System, Village Knowledge Centre (VKC), DEMIC, consultancy clinics, Agricultural journalism (Print media) – definition, principles, importance, ABC of news and types of news.		
UNIT-IV	**Capacity building**	**9**
Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, training functions of FTC, KVK, EEI, MANAGE and NAARM.		
UNIT-V	**Participatory Extension, Diffusion of Innovations**	**9**
Participatory Extension Approaches – RRA, PRA; Diffusion of Innovations – definition, elements; Innovation – definition, attributes; Adoption – meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; Consequences of innovations.		
Total hours to be taught	**(L:45): 45 Periods**	

TEXT BOOK :

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1	Basavaprabhu jiril Dipak De and N.Meera shaik 2012 ICTs: Digital Opportunities in agricultural extension.Agrobios India,Jodhpur.
2	Supe, S.V.2011.Integrated extension Education, Agro Tech. Publishing Academy, Udaipur
3	Sharma, F.L, Panjabi, N.K, Shri Ram and L.L.Somani. 2013. Agro Tech Publishing Academy, Udaipur.
4	Somani, L.L.2012. Extention Methodologies for transfer of Agriculture Technologies.Agro Tech Publishing Academy, Udaipur
REFERENCES	
1	Ahuja, B.N. 1997. Theory and Practice of Journalism, Surjeet Publications, New Delhi
2	Chauhan Nikulsinh. 2013. Use of ICTs in Agricultural Extension, Biotech Books
3	Janakiram, B. 2007. Training and Development, Wiley India Private limited, New Delhi
4	Lynton Rolf, P and Pareek Udai. 1990. Training for Development, Vistaar Publications, New Delhi

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15803	AGRICULTURAL FINANCE, BANKING AND COOPERATION	3	0	0	3	100

Objective(s)	• To make the students aware about the agricultural finance, Banking and co-operation • To acquaint the students with the basic concepts, principles and functions of management. To understand the process finance banking and co-operation.
Outcome(s)	• Outcome Students will be able to apply the basic managerial theories into practices such as demand & supply, consumer surplus, Cost analysis, market function & price machines & Budgeting considering the rural aspects & conditions • At the end Students will be able to understand the micro finance concepts & its application to the agriculture business

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	**Farm Financial Analysis**	**9**

Principles of Credit - 5C's, 3R's and 7 P's of Credit – Project Cycle and Management - Preparation of bankable projects / Farm credit proposals - Feasibility - Time value of money: Compounding and Discounting - Appraisal of farm credit proposals - Undiscounted and Discounted measures - Repayment plans - Farm Financial Statements: Balance Sheet, Income Statement and Cash Flow Statement – Financial Ratio Analysis

UNIT-III	**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 – Microfinance and Its role in poverty alleviation – Self-Help Groups – Non-Governmental Organizations - Rural credit policies followed by State and Central Government – Subsidized farm credit, Differential Interest Rate (DIR), Kisan Credit Card (KCC) Scheme.– Relief Measures and Loan Waiver Scheme and Know Your Customer (KYC).

UNIT-IV	**Co-operation**	**9**

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Co-operation: Philosophy and Principles - History of Indian Co-operative credit movement: Pre and Post - Independence periods and Co-operation in different plan periods - Co-operative credit institutions: Two tier and three tier structure, Functions: provision of short term and long term credit, Strength and weakness of co-operative credit system,. - Special Co-operatives: LAMPS and FSS: Objectives, role and functions - National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd. (NAFSCOB): Objectives and functions.		
UNIT-V	**Banking and Insurance**	**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 - 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 hours to be taught	**(L:45): 45 Periods**	

REFERENCES

1	Muniraj, R. 1987. Farm Finance for Development. Oxford & IBH. New Delhi
2	Subba Reddy, S and P. Raghu Ram. 2011. Agricultural Finance and Management. Oxford & IBH. New Delhi
3	Lee, W.F., M.D. Boehlje, A.G. Nelson and W.G. Murray. 1998. Agricultural Finance. Kalyani Publishers. New Delhi
4	Mammoria, C.B. and R.D. Saxena. 1973. Cooperation in India. Kitab Mahal. Allahabad

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15804	ERGONOMICS AND SAFETY IN AGRICULTURE	3	0	0	3	100

Objective(s)	• Understand the principles and applications of ergonomics and human factors. • Effectively understand the relevance of ergonomics and human factors in the practice of engineering. • Apply ergonomics and human factors tools and concepts introduced in class via a service learning project.

UNIT-I	**Human engineering**	**9**
Human factors in system development – concepts of system – ergonomics – basic process in system development – human concept – machine concept – local environment – human technology interaction – factors considered in system development		
UNIT-II	**Human performance and response**	**9**
Human performance - performance reliability – Anthropometry – measurement of anthropometric data – static and dynamic anthropometry - physiological factors for measurements – work rate – energy expenditure - oxygen consumption – biomedical measurements		
UNIT-III	**Posture and movement**	**9**
Biomechanics – human body – posture - terminology – types of movements – precautions taken during work movement – strength of endurance – speed and accuracy – human control system – human motor activities - vertical work surface –horizontal work surface – work counter		
UNIT-IV	**Behavior and perception**	**9**
Communication and cognitive issues – psycho -social behavior aspects and stereo type – information processing and perception – human error and risk perception - visual issues – visual displays – environmental factors		
UNIT-V	**Ergonomic design process**	**9**

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Ergonomic design methodology – ergonomic design criteria – design process involving ergonomics check – occupational safety and stress at workplace – work station design – vertical arm reach – design application possibility – design and human compatibility – comfort and adaptability aspects

Total hours to be taught	**(L:45): 45 Periods**

TEXT BOOK :	
1	Bridger R.S. 1995. Introduction to Ergonomics. Mc Hill Corporation.
2	Gite LP. 2009. Anthropometric and strength data of Indian Agricultural Workers for farm equipment design. AICRP on ESA. CIAE, Bhopal.

REFERENCES	
1	Bridger R.S. 1995. Introduction to Ergonomics. Mc Hill Corporation.
2	Gite LP. 2009. Anthropometric and strength data of Indian Agricultural Workers for farm equipment design. AICRP on ESA. CIAE, Bhopal.
3	Tayyari F. and Smith J. L. 1997. Occupational ergonomics–Principles and Applications. Chapman & Hall
4	Astrand P. And and Rodahl K. 1977. Textbook of Work Physiology. Mc Hill Corporation, New York**.**

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ENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agriculture Engineering	Programme Code	1111

VIII Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15805	SUPPLY CHAIN MANAGEMENT	3	0	0	3	100

Objective(s)	• To help understand the importance of and major decisions in supply chain management for gaining competitive advantage.
Outcome(s)	• Ability to build and manage a competitive supply chain using strategies, models, techniques and information technology.

UNIT-I	**INTRODUCTION**	**9**

Supply Chain – Fundamentals –Evolution- Role in Economy - Importance - Decision Phases - Supplier-Manufacturer-Customer chain. - Enablers/ Drivers of Supply Chain Performance. Supply chain strategy - Supply Chain Performance Measures.

UNIT-II	**STRATEGIC SOURCING**	**9**

Outsourcing – Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation. Creating a world class supply base-Supplier Development - World Wide Sourcing.

UNIT-III	**SUPPLY CHAIN NETWORK**	**9**

Distribution Network Design – Role - Factors Influencing Options, Value Addition – Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models. Supply Chain Network optimization models. Impact of uncertainty on Network Design - Network Design decisions using Decision trees.

UNIT-IV	**PLANNING DEMAND, INVENTORY AND SUPPLY**	**9**

Managing supply chain cycle inventory. Uncertainty in the supply chain –- Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing inventory for short life - cycle products multiple item –multiple location inventory management. Pricing and Revenue Management

UNIT-V	**CURRENT TRENDS**	**9**

Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. . SC Restructuring - SC Mapping -SC process restructuring, Postpone the point of differentiation – IT in Supply Chain - Agile Supply Chains -Reverse **Supply chain. Agro Supply Chains.**

Total hours to be taught	**(L:45): 45 Periods**

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TEXT BOOK :	
1	Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2009.
2	Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education, Sixth edition, 2015.
3	Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5th Edition, 2007.
REFERENCES	
1	David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.
2	Altekar Rahul V, Supply Chain Management-Concept and Cases, PHI, 2005.
3	Shapiro Jeremy F, Modeling the Supply Chain, Cengage, Second Reprint , 2002.

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Department	**Agriculture Engineering**	**Programme Code**	**1111**

VIII Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15806	UTILITY MANAGEMENT	3	0	0	3	100

Objective(s)	• To provides the vital information about overall energy conservation in electrical, thermal mechanical and appliances • To get knowledge in energy utilization analysis and evaluation of energy conservation in home and transport appliances
Outcome(s)	• Analyze the present pattern of energy consumption in different cost centers of operations • Evaluate the energy inputs and production output • Identifying potential areas of thermal electrical and mechanical energy conservation. • Utilize wastage in major areas and reduce input sources • Carry out modifications, retrofitting or replacement of existing plant/machinery so as to save energy

UNIT-I	**ELECTRICAL EQUIPMENT OPERATION AND MAINTENANCE**	9

General concept of power system - Transmission network in the Indian scenario - Commercial operations of a distribution utility - Distribution automation - Indian electricity rules-Electrical Systems- Transformers- Power factor improvements- Demand Side management -Load Management- Automatic power factor Controllers-Digital Signal Processing- Electronic Lighting ballasts for Lighting- LED Lighting-Trends and Approaches

UNIT-II	**THERMAL EQUIPMENT OPERATION AND MAINTENANCE**	9

Boilers- types of boilers - performance evaluation- Loss analysis- Steam turbines - Steam Utilization- Properties-steam distribution and losses- steam trapping, Condensate, Flash steam recovery- Furnaces- waste heat recovering options- Refrigeration and Air Conditioning- Vapor compressor refrigeration cycle-refrigerents new trends

UNIT-III	**WASTE WATER MANAGEMENT**	9

Water Quality Monitoring-Collection of water samples & estimation ofphysical parameters, estimation of Chemical parameters- Estimation ofalkalinity- BOD and COD- water use minimization- Water Recycling andReuse - Waste water treatment- Waste water and sewerage system- Wastewater treatment plants- Natural methods of waste water treatmentplants- soil filters- wetlands.

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UNIT-IV	**MECHANICAL EQUIPMENT OPERATION AND MAINTENANCE**	9
Design considerations-Governing regulations and codes and standards- Torque and Power-Basic theory-Shafts, Flywheels-Power Transmission-Electromechanical energy- Electric Motors-factors affecting motor performance -Bearing and Lubricants-Energy Saving Measures		
UNIT-V	**ENERGY CONSERVATION IN OTHER APPLIANCE**	9
Compressors-types –applications- specific power consumption- Fans and blowers- Fan Performance and Efficiency measures- pumps and pumping system - Diesel generating systems- energy performance assessment of diesel conservation avenues.		
Total hours to be taught		(L:45): 45 PERIODS

TEXT BOOK :	
1	General aspects of energy management and energy audit. Bureau of energy efficiency publication
2	Energy audit and management for the Indian industry. The institute of chartered accountants of india – published by Dr. B. Chakravarthy, Director (CPE)
3	Energy Management: W.R.Murphy, G.Mckay (Butterworths)
REFERENCES	
1	Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley Interscience Publication)
2	Energy Economics -A.V.Desai (Wieley Eastern)
3	Industrial Energy Conservation : D.A. Reay (Pergammon Press)
4	Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
5	Energy Conservation guide book Patrick/Patrick/Fardo (Prentice Hall)

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Verticals 1 Farm Machinery and Energy Engineering

S.No.	Course Code	Course Title	L	T	P	C
1	22AG15101	Mechanics of Tillage and Traction	3	0	0	3
2	22AG15102	Energy conservation in Food Processing Industry	3	0	0	3
3	22AG15103	Landscape Design and Site Planning	3	0	0	3
4	22AG15104	Industrial Safety Management	3	0	0	3
5	22AG15105	Precision Farming Equipment	3	0	0	3
6	22AG15106	Waste and By Product Utilization	3	0	0	3
7	22AG15107	Refrigeration and Cold Storage	3	0	0	3

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Department	Agriculture Engineering	Programme Code	1111

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15101	MECHANICS OF TILLAGE AND TRACTION	3	0	0	3	100

Objective(s)	• To impart the fundamental knowledge of mechanics and dynamics in various tillage implements • To design the tillage tool • To study the tyres, traction and its applications • To understand the soil compaction and plant growth

UNIT-I	**MECHANICS OF TILLAGE**	**9**
Introduction to mechanics of tillage tools - History of tillage, Soil machine crop system, Mechanics of tillage tools, Analysis of soil machine dynamics in tillage. Engineering properties of soil principles and concepts, stress strain relationship- Physical, mechanical and dynamic properties of soil.		
UNIT-II	**DESIGN OF TILLAGE TOOL**	**9**
Design of tillage tools- Introduction, design factors, Mould board plough surfaces. Principles of soil cutting- Introduction, Analysis of soil cutting and tillage. Design equation, force analysis.		
UNIT-III	**APPLICATION OF DIMENSIONAL ANALYSIS IN SOIL DYNAMICS**	**9**
Dimensional analysis-Introduction, Dimensions, Dimensional Homogeneity Buckingham pi theorem. Development of prediction equations, Methods of dimensional analysis, Application of dimensional analysis and similitude to soil mechanics		
UNIT-IV	**TRACTION AND TYRES**	**9**
Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction. Cone Index and tire basics, Tires for agricultural tractors, Tire terminology and selection of tires and ballasting		
UNIT-V	**SOIL COMPACTION AND PLANT GROWTH**	**9**
Soil compaction and plant growth, variability and geo statistics, application of GIS in soil dynamics-Mechanical and hydraulic properties of compacted soil. Soil physical properties and plant growth, Measures for optimizing crop growth by avoiding excessive soil compaction, Geostatistics/kriging, GIS for soil variability studies		
	Total hours to be taught	**(L:45): 45 PERIODS**

Outcome(s)	• Acquire knowledge regarding mechanics of tillage tools, scouring of soil and importance,

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	• Determine Kc and Kϕ using plate shrinkage test, wheel slip and • Study the role in traction mechanism, slip measurement and slip control method, rolling resistance and • Effect of type size inflation pressure and lug height on tractive performance, • Study of effect of soil compaction by agricultural machinery.
TEXT BOOK :	
1	Klenin, N.L.; Popov, I.F. and V.A. Sakum, (1985). Agricultural machines. Amerind Pub. Co. NewYork
2	J. B. Liljedahl, P. K. Turnquist, D. W. Smith, & M. Hoki , 1996. Tractors and their power units. Fourth ed. American Society of Agricultural Engineers, ASAE
3	Kepner, R. A., Roy Bainer and E. L. Barger. 1978. Principles of farm machinery. Third edition; AVI Publishing Company Inc: Westport, Connecticut
REFERENCES	
1	Ralph Alcock.1986. Tractor Implements System. AVI Pub
2	S. C. Jain, Farm Machinery- An Approach

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Department	Agriculture Engineering	Programme Code	1111

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15102	ENERGY CONSERVATION IN FOOD PROCESSING INDUSTRY	3	0	0	3	100

Objective(s)	• To learn the different aspects of energy auditing in the Food Industry • To know about the energy saving opportunities in existing food processing facilities	
UNIT-I	**ENERGY AUDITING, SUSTAINABILITY IN THE FOOD INDUSTRY**	**9**
Fundamentals of Energy Auditing,-Sustainability in the Food Industry -Energy Conservation Technologies Applied to Food Processing Facilities- Energy Conservation in Steam Generation and Consumption System. Energy Conservation in Compressed Air System- Energy Conservation in Power and Electrical Systems. Energy Conservation in Heat Exchanger		
UNIT-II	**WASTE HEAT RECOVERY**	9
Waste Heat Recovery and Thermal Energy Storage in Food Processing Facilities- novel Thermodynamic Cycles Applied to the Food Industry for Improved Energy Efficiency		
UNIT-III	**ENERGY SAVING OPPORTUNITIES IN EXISTING FOOD PROCESSING**	9
FACILITIES Energy Consumption pattern, Energy Conservation in Grains and Oilseeds Milling Facilities, in Sugar and Confectionary Processing Facilities, in Fruit and Vegetable Processing Facilities, in Dairy Processing Facilities, in Meat Processing Facilities, in Bakery Processing Facilities		
UNIT-IV	**ENERGY CONSERVATION IN EMERGING FOOD PROCESSING SYSTEMS**	9
Membrane Processing of Foods, Energy Efficiency and Conservation in Food Irradiation, in Pulsed Electric Fields Treatment, in High-Pressure Food Processing, in Microwave Heating, in Supercritical FluidProcessing Conversion of Food Processing Wastes into Energy		
UNIT-V	**FOOD PROCESSING WASTES AND UTILIZATIONS**	9
Concepts of Anaerobic Digestion of Food Processing Wastes, Fermentation of Food Processing Wastes into Transportation Alcohols, Bio-diesel Production from Waste Oils and Fats, Thermo- chemical Conversion of Food Processing Wastes for Energy Utilization		
	Total hours to be taught	(L:45): 45 PERIODS
Outcome(s)	• Classify the energy resources based on sources and purposes	

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	• Identify the types of energy audits in production agriculture for rural living and scope of energy conservation • Identify the energy efficient machinery systems and analyse the technologies and methods forconservation of energy resource • Identify the factors affecting energy conservation and analyse the energy economics, pricing andincentives for energy conservation • Make use of a case study on energy audit in agricultural fields for comparative study.

TEXT BOOK :	
1	L.Wang, Energy Efficiency and Management in Food Processing Facilities, CRC Press, 2009
2	R. P. Singh, Energy in Food Processing, Elsevier Publishing Co., 1986
3	B. Mattsson, and U. Sonesson, Environmentally Friendly Food Processing, CRC Press, 2003
REFERENCES	
1	Sydney Reiter,Industrial and Commercial Heat Recovery Systems, Van Nostrand Reinhold, 1985
2	Spiewak Scott A, Cogeneration and Small Power Production Manual, The Fairment Press, 1987

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Department	Agriculture Engineering	Programme Code	1111

- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15103	LANDSCAPE DESIGN AND SITE PLANNING	3	0	0	3	100

Objective(s)

- To impart the basic knowledge of landscape design.
- To introduce the concept of site selection.
- To make plan for different gardening requirement.
- To train the students in designing of landscape for different type of gardening.
- To know the different treatments and maintenance procedure.

UNIT-I	BASICS OF LANDSCAPING	9

Landscape design - definition - objectives - scope and benefits; Site survey - analysis and appraisal; Landform design and grading.

UNIT-II	SITE SELECTION AND PLANTING PRINCIPLES	9

Soil and Site Conditions - Plant selection techniques - Selection of trees and shrubs - Use of Native Species - Seeding – sowing and planting methods - Planting Season.

UNIT-III	PLANTING PRACTICES	9

Planting design - principles and practice of mulching - Pruning of trees and shrubs; Tools used; Selection of overhead irrigation system - Selection of surface irrigation system; Fountains - need - uses- design; Drainage - design of surface drainage.

UNIT-IV	LANDSCAPE APPLICATIONS	9

Landscape application in gardens - Indoor landscaping - Terrace gardening - layout of lawn on a terrace - Benches layout in gardens - Landscaping of residential areas - Lighting of gardens - Rockery with a waterfall.

UNIT-V	SURFACE TREATMENTS IN LANDSCAPING	9

Surface treatments - Landscape elements of construction - Path ways - design and layout - Roads - design and layout of earthen roads - concrete road and Tar road; Parking requirements - Maintenance of landscape.

Total	45 Periods

Outcomes:

- Understand the basic concept of landscape design.
- Select the suitable site and plants for designing landscape.

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• Analyse the different gardening requirement. • Design the landscape for different type of gardening. • Apply the different treatments and maintenance procedure**.**	
TEXT BOOK :	
1	Rita Buchanan, “Taylor's Master Guide to Landscaping, Houghton Mifflin Gardening”, ISBN: No. 0618055908, 2000.
2	Jack E Ingels, “Landscaping”, Thomson Delmar Learning, ISBN No.: 082736735X,1997.
REFERENCES:	
1	Steven Angleyet.al., “Landscape Estimating and Contract Administration”, Thomson Delmar Learning, ISBN: No. 0618055908,2001.

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- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15104	INDUSTRIAL SAFETY MANAGEMENT	3	0	0	3	100

Objective(s)

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT-I	SAFETY TERMINOLOGIES	9

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators- Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT-II	STANDARDS AND REGULATIONS	9

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT-III	SAFETY ACTIVITIES	9

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT-IV	WORKPLACE HEALTH AND SAFETY	9

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane SafetyToxic gas Release

UNIT-V	HAZARD IDENTIFICATION TECHNIQUES	9

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Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment	
Total	**45 Periods**

Outcomes:

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards.•
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

TEXT BOOK :

1	L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education
2	R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER

REFERENCES:

1	Frank Lees (2012) 'Lees' Loss Prevention in Process Industries.Butterworth-Heinemann publications, UK, 4th Edition.
2	John Ridley & John Channing (2008)Safety at Work: Routledge, 7th Edition

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- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15105	PRECISION FARMING EQUIPMENT	3	0	0	3	100

Objective(s)	• To learn about the fundamentals of precision farming principles and application of precision farming equipment.	
UNIT-I	**ROLE OF ELECTRONICS IN AGRICULTURAL ENGINEERING**	**9**
Role of electronics in agricultural engineering for precision agriculture. Basics of precision agriculture, tools for implementation of precision agriculture. Introduction of GIS/GPS positioning system for precision farming. Use of GIS and GPS in farm machinery and equipment		
UNIT-II	**SENSORS, MICROCONTROLLER AND ACTUATOR FOR PRECISION AGRICULTURE**	**9**
Types of sensor- principle and concept of different sensor like ultrasonic, proximity, PIR, IR, radar, pressure, gas, temperature, moisture, strain /weight, colour sensor etc. used in agriculture. Microcontroller: Arduino, Raspberry Pi and PLC Actuator : DC Motor, Pump, linear Actuator etc. - Basic input circuits and signal conditioning systems – amplifiers and filters		
UNIT-III	**PRECISION FARMING CONCEPTS AND PRECISION FARMING MACHINERY**	**9**
Precision farming concepts- Map based system- Real time system – Combination Map and real time system -components of PF – Site specific management- Constraints of PF- Precision tillage, planting, intercultural, plant protection and harvesting equipment, laser guided leveller, power sprayer, straw chopper cum spreader, straw bailer, combine harvester etc.		
UNIT-IV	**SITE-SPECIFIC MANAGEMENT SYSTEM**	**9**
Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary· treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, Tertiary treatments.		
UNIT-V	**UNMANNED VEHICLES AND IOT IN AGRICULTURE**	**9**
UAV -Drones- Types - applications – rules and regulations – Autonomous ground vehicles – Robotics-platforms and unmanned agricultural vehicles- IoT - crop yield estimates- threat identification- crop insurance-pesticides spraying, environmental monitoring- protected cultivation food quality monitoring etc,		
	Total	**45 Periods**

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Outcomes:

- Understand the role of electronics in precision farming
- Analyse the principles and applications of sensors, micro controllers and actuators in precision farming equipment
- Understand the precision farming concepts and machinery
- Understand about site specific management system and unmanned vehicles & IoT applications
- Analyse the application of sensors and electronics in farm machinery

TEXT BOOK :

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

REFERENCES:

1	Michael, A.M. 2007. Irrigation: Theory and Practice. Vikash Publishing House Pvt. Ltd., New Delhi.
2	Rai G.D. 1994. Non-conventional sources of energy. Khanna Publishers, Delh

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- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15106	WASTE AND BY PRODUCT UTILIZATION	3	0	0	3	100

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

Outcomes:

- Types of waste and influences
- Waste water management from any food industry.
- By product utilization from processing plants of cereals, pulses

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• Hands on training in wastewater treatment process • Advance procession techniques for waste water treatment	
TEXT BOOK :	
1	Huang, R.T. 1982. Compost Engineering: Principles and Practices.John Willey & Sons, New York.
REFERENCES:	
1	Standards, ASAE: Manure Production and Characteristics. ASAE, NewYork
2	USDA: Agricultural Waste Management Field Hand Book, New York, USA

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agriculture Engineering	Programme Code	1111

- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15107	REFRIGERATION AND COLD STORAGE	3	0	0	3	100

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

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

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

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

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

UNIT-III	**APPLIED PSYCHROMETRY**	**9**

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

UNIT-IV	**AIR CONDITIONING SYSTEM**	**9**

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

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

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Cooling and heating load estimation, cold storage design, types of cooling plants for cold storage. Insulation properties and types of insulation material. Cold storage for milk, meat, fruits, vegetables, poultry and marine products. Refrigerated Transport, Handling and Distribution, Cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display. Sensors for cold storage management.	
Total	**45 Periods**

Outcomes:

- Select appropriate components of the refrigeration unit and analyze the effect of different refrigerants on environment
- Differentiate various refrigeration cycles and its applicability
- Apply knowledge of psychrometry for air conditioning & various food processing operations
- Apply the knowledge of refrigeration and air conditioning in persevering foods using domestic and industrial refrigeration systems
- Choose and design appropriate cold storage system for ensuring the product quality

TEXT BOOK :

1	C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2008
2	Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice Hall of India, New Delhi, 2009

REFERENCES:

1	Roy J. Dossat, Principles of Refrigeration, Pearson Education, New Delhi, 2007
2	N. F Stoecker and Jones, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi, 2008

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Verticals 2 Water Management and Protected Cultivation

S.No.	Course Code	Course Title	L	T	P	C
1	22AG15201	Automation in Irrigation	3	0	0	3
2	22AG15202	Disaster Management	3	0	0	3
3	22AG15203	Protected Cultivation and Precision Farming	3	0	0	3
4	22AG15204	Organic Farming Technology	3	0	0	3
5	22AG15205	Irrigation Water Quality and Waste Water Management	3	0	0	3
6	22AG15206	Sustainable Agriculture and Food Security	3	0	0	3
7	22AG15207	Agricultural Business Management	3	0	0	3

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15201	Automation in Irrigation	3	0	0	3	100

Objective(s)

- To expose the concept of Irrigation Automation
- To introduce the concepts of Automatic Systems
- To get an idea about IOT and its applications in Irrigation
- To gain knowledge on automation in surface Irrigation
- To explore and use new technologies in Irrigation

UNIT-I	INTRODUCTION TO AUTOMATION	**9**

Automatic Irrigation - Traditional methods of Irrigation - Need for Automation - Comparison between Traditional and Automated Irrigation - Advantages - Disadvantages - Economic Impacts of Automation on Agricultural Firms - Future of Automation.

UNIT-II	SYSTEMS OF AUTOMATION	9

Pneumatic System - Portable timer system –principles –components- Timer/Sensor Hybrid/SCADA - Methods of automating Irrigation layout - Machine Learning in Tank Monitoring System.

UNIT-III	IOT IN IRRIGATION	9

IOT based Automated Irrigation System - IOT based Smart Irrigation - Sensor based Automation - types - operation - Solar based Automatic Irrigation System - components - operation - Automation by sensing soil moisture - Automation using ANN based controller - operation.

UNIT-IV	SURFACE AND MICRO-IRRIGATION AUTOMATION	9

Automation and control in Surface Irrigation Systems - Equipments - benefits - barriers - Automation Design in Bay, Basin and Furrow Irrigation - Automation in Micro Irrigation - Design - Cost - Operation and maintenance.

UNIT-V	ASSESSMENT OF PARAMETERS IN IRRIGATION	9

Crop water estimate using Satellite data - Automation of Lysimeter for PET Measurements and Energybased Remote Sensing model - Remote Monitoring design of Automatic Irrigation system - Cost and Benefits of Automation.

Total	**45 Periods**

Outcomes:

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

- understand the technologies available for automation
- design automated systems for irrigation
- know various IOT applications
- gain knowledge on automated surface irrigation
- understand the various parameters involved in design of automated system.

TEXT BOOK :

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

REFERENCES:

1	Darell D.Zimbelman, Planning, Operation, Rehabilitation and Automation of Irrigation water delivery system, American Society of Agricultural Engineers,1987

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15202	Disaster Management	3	0	0	3	100

Objective(s)

- To provide an exposure to disasters, their significance and types.
- To understand the approaches to disaster risk reduction.
- To understand the interrelation between disasters and development.
- To impart knowledge over the disaster risk management.
- To know the various applications of disaster management.

UNIT-I	INTRODUCTION TO DISASTERS	9

Definition - Disaster - Hazard - Vulnerability - Resilience - Risks; Disasters - Types – Classification - Causes - Impacts - differential impacts; Global trends in disasters - urban disaster-pandemics - complex emergencies - Dos and Don'ts during various types of Disasters.

UNIT-II	APPROACHES TO DISASTER RISK REDUCTION (DRR)	9

Disaster cycle - Phases - Culture of safety - prevention - mitigation and preparedness community based DRR – Structural and Non-structural measures - Roles and responsibilities of community – Panchayat Raj Institutions/Urban Local Bodies (PRIs/ULBs) of States - Centre and other stake-holders; Institutional Processes and Framework at State and Central Level - State Disaster Management Authority (SDMA) - Early Warning System - Advisories from Appropriate Agencies.

UNIT-III	INTER - RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9

Factors affecting Vulnerabilities - differential impacts - impact of Development projects such as dams
- embankments - changes in Land-use; Climate Change Adaptation - IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge - appropriate technology and local resources.

UNIT-IV	DISASTER RISK MANAGEMENT IN INDIA	9

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Hazard and Vulnerability profile of India - Components of Disaster Relief - Water - Food - Sanitation
- Shelter - Health - Waste Management - Institutional arrangements; Mitigation, Response and Preparedness; Disaster Management Act and Policy - Other related policies - plans - programs and legislation; Role of GIS and Information Technology Components in Preparedness - Risk Assessment
- Response and Recovery Phases of Disaster - Disaster Damage Assessment.

UNIT-V	APPLICATIONS, CASE STUDIES AND FIELD WORKS	9

Landslide Hazard Zonation; Case Studies - Earthquake Vulnerability - Assessment of Buildings and Infrastructure - Drought Assessment - Coastal Flooding - Storm Surge Assessment - Floods - Forest Fires - Man Made disasters; Space Based Inputs for Disaster Mitigation and Management - field works related to disaster management.

Total	**45 Periods**

Outcomes:

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

- differentiate the types of disasters, causes and their impact on environment and society.
- assess vulnerability, damage assessment and various methods of risk reduction measures aswell as mitigation.
- get an ideas about Climate change adaptation, IPCC Scenario and Scenarios in the context ofIndia
- know the various disaster risk management practices in India.
- acquire knowledge on applications of disaster management.

TEXT BOOK :

1	Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN
2	Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt.Ltd., 2012. ISBN

REFERENCES:

1	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
2	Government of India, National Disaster Management Policy, 2009.
3	Gupta Anil K, Sreeja S. Nair, “Environmental Knowledge for Disaster Risk Management”,NIDM, New Delhi, 2011.
4	KapurAnu, “Vulnerable India: A Geographical Study of Disasters”, IIAS and Sage Publishers,New Delhi, 2010.

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15203	Protected Cultivation and Precision Farming	3	0	0	3	100

Objective(s)	• To impart knowledge on different types of protected cultivation system. • To know about Hi-tech protected cultivation of vegetable crops. • To get an idea about protected cultivation of flower crops. • To study about precision farming techniques in agriculture. • To expose the various precision farming techniques in horticulture crops.

UNIT-I	PROTECTED CULTIVATION AND ITS TYPES	9

Protected cultivation - scope and importance - methods; Growing structures - green house - poly house - net house - poly tunnels - screen house - protected nursery house; Environmental factors influencing greenhouse production - cladding - glazing - covering material - ventilation systems; Growing media - soil and soilless - nutrient film technique - hydroponics - aeroponics - aquaponics;

Crop management - canopy management - micro irrigation and fertigation systems. Automatic irrigation

UNIT-II	PROTECTED CULTIVATION OF VEGETABLE CROPS	9

Protected cultivation technology for vegetable crops - various varieties- need of fertilizer – types of fertilizers -tomato - capsicum - cucumber - gherkins -strawberry and melons - integrated pest and disease management - post harvest handling.

UNIT-III	PROTECTED CULTIVATION OF FLOWER CROPS	9

Protected cultivation technology for flower crops - roses - chrysanthemum - carnation - gerbera - anthurium - orchids - foliages and fillers - various varieties- need of fertilizer – types of fertilizers - post harvest Handling-Advanced technology in protected cultivation- Automation Ventilation system

UNIT-IV	PRECISION FARMING TECHNIQUES	9

Precision farming - introduction - concept and importance; Mobile mapping system and its application in precision farming; Design - layout and installation of drip and fertigation; Site specific management (SSM) - geo-referencing and photometric correction; Sensors - information gathering and application; Crop simulation models - role in precision farming - integrated pest and disease management

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UNIT-V	PRECISION FARMING OF CROPS	9
Precision farming technology- cotton - sugar cane - banana - turmeric - tomato - chillies - brinjal - bitter gourd - bottle gourd - cauliflower - cabbage - rose - chrysanthemum – tuberose- Advanced technology in Precision Farming.		
	Total	**45 Periods**

Outcomes:

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

- understand different types of protected cultivation system.
- know protected cultivation techniques used in vegetable crops.
- gain sufficient knowledge on protected cultivation of flower crops.
- familiar with precision farming techniques.
- apply precision farming techniques in various crops.

TEXT BOOK :

1	Joe.J.Hanan,“ Green houses: Advanced Technology for Protected Horticulture”, CRC Press, LLC. Florida,1998
2	Paul V. Nelson, “Green house operation and management”. Ball publishing USA,1991

REFERENCES:

1	Lyn. Malone, Anita M. Palmer, Christine L. VIoghat Jach Dangeermond, “Mapping out world: GIS lessons for Education”. ESRI press,2002.
2	David Reed. “Water, media and nutrition for green house crops”. Ball publishing USA,1996.
3	Adams, C.R. K.M. Bandford and M.P. Early. 1996, “Principles of Horticulture”. CBS publishers and distributors. Daryaganj, New`` Delhi.

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- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15204	Organic Farming Technology	3	0	0	3	100

Objective(s)

- To study the principles and practices of organic farming
- To know the soil health management practices through organic farming
- To learn different organic production technologies including certification
- To introduce different crop protection practices in organic farming
- To expose the Post harvest technologies, export and market avenues

UNIT-I — **9**

Organic farming - concept - History - genesis and status of Organic farming in Tamil Nadu and India – Organic ecosystem and its concepts - Pre-requisites and basic steps for organic farming; conversion to organic farming - planning and processes in practices- IFS approach-Integration of animal components - Difference between conventional and organic agriculture - Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.

UNIT-II — **9**

Soil health - concepts - problem diagnosis - conservation of soil - problem soil reclamation under organic farming - soil physical, chemical and biological improvement - organic carbon status and improvement strategies - sources of organics - production potentials - maintenance of soil health - long term effect

UNIT-III — **9**

Crop production technologies - Response of crops and varieties - cropping systems - intercropping in relation to maintenance of soil productivity; Role of green manures and pulses - Indigenous Technical Knowledge (ITK'S) - Integrated Farming System (IFS) - Resource conservation - enhancing crop productivity and food production;
Conservative irrigation practices - problems of modern irrigation system.

UNIT-IV — **9**

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Weeds, Insects and diseases management under organic farming; Biological agents and pheromones, bio- pesticides for crop protection; Sustainable crop protection practices - ITK's in crop protection.		
UNIT-V		**9**
Post harvest technology - preservation - value addition - quality parameters - marketing and export avenues; Organic certification - Standards and agencies - marketing and export avenues - certification for exports; Sustainability indices for evaluating long term and indirect benefits; Economic evaluation of organic agricultural technologies.		
	Total	**45 Periods**

Outcomes:

- Able to learn the basics of organic farming
- Ability to manage soil health using organic management practices
- Able to produce organic crops using various organic production technologies
- Able to protect crops using organic practices
- Ability to export various organic products

TEXT BOOK :

1	Dahama, A.K., "Organic Farming for Sustainable Agriculture", Agrobios (India), Jodhpur pp.301, 2002.
2	Palaniappan, SP. and K. Annadurai, "Organic farming: Theory and Practice", Scientific Publishers, Jodhpur, 1999.

REFERENCES:

1	Lampkin, N., "Organic farming", Ipswich, U. K . Farming Press Books pp.710, 1990.
2	Sharma, Arun K., "A Hand book of Organic Farming", Agrobios (India), Jodhpur pp. 627, 2002.
3	Thampan, P. K., "Organic Agriculture", Peekay Tree Crops Development Foundation, Cochin pp.354, 1995.
4	Vyas, S. C., Smriti Vyas, Sameer Vyas and H. A. Modi., "Biofertilizers and Organic farming", Akta Prakashan, Nadiad, pp.252,1998.
5	Anantha krishnan, T. N. (ed.), "Emerging Trends in Biological Control of Phytophagous Insects", Oxford & IBH,1992.

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15204	Irrigation Water Quality and Waste Water Management	3	0	0	3	100

Objective(s)

- To understand the concept of water quality
- Able to describe the soil-water relationship
- To understand the concept of recycling and reuse
- Able to calculate the irrigation water requirement
- To acquire knowledge on water resources

UNIT-I	IRRIGATION WATER QUALITY AND WATER POLLUTION	**9**

Water quality for irrigation – Salinity and permeability problem – Root zone salinity - Irrigation practices for poor quality water – Saline water irrigation – Future strategies. Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland.

UNIT-II	SOIL WATER TENSION AND MEASUREMENT OF SOIL WATER	**9**

Rooting characteristics – soil water tension and soil water stress – Soil water potential concept – total and gravitational potential – soil water retention – hydraulic conductivity – determination. Measurement of soil water-gravimetric, thermo-gravimetric – tensiometric, electrical resistance, pressure plate and pressure membrane apparatus methods – neutron scattering, immersion, dielectric, thermal conductivity, penetrometric and air permeability methods.

UNIT-III	RECYCLING AND REUSE OF WATER	**9**

Multiple uses of water – Reuse of water in agriculture – Low cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation.

UNIT-IV	WATER QUALITY MANAGEMENT	**9**

Principles of water quality – Water quality classification – Water quality standards - Water quality indices – TMDL Concepts – Water quality models.

UNIT-V	AGRICULTURAL DRAINAGE SYSTEMS	**9**

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Agricultural drainage - Drainage coefficient, principles of flow through soils, Darcy's law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.	
Total	**45 Periods**

Outcomes:

- Able to select suitable irrigation methods for effective utilization of water resources
- To understand the concept and functioning of water cycle
- Able to implement new techniques for water recycle.
- Able to design suitable drainage system for effective crop production
- To understand different agricultural drainage systems

TEXT BOOK :

1	A.M. Michael. 2015. Second edition. Irrigation -Theory and Practice, Vikas publishing house, New Delhi.
2	V.V.N. Murthy. 2016. Sixth edition. Land and water management, Kalyani publishing, New Delhi.

REFERENCES:

1	Dilip Kumar Majumdar, Irrigation water Management-Principles and Practice, Prentice-Hall of India Pvt. 3Ltd, New Delhi, 2006.
2	J.N. Luthin, Drainage Engineering, John Wiley and Sons, New York, 1966

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- Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15205	Sustainable Agriculture and Food Security	3	0	0	3	100

Objective(s)

- To study the importance of land resources for sustainability.
- To know the importance of water resources for sustainability
- To understand organic farming for sustainable agriculture.
- To study the importance of food security and ecological balance.
- To know the policies and programmes for sustainable agriculture and food security

UNIT-I	LAND RESOURCE	9

Land Resources of India and Tamil Nadu - Population and land - Land utilization - Net Area Sown - Changes in cropping pattern - land degradation- Rainfall - Rainfall forecasting; Adequacy for crop growth - Drought and production instability

UNIT-II	SUSTAINABLE AGRICULTURE	9

Sustainable agriculture – Introduction- Definition- Concept -Goals- Adverse effect of modern agriculture- Agro-ecosystems; Impact of climate change on Agriculture - Effect on crop yield - effect on Soil fertility.

UNIT-III	SUSTAINABLE INDICATORS AND ORGANIC FARMING	9

Food grain production at State Level - Indicators of Sustainable food availability - Indicators of food production sustenance; Organic farming - principles and practices -Natural farming principles - Sustainability in rainfed farming.

UNIT-IV	FOOD PRODUCTION AND FOOD SECURITY	9

Performance of Major Food Crops over the past decades - trends in food production - Decline in total factor productivity growth - Demand and supply projections; Market - Impact of market force - Rural Land Market - Emerging Water market; Sustainable food security indicators and index - Indicator of sustainability of food and nutritional security - Path to sustainable development; Vertical farming.

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UNIT-V	POLICIES AND PROGRAMMES	9
Food and Crop Production policies - Agricultural credit Policy - Crop insurance - Policies of Natural Resources Use - Policies for sustainable Livelihoods - Virtual water and trade - Sustainable food Security Action Plan & implementation-- case studies		
	Total	**45 Periods**

Outcomes:

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

- gain knowledge on the need for sustainable agriculture.
- understand the importance of land and water resources for sustainability.
- know the relationship between organic farming and sustainable agriculture.
- comprehend the need for food security on global level.
- get awareness on the policies and programmes for sustainable agriculture and food security.

TEXT BOOK :

1	M.S.Swaminathan, "Science and sustainable food security", World Scientific Publishing Co., Singapore, 2010.
2	B.K.Desai and Pujari, B.T. "Sustainable Agriculture: A vision for future", New India Publishing Agency, New Delhi, 2007.
3	

REFERENCES:

1	Swarna S.Vepa et al., "Atlas of the sustainability of food security". MSSRF, Chennai, 2004
2	Sithamparanathan, J., Rengasamy, A., Arunachalam, N., "Ecosystem principles and sustainable agriculture", Sci tech Publications, Chennai, 1999.
3	Tanji, K. K., and Yaron, B. " Management of water use in agriculture", Springer Verlag , Berlin, Germany, 1994.

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Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
22AG15206	Agricultural Business Management	3	0	0	3	100

Objective(s)

- To know the importance of agri - business management, its characteristics and principles.
- To impart knowledge on the functional areas of Agri-business like employee management, quality control and SWOT Analysis.
- To become familiar with Production, Operations, management and marketing techniques.
- To learn the various aspects of financial management in agricultural business, branding and promotion.
- To describe the methods of pricing, retailing, distribution and training in agricultural business.

UNIT-I	CONCEPTS OF AGRICULTURAL BUSINESS	9

Agri-business - scope - characteristics - types; Small business - characteristics and stages of growth; Management - importance - definition - management and Administration - management thoughts - Management functions - planning, organizing, staffing, directing, supervision, motivation, leading and controlling.

UNIT-II	AGRI - BUSINESS ORGANIZATION	9

Principles and forms of agri-business organizations; Controlling - types, performance evaluation andcontrol techniques; Management approaches - Profit Centered Approach - Management by objectives and Quality Circles; Strength, Weakness, Opportunities and Threat (SWOT) Analysis.

UNIT-III	AGRICULTURAL MARKETING	9

Functional areas of Agri-business - Production and Operations management - functions, planning physical facilities and managing quality; Agro-inputs and products inventory management - raw material procurement,

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inventory types and costs; Marketing management & environment - marketing mix - Agricultural input marketing firms.		
UNIT-IV	**AGRICULTURAL BUSINESS FINANCE**	**9**
Forms of agri-business organizations - Role of lead bank in agribusiness finance - Financial management - Acquiring capital; Budget analysis - Concepts and determinants; Business project - scheduling of raw material procurement - production management - launching products (branding and placement).		
UNIT-V	**MARKET PROMOTION AND HUMAN RESOURCES**	**9**
Agricultural products - marketing promotion activities - product pricing methods; District Industries Centre; Consumer survey - Agricultural inputs retailing - Market potential assessment - types of distribution channels - Return on Investment - Personnel management; Recruitment, selection and training - Technology in Agri Business.		
	Total	**45 Periods**

Outcomes:

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

- know the importance of Agri-business management, its characteristics and principles.
- understand the methods of managing employees, quality control and SWOT Analysis.
- familiar with the functions of Production and Operations management and marketing techniques.
- have knowledge on various aspects of financial management in agri business, branding and promotion.
- understand the methods of pricing, retailing, distribution and training in agricultural business.

TEXT BOOK :

1	. Himanshu, “Agri Business Management - Problems and prospects”, Ritu Publications, Jaipur, 2005.
2	SmitaDiwase, “Indian Agriculture and Agribusiness Management”, Krishi resource Management.

REFERENCES:

1	S. Diwase, “Indian Agriculture & Agri-Business Management”, Scientific Publishers, 2nd edition, 2014.
2	Chandra Prasanna, “Projects: Preparation, Appraisal, Budgeting and Implementation”, Tata McGraw Hill Publications, New Delhi, 2001.
3	Kotler, P., “Marketing Management Analysis, Planning and Control”, Prentice Hall Inc., New York, 2001.
4.	Rao, V.S.P., and Narayana, P.S., “Principles and Practices of Management”, Konark Publishing Private Limited, New Delhi, 2001.

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CURRICULUM

REGULATION-2024

CHOICE BASED CREDIT SYSTEM (CBCS)

B.Tech –AGRICULTURAL ENGINEERING

DEPARTMENT OF AGRICULTURAL ENGINEERING

MAHENDRA ENGINEERING COLLEGE

(AUTONOMOUS)

MALLASAMUDRAM WEST, TAMIL NADU 637503

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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM

Regulation 2024

I-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24MA12101	Engineering Mathematics- I	BS	3	1	0	4
2	24CY12001	Engineering Chemistry	BS	3	0	0	3
3	24HS11001	Communicative English	HS	3	0	0	3
4	24GE13101	Engineering Graphics	ES	2	0	2	3
5	24HS11002	Heritage of Tamils	MC	1	0	0	1
		Induction program	MC	0	0	0	0
PRACTICAL							
6	24CY22001	Chemistry Laboratory	BS	0	0	3	1.5
7	24HS21001	Personality Development Practice Laboratory	EEC	0	0	2	1
8	24GE23101	Computer Aided Drafting and Modeling Laboratory	ES	0	0	3	1.5
Total				**13**	**1**	**10**	**18**

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II-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24MA12201	Engineering Mathematics - II	BS	3	1	0	4
2	24PY12001	Engineering Physics	BS	3	0	0	3
3	24CS13001	Problem Solving Techniques Using C	ES	3	0	0	3
4	24EE13001	Basics of Electrical and Electronics Engineering	ES	2	0	2	3
5		Engineering Mechanics	ES	3	0	0	3
6	24HS11003	Tamils and Technology	MC	1	0	0	1
PRACTICAL							
7	24PY22001	Physics Laboratory	BS	0	0	3	1.5
8		Problem Solving Techniques Using C Lab	ES	0	0	3	1.5
9	24GE23001	Engineering Practices Laboratory	ES	0	0	3	1.5
Total				**15**	**1**	**11**	**21.5**

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III-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24MA12301	Transforms and Partial Differential Equations	BS	3	1	0	4
2	24AG14301	Crop Production Technology	PC	3	0	0	3
3	24AG14302	Strength of Materials for Agricultural Engineering	PC	3	0	0	3
4	24AG14303	Fluid Mechanics and hydraulics	PC	3	0	0	3
5	24AG14304	Surveying and Leveling	PC	3	0	0	3
6		Open Elective - I	OE	2	1	0	3
7	24CY11001	Environmental Science & Sustainability	HS	2	0	0	2
PRACTICAL							
8	24AG24301	Surveying and Levelling Laboratory	PC	0	0	3	1.5
9	24AG24302	Fluid Mechanics and Hydraulics Laboratory	PC	0	0	3	1.5
10	24AG24303	Crop Production Technology Laboratory	PC	0	0	3	1.5
TOTAL				**19**	**2**	**9**	**25.5**

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CHOICE BASED CREDIT SYSTEM

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IV-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24MA12403	Probability Distributions and Statistics	BS	3	1	0	4
2	24AG14401	Soil Mechanics	PC	3	0	0	3
3	24AG14402	Theory of Machines	PC	3	0	0	3
4	24AG14403	Tractor and Power Units	PC	3	0	0	3
5		Open Elective -II	OE	2	1	0	3
6		Open Elective - III	OE	3	0	0	3
7	24HS11006	Universal Human Values	HS	3	0	0	3
PRACTICAL							
8	24AG24401	Soil Mechanics Laboratory	PC	0	0	3	1.5
9	24AG24402	Strength of Materials Laboratory	PC	0	0	3	1.5
10	24HS21002	Professional Communication Skills	EEC	0	1	2	2
TOTAL				**20**	**2**	**9**	**27**

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CHOICE BASED CREDIT SYSTEM

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V-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24AG14501	Design of Agricultural Machinery	PC	3	0	0	3
2	24AG14502	Renewable Energy Engineering	PC	3	0	0	3
3	24AG14503	Unit Operations in Agricultural Processing	PC	3	0	0	3
4		Professional Elective – I	PE	3	0	0	3
5		Open Elective –IV	OE	2	1	0	3
6		Open Elective – V	OE	3	0	0	3
7	24HS11004	Constitution of India	MC	3	0	0	0
PRACTICAL							
8	24AG24501	Bio Energy Laboratory	PC	0	0	3	1.5
9	24HS21003	Interview Skills and Soft Skills	EEC	0	1	2	2
10	24AG56504	In-plant Training	EEC	0	0	0	1
TOTAL				**20**	**2**	**8**	**22.5**

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Regulation 2024

VI-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24AG14601	Farm Machinery and Equipment - I	PC	3	0	0	3
2	24AG14602	Irrigation Equipment Design	PC	3	0	0	3
3	24AG14603	Post-Harvest Technology	PC	3	0	0	3
4	24AG14604	Food and Dairy Process Engineering	PC	3	0	0	3
5		Professional Elective – II					
6		Principles of Management	EEC	3	0	0	3
PRACTICAL							
7	24AG24601	Post Harvest Engineering Laboratory	PC	0	0	3	1.5
8	24AG24602	Unit Operations Llaboratory	PC	0	0	3	1.5
9	24AG36603	Mini project	EEC	0	0	2	1
TOTAL				**18**	**0**	**8**	**22**

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VII-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24AG14701	Remote Sensing and GIS in Agriculture	PC	3	0	0	3
2	24AG14702	Farm Machinery and Equipment - II	PC	3	0	0	3
3	24AG14703	Storage and Packaging Technology	PC	3	0	0	3
4	24AG14704	Soil and Water Conservation Engineering	PC	3	0	0	3
5		Professional Elective – III	PE	3	0	0	3
6	24AG16704	Professional Elective – IV	PE	3	0	0	3
PRACTICAL							
7	24AG24701	GIS laboratory	PC	0	0	2	1
8	24AG24702	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	2	1.5
9	24AG36702	Project Work (Phase –I)	EEC	0	0	6	3
TOTAL				**15**	**0**	**9**	**23.5**

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VIII-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1		Professional Elective – V	PE	3	0	0	3
2		Professional – VI	PE	3	0	0	3
PRACTICAL							
3	24AG36801	Project Work – (Phase –II)	EEC	0	0	12	6
TOTAL				**6**	**0**	**12**	**12**

TOTAL CREDITS: 170

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SUMMARY

CREDITS AS PER SEMESTER

S.No	SUBJECT AREA	Credits Per Semester								CREDITS
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3			3					6
2	BS	8.5	8.5	4	4					25
3	ES	4.5	12							16.5
4	PC			16.5	12	10.5	15	14.5		68.5
5	PE					3	3	6	6	18
6	OE			3	6	6				15
7	MC	1	1							2
8	EEC	1			2	3	4	3	6	19
9	TOTAL	18	21.5	23.5	27	22.5	22	23.5	12	170

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HUMANITIES AND SOCIAL SCIENCES (HS)

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24HS11001	Communicative English	HS	3	0	0	3
2	24CY11001	Environmental Science & Sustainability	HS	2	0	0	2
3		Universal Human Values	HS	3	0	0	3

BASIC SCIENCES (BS)

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24MA12101	Engineering Mathematics- I	BS	3	1	0	4
2	24CY12001	Engineering Chemistry	BS	3	0	0	3
3	24CY22001	Chemistry Laboratory	BS	0	0	3	1.5
4	24MA12201	Engineering Mathematics - II	BS	3	1	0	4
5	24PY12001	Engineering Physics	BS	3	0	0	3
6	24PY22001	Physics Laboratory	BS	0	0	3	1.5
7	24MA12301	Transforms and Partial Differential Equations	BS	3	1	0	4
8	24MA12403	Probability Distributions and Statistics	BS	3	1	0	4

ENGINEERING SCIENCES (ES)

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24GE13101	Engineering Graphics	ES	2	0	2	3
2	24GE23101	Computer Aided Drafting and Modeling Laboratory	ES	0	0	3	1.5
3	24CS13001	Problem Solving Techniques Using C	ES	3	0	0	3
4	24EE13001	Basics of Electrical and Electronics Engineering	ES	2	0	2	3
5		Engineering Mechanics	ES	3	0	0	3
6		Problem Solving	ES	0	0	3	1.5

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		Techniques Using C Lab					
7	24GE23001	Engineering Practices Laboratory	ES	0	0	3	1.5

Mandatory Course (MC)

S.No.	Course Code	Course Title	Category	L	T	P	C
1		Heritage of Tamils	MC	1	0	0	1
2		Tamils and Technology	MC	1	0	0	1
3		Constitution of India	MC	3	0	0	0

PROFESSIONAL CORE (PC)

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24AG14301	Crop Production Technology	PC	3	0	0	3
2	24AG14302	Strength of Materials for Agricultural Engineering	PC	3	0	0	3
3	24AG14303	Fluid Mechanics and hydraulics	PC	3	0	0	3
4	24AG14304	Surveying and Levelling for Agricultural Engineering	PC	3	0	0	3
5	24AG24301	Surveying and Levelling Laboratory	PC	0	0	3	1.5
6	24AG24302	Fluid Mechanics and Hydraulics Laboratory	PC	0	0	3	1.5
7	24AG24303	Crop Production Technology Laboratory	PC	0	0	3	1.5
8	24AG14401	Soil Mechanics	PC	3	0	0	3
9	24AG14402	Theory of Machines	PC	3	0	0	3
10	24AG14403	Tractor and power units	PC	3	0	0	3
11	24AG24401	Soil Mechanics Lab	PC	0	0	3	1.5
12	24AG24402	Strength of Materials Laboratory	PC	0	0	3	1.5

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13	24AG14501	Design of Agricultural Machinery	PC	3	0	0	3
14	24AG14502	Renewable Energy Engineering	PC	3	0	0	3
15	24AG14503	Unit Operations in Agricultural Processing	PC	3	0	0	3
16	24AG24501	Bio Energy Engineering	PC	0	0	3	1.5
17	24AG14601	Farm Equipment - I	PC	3	0	0	3
18	24AG14602	Irrigation Equipment Design	PC	3	0	0	3
19	24AG14603	Post Harvest Technology	PC	3	0	0	3
20	24AG14604	Food and Dairy Process Engineering	PC	3	0	0	3
21	24AG24601	Post Harvest Engineering Laboratory	PC	0	0	3	1.5
22	24AG24602	Unit Operations Llaboratory	PC	0	0	3	1.5
23	24AG14701	Remote Sensing and GIS in Agriculture	PC	3	0	0	3
24	24AG14702	Farm Equipment - II	PC	3	0	0	3
25	24AG14703	Storage and Packaging Technology	PC	3	0	0	3
26	24AG14704	Soil and water Conservation Engineering	PC	3	0	0	3
27	24AG24701	GIS laboratory	PC	0	0	2	1
28	24AG24702	Operation and Maintenance of Farm Machinery Laboratory	PC	0	0	2	1.5

PROFESSIONAL ELECTIVES (PE) - V SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24AG15501	Hydrology and Water Resource Engineering	PE	3	0	0	3
2	24AG15502	Municipal Solid Waste Management	PE	3	0	0	3
3	24AG15503	Groundwater, Wells and Pumps	PE	3	0	0	3
4	24AG15504	Farm Drainage System Design	PE	3	0	0	3
5	24AG15505	Modeling in Integrated Water Resources Management	PE	3	0	0	3
6	24AG15506	Natural Resources Management	PE	3	0	0	3

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PROFESSIONAL ELECTIVES (PE) - VI SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24AG15601	IOT in Agricultural Engineering	PE	3	0	0	3
2	24AG15602	Food Process Equipment and Design	PE	3	0	0	3
3	24AG15603	Emerging Technologies in Food Processing	PE	3	0	0	3
4	24AG15604	Process Engineering of Fruits and Vegetables	PE	3	0	0	3
5	24AG15605	Fundamentals of Food Process Engineering	PE	3	0	0	3
6	24AG15606	Novel Technologies for Food Processing and Shelf life Extension	PE	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - VII SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24AG16701	Precision Farming	PE	3	0	0	3
2	24AG16702	Design of Farm Structures	PE	3	0	0	3
3	24AG16703	Climate Change and Adaptation	PE	3	0	0	3
4	24AG16704	Testing and Evaluation of Farm Machinery	PE	3	0	0	3
5	24AG16705	Systems Analysis in Agricultural Engineering	PE	3	0	0	3
6	24AG16706	Machine learning for Soil and Crop Management	PE	3	0	0	3

PROFESSIONAL ELECTIVES (PE) - VIII SEMESTER

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24AG16801	Design of greenhouse Structures	PE	3	0	0	3
2	24AG16802	Extension Methodologies and Transfer of Agricultural Technology	PE	3	0	0	3

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3	24AG16803	Agricultural Finance, Banking and cooperation	PE	3	0	0	3
4	24AG16804	Human Engineering and safety in Agriculture	PE	3	0	0	3
5	24AG16805	Supply Chain management	PE	3	0	0	3
6	24AG16806	Intellectual Property Management	PE	3	0	0	3

OPEN ELECTIVES (OE)

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24MA12304	Quantitative Aptitude And Problem Solving Skills	OE	2	1	0	3
2	24CS14403	Java Programming	OE	3	0	0	3
3	24MA12406	Numerical, Logic and Visual Reasoning Skills	OE	2	1	0	3
4	24MA12501	Interpretation, Analysis and Critical Thinking Skills	OE	2	1	0	3
5		Advanced Java Programming	OE	3	0	0	3
6		Fundamentals of Operating System	OE	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	Course Code	Course Title	Category	L	T	P	C
1	24HS21001	Personality Development Practice Laboratory	EEC	0	0	2	1
2	24HS60001	Professional Communication Skills	EEC	0	1	2	2
3	24HS60002	Interview Skills and Soft Skills	EEC	0	1	2	2
4	24AG56504	In-plant Training	EEC	0	0	0	1
5		Principals of Management	EEC	3	0	0	3
6	24AG36603	Mini project	EEC	0	0	2	1
7	24AG36702	Project Work (Phase –I)	EEC	0	0	6	3
8	24AG36801	Project Work (Phase –II)	EEC	0	0	6	6

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Verticals 1 Water Management and Protected Cultivation

S.No.	Course Code	Course Title	L	T	P	C
1	24AG15101	Automation in Irrigation	3	0	0	3
2	24AG15102	Disaster Management	3	0	0	3
3	24AG15103	Organic Farming Technology	3	0	0	3
4	24AG15104	Irrigation Water Quality and Waste Water Management	3	0	0	3
5	24AG15105	Sustainable Agriculture and Food Security	3	0	0	3
6	24AG15106	Agricultural Business Management	3	0	0	3

Verticals 2 Farm Machinery and Energy Engineering

S.No.	Course Code	Course Title	L	T	P	C
1	24AG15101	Mechanics of Tillage and Traction	3	0	0	3
2	24AG15102	Energy conservation in Food Processing Industry	3	0	0	3
3	24AG15103	Landscape Design and Site Planning	3	0	0	3
4	24AG15104	Industrial Safety Management	3	0	0	3
5	24AG15105	Waste and By Product Utilization	3	0	0	3
6	24AG15106	Refrigeration and Cold Storage	3	0	0	3

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DEPARTMENT OF AGRICULTURE ENGINEERING

Regulation 2024

I Semester

Sl. No.	Course code	Course Title	L	T	P	C
THEORY						
1	24MA12101	Engineering Mathematics- I	3	1	0	4
2	24CY12001	Engineering Chemistry	3	0	0	3
3	24HS11001	Communicative English	3	0	0	3
4	24GE13101	Engineering Graphics	2	0	2	3
5	24HS11002	Heritage of Tamils	1	0	0	1
6		Induction program	0	0	0	0
PRACTICAL						
7	24CY22001	Chemistry Laboratory	0	0	3	1.5
8	24HS21001	Personality Development Practice Laboratory	0	0	2	1
9	24GE23101	Computer Aided Drafting and Modeling Laboratory	0	0	3	1.5
		TOTAL	**13**	**1**	**10**	**18**

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	Programme Code	

I - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24MA12101	ENGINEERING MATHEMATICS-I (Common to all Branches)	3	1	0	4	100

Objective(s)

To enable the students to:

- Learn the types of matrices and linear algebra in a comprehensive manner.
- Familiarize with functions of several variables and its applications toengineering.
- Define the geometric aspects of curvature, radius of curvature, evolutes and envelopesas application of differential calculus.
- Explain various techniques of integration.

Learn double and triple integrals and give their representation as area and volume.

UNIT-I	MATRICES	9+3

Matrix and its types – Rank of matrix –Solving system of linear equations - Characteristic equation - Eigenvalues and Eigenvectors of the matrix - Cayley-Hamilton Theorem, Diagonalization of real and symmetric matrices by Orthogonal transformation – Reduce the quadratic form to canonical form.

UNIT-II	DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES	9+3

Differentiation of implicit functions – Partial derivatives – Total derivative – Euler's theorem – Jacobian andproperties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables
– Lagrange's method of undetermined multipliers.

UNIT-III	APPLICATIONS OF DIFFERENTIAL CALCULUS	9+3

Curvature in Cartesian co-ordinates– Centre and radius of curvature – Circle of curvature – Evolutes –
Envelopes – Evolute as envelope of normals and their properties.

UNIT-IV	INTEGRAL CALCULUS	9+3

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Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts,
Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction,Integration of irrational functions - Improper integrals – Applications to Engineering problems

UNIT-V	MULTIPLE INTEGRALS	9+3

Double integrals in Cartesian co-ordinates – Change of order of integration – Area as double integral – Tripleintegral in Cartesian co-ordinates – Volume as triple integral – Change of variables in double integrals.Applications to Engineering problems

Total	(L:45+T:15):60 Periods

Outcomes:

At the end of the course the students will be able to:

- Determine the rank of a matrix, eigenvalues, eigenvectors and inverse of a givenmatrix and diagonalize symmetric matrix by orthogonal transformations, solve system of linear equations.
- Determine maxima and minima of functions of several variables.
- Apply the concepts of differential calculus in physical problems.
- Apply different methods of integration in solving practical problems.

Compute the area and volume by using multiple integrals.

TEXT BOOK :

1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017.
2	James Stewart, Calculus with Early Transcendental function, Cengage, 2013.

REFERENCES:

1	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2016.
2	Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, McGraw-Hill, 2013.
3	Ben Orlin, Change is the Only Constant: The Wisdom of Calculus in a Madcap World, Pearson 2018.

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MAHENDRA ENGINEERING COLLEGE
(Autonomous)

Syllabus

Department	Agricultural Engineering	Programme Code	1111

I - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24CY12001	ENGINEERING CHEMISTRY	3	0	0	3	100

Objective(s)

To make the students familiar with:

1. The treatment of water used for domestic and industrial purpose.
2. Various types of polymers in our day today life.
3. The basic principle and preparation methods of Nanomaterials.
4. The Construction and applications of different types of batteries.
5. The preparation, properties and combustion method of fuels.

UNIT-I	WATER TECHNOLOGY	9

Types of water - Alkalinity, types and determination - Hardness, types and Estimation by EDTA method. Domestic water treatment – disinfection methods (Chlorination, ozonation, UV treatment) – Boiler feed water – requirements – Decreased efficiency of using hard water in boilers – external conditioning – demineralization process, Electro dialysis process, reverse osmosis - Internal conditioning (phosphate, calgon and carbonate conditioning methods) – Conservation of Water using 3R method– WHO and BIS guidelines for drinking water.

UNIT-II	POLYMER CHEMISTRY	9

Introduction - Classification of polymers – Natural and synthetic - Thermoplastic and Thermosetting - Functionality – Degree of polymerization - Types and mechanism of polymerization: Addition (Free Radical); condensation and copolymerization - Preparation, properties & applications of selected commodity and engineering polymers (Polyester, Polystyrene, PVC, Nylon, Teflon, Bakelite and Epoxy resin).

UNIT-III	NANOCHEMISTRY	9

Basic - Distinction between molecules, nanoparticles and bulk materials - size-dependent properties (optical, electrical, mechanical and magnetic) - Types of nanomaterials: Definition, properties and uses of –nanoparticles , nanocluster, nanorod, nanotube and nanowire - Synthesis of nanomaterials: laser ablation, Sol gel, Synthesis of Carbon nano tubes by CVD Method- SWCNT and MWCNT- Applications (Medicine, Agriculture and Electronics).

UNIT-IV	ENERGY STORAGE DEVICE	9

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Types of batteries - Primary battery - dry cell - Secondary battery - Construction and application of lead acid battery and Lithium ion batteries – Battery used in EV application – Nuclear energy – Fission and Fusion reactions – Light water nuclear reactor for power generation (block diagram only) - Fuel cell (H_2-O_2) - Super Capacitors.

UNIT-V	FUELS AND COMBUSTION	9

Introduction - classification of fuels - Coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - Petroleum - manufacture of synthetic petrol (Bergius process) - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - flue gas analysis (ORSAT Method).

Total	45 Periods

Outcomes:

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

1. Explain the various water quality parameters and their treatments for domestic and industrial applications.
2. Classify the reaction mechanism, synthesis and application of polymers.
3. Develop the essential concepts of nanoscience and nanotechnology in designing the nanomaterial for Engineering.
4. Compare the working principles of batteries and super capacitors.
5. Illustrate the suitable fuels for engineering processes and applications

TEXT BOOK :

1	Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2022.
2	Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2021.
3	Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2019.
4	Lindsay S.M., "Introduction to Nanoscience" Oxford University, 2009.

REFERENCES:

1	Dr.C.K.Charles and Dr.G.Ramachandran, "Applied Chemistry", CARS Publishers,Chennai,2015
2	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2012.
3	Linden's "Handbook of Batteries", Thomas B. Reddy, Fourth Edition McGraw-Hill, New York, 2011.
4	Shikha Agarwal,"Engineering Chemistry-Fundamental and Application",Cambridge University press,Delhi,Second Edition,2019.

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	Programme Code	1111

I - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24HS11001	COMMUNICATIVE ENGLISH (Common to all B.E/, B. Tech Degree Programmes)	3	0	0	3	100

Objective(s)

- To help learners to improve their knowledge of grammar
- To enable them to use vocabulary appropriately in different academic and professional contexts
- To support learners to acquire listening and speaking skills
- To facilitate them to develop their reading skills by familiarizing different types of reading strategies
- To equip them with writing skills needed for academic as well as professional context

UNIT-I — **9**

Listening- Listening to Short Conversations (Formal and Informal)
Speaking – Introducing Oneself and Others
Reading – Skimming and Scanning-Reading Comprehension Passages and Answering Multiple Choice Questions
Writing - Leave/On Duty application, Bonafide Certificate-requisition, Check list, Instructions
Grammar & Vocabulary – Parts of Speech, Articles, Prefixes and Suffixes

UNIT-II — **9**

Listening – Listening to Telephonic Conversations
Speaking –Word Building Activity
Reading – Short stories
Writing- Recommendations, Composing E-Mail(Formal & Informal), Letter Writing- Letter to the Editor
Grammar & Vocabulary – Sentence Pattern, Tenses, British Terms and American Equivalents

UNIT-III — **9**

Listening - Listening to TED Talks and Note taking
Speaking – Role Play
Reading –Cloze Reading and Fill up the Gaps
Writing - Letter Writing – Permission Letter (In-Plant Training/Industrial Visit), Business letters- Calling for Quotation and Placing Order
Grammar & Vocabulary – Modal Verbs, Voice- Active Voice, Passive Voice and Impersonal Passive, Numerical Expressions

UNIT-IV — **9**

Listening - Listening to Audio Lectures
Speaking – Taking part in Casual Conversation

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Reading - Reading Advertisements **Writing** – Poster Making, and Job Application **Grammar & Vocabulary** – Cause and Effect Expressions, Question tags, Gerunds and Infinitives, One word substitution		
UNIT-V		9
Listening – Listening to Academic lectures **Speaking** – Describing Objects **Reading** – Transcoding (Conversion of Flow Chart, Bar chart, Pie chart into a paragraph) **Writing** –Review writing (Films & Books), Essay Writing **Grammar & Vocabulary** – If Conditionals, Concord, Same Word used as Noun and Verb, Nominal Compounds		
	Total	**45 Periods**

Outcomes:

At the end of the course, the learners will be able to

- Develop listening and reading skills and comprehend the academic articles in English
- Develop vocabulary skills and use words appropriately in different academic contexts.
- Analyze and interpret the data with correct usage of grammar
- Demonstrate effective LSRW skills with emerging technology
- Create strong communication skills in both personal and professional life

TEXT BOOK :

1	Murphy, Raymond, *English Grammar in Use*, Fifth Edition. Cambridge University Press, New Delhi, 2019
2	N.P.Sudharshana and C.Savitha, *English For Technical Communication*, Cambridge University Press, New Delhi, 2016

REFERENCES:

1	Lewis Norman, *Word Power Made Easy*, Goyal Publishers: New Delhi. 2020.
2	Ashraf Rizvi. *Effective Technical Communication*, Tata McGraw Hill, 2017.
3	Jack C. Richards with Jonathan Hull and Susan Proctor, *Interchange*. 4th Edition, Cambridge University Press, New Delhi, 2016

Extensive Reading:

1	Khera, Shiv. *You can Win*. Macmillan, Delhi. 2014

Websites:

1	http://www.englishclub.com
2	http://www.talkenglish.com
3	https:// www.ted.com/talks
4	https://nptel.ac.in/

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Mechanical Engineering	Programme Code	5082

I Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24GE13101	ENGINEERING GRAPHICS (Common to Non circuit Branches)	3	0	0	3	100

Objective(s)

- Increase ability to communicate with people through drawing skills as per the BIS standard.
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic engineering drawing formats.

UNIT-I	**Plane Curves and Free Hand Sketching**	**9**

Importance of drawing in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Basic Geometrical constructions, Curves used in engineering practices: Conics –Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid –construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects.

UNIT-II	**Projection of Points, Lines and Plane Surfaces**	**9**

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

UNIT-III	**Projection of Solids**	**9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT-IV	**Projection of Sectioned Solids and Development of Surfaces**	**9**

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

UNIT-V	**Isometric and Perspective Projections**	**9**

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

Total hours to be taught	**45**

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Outcome(s)	• Students' ability to indicate proper dimensions on drawings will improve • Students' ability to perform basic sketching techniques will improve. • Students will become familiar with office practice and standards. • Students will be able to improve their visualization skills so that they can apply these skills in developing new products.

TEXT BOOK :	
1	S.Gowri &K.Jayapoovan, "Engineering Graphics" 6th Edition, Vikas Publication New Delhi
2	N S Parthasarathy and Vela Murali, "Engineering Drawing" Oxford University Press 2015.
3	K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2011.

REFERENCES:	
1	M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education 2005.
2	K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications 1998.
3	Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
4	Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited 2008.

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Regulations 2024

Semester - I
(Common to all B.E./B.Tech. Programmes)

Course Code	Course Name	Periods/Week			Credit	Maximum Marks
		L	T	P	C	
24HS11002	தமிழர் மரபு	1	0	0	1	100

அலகு 1	மொழிமற்றும் இலக்கியம்	3

இந்தியமொழிக் குடும்பங்கள்–திராவிடமொழிகள்–தமிழ்ஒருசெம்மொழி–தமிழ்செவ்வியக்கங்கள்–சங்கஇலக்கியத்தின் சமயச் சார்பற்றதன்மை–சங்கஇலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில்மேலாண்மைக் கருத்துக்கள்–தமிழ்க் காப்பியங்கள், தமிழகத்தில்சமணபௌத்தசமயங்களின் தாக்கம் –பக்திஇலக்கியம், ஆழ்வார்கள்மற்றும் நாயன்மார்கள்– சிற்றிலக்கியங்கள்–தமிழில்நவீனஇலக்கியத்தின் வளர்ச்சி –தமிழ்இலக்கிய வளர்ச்சியில்பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு 2	மரபு–பாறைஓவியங்கள்முதல்நவீனஓவியங்கள்வரை–சிற்பக் கலை	3

நடுகல்முதல்நவீனசிற்பங்கள்வரை–ஐம்பொன் சிலைகள்–பழங்குடியினர் மற்றும் அவர்கள்தயாரிக்கும் கைவினைப் பொருட்கள்,பொம்மைகள்–தேர் செய்யும் கலை–சுடுமண் சிற்பங்கள்–நாட்டுப்புறத் தெய்வங்கள்–குமரிமுனையில்திருவள்ளுவர் சிலை–இசைக் கருவிகள்–மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூகபொருளாதாரவாழ்வில்கோவில்களின் பங்கு.

அலகு 3	நாட்டுப்புறக் கலைகள்மற்றும் வீரவிளையாட்டுகள்	3

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

அலகு 4	தமிழர்களின் திணைக் கோட்பாடுகள்	3

தமிழகத்தின் தாவரங்களும் விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்கஇலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள்–தமிழர்கள்போற்றிய அறக்கோட்பாடு–சங்ககாலத்தில்தமிழகத்தில்எழுத்தறிவும் கல்வியும் – சங்ககாலநகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில்ஏற்றுமதிமற்றும் இறக்குமதி–கடல்கடந்தநாடுகளில்சோழர்களின் வெற்றி.

அலகு 5	இந்தியதேசியஇயக்கம் மற்றும் இந்தியபண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3

இந்தியவிடுதலைப்போரில்தமிழர்களின் பங்கு–இந்தியாவின் பிறப்பகுதிகளில்தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதைஇயக்கம் – இந்தியமருத்துவத்தில்,சித்தமருத்துவத்தின் பங்கு–கல்வெட்டுகள்,கையெழுத்துப்படிகள்–தமிழ்ப் புத்தகங்களின் அச்சுவரலாறு.

TOTAL – 15 PERIODS

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Regulations 2024

Semester - I

(Common to all B.E./B.Tech. Programmes)

Course code	Course Name	Periods/week			Credit	Maximum marks
		L	T	P	C	
24HS11002	HERITAGE OF TAMILS	1	0	0	1	100

UNIT-I	**LANGUAGE AND LITERATURE**	3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan

UNIT-II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT-III	**FOLK AND MARTIAL ARTS**	3

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT-IV	**THINAI CONCEPT OF TAMILS**	3

Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT-V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL HOURS	**15**

	TOTAL – 15 PERIODS
TEXT BOOK ANDREFERENCE BOOKS	
1.	தமிழகவரலாறு–மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடுதமிழ்நாடுபாடநூல்மற்றும் கல்வியியல்பணிகள்கழகம்)
2.	கணினித் தமிழ்–முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி–வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4.	பொருநை–ஆற்றங்கரைநாகரிகம் (தொல்லியல்துறைவெளியீடு)
5.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6.	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

MAHENDRA ENGINEERING COLLEGE
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DEPARTMENT:	SCIENCE & HUMANITIES	Programme Code & Name	CY & CHEMISTRY

SEMESTER – I (For Non Circuit Branches & ECE) & SEMESTER – II (For Circuit Branches (Except ECE))

COURSE CODE	COURSE NAME	HOURS/WEEK			CREDIT	MAXIMUM MARKS
		L	T	P	C	
24CY22001	CHEMISTRY LABORATORY (Any eight experiments to be conducted)	0	0	3	1.5	100

Objectives	▪ To inculcate experimental skills to test basic understanding of water quality parameters, such as, alkalinity, hardness, DO and chloride. ▪ To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions. ▪ To design and plan the experimental procedure and to record and process the results.
Outcomes	On completion of this course, students will have the knowledge in ▪ Explain the essential principles and their analysis of water quality parameters, like hardness, alkalinity, DO, and chloride. ▪ Experiment with different types of instruments for analysis of materials using small quantities involved for quick and accurate results. ▪ Analyze the normality of different types of materials such as PVA and Ferrous ion.
1.	Determination of Total, Temporary & Permanent hardness of water using EDTA method.
2.	Determination of the Alkalinity level of a water sample.
3.	Determination of Chloride content of water sample by Argentometry.
4.	Determination of DO content of water sample using Winkler's method.
5.	Determination of molecular weight of polyvinyl alcohol using Viscometry.
6.	Estimation of Iron content of the given solution using Potentiometry.
7.	Determination of strength of given hydrochloric acid using pH meter.
8.	Conductometric titration of strong acid vs strong base.
9.	Determination of strength of acids in a mixture using Conductometry.
10.	Estimation of sulphate in a solution using Conductometry (precipitation).

TEXT BOOK

1.	Chemistry lab Manual, Department of Chemistry, Mahendra Engineering College, Mallasamudram, 2022.
2.	Chemistry lab Manual, Department of Chemistry, Mahendra Engineering College,

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	Mallasamudram, 2020.
REFERENCES	
1.	Applied chemistry theory and practice by O. P. Vermani and A. K. Narula, second edition.
2.	J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).
3.	Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, Mcmillan, Madras 1980 1980

MEMBERS

1. Dr.P.Dhanakodi
2 Dr.M.Gunasekaran

SUBJECT EXPERT

Dr.V.Thangaraj M.Sc., Mphil., Ph.D.
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Syllabus - Regulation 2024

Department	**English**

Semester I – Non-Circuit Branches
Semester II – Circuit Branches
(Common to all B.E./ B.Tech. Programmes)

Course code	**Course Name**	**Hours/week**			**Credit**	**Maximum marks**
		L	**T**	**P**	**C**	
24HS21001	**Personality Development Practice Laboratory**	0	0	2	1	**100**

Objectives	• To develop listening and speaking skills of students for a variety of purposes like making presentations, attending interviews and participating in discussions • To enhance the non-verbal and social interaction skills of students for becoming effective communicators • To enable learners to hone their linguistic (LSRW) skills with the help of Technology
Outcomes	**At the end of the course, the students will be able to** • Understand the language proficiency and its techniques • Prepare the resume with organized details • Develop soft skills to excel in their career

LIST OF EXERCISES

1.	Importance of Communication Skills
2.	Building Vocabulary (Basic level)
3.	Stage Dynamics (Group PPT Presentation)
4.	Predicting the Content of a Given Article (Newspaper, Magazine, etc.,)
5.	Common Errors in English
6.	Interview Skills
7.	Presentation skills
8.	Group Discussion
9.	Soft Skills (Self-Confidence, Team Work, Time Management, Adaptability, Openness to Criticism)

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10.	Creative Writing – Any Essay type (Descriptive, Narrative etc.)	
		Total Hrs : 15

REFERENCE BOOKS:

1. Joshi, Manmohan, ***Soft Skills***, 1st Edition. Bookboon, 2017
2. Raman, Meenakshi & Sangeeta Sharma. ***Technical Communication: Principles and Practice***, Ed.III, Oxford University Press, New Delhi. 2015

Online Websites:

https:// www.ted.com/talks
https://quizziz.com
www.pdfdrive.com
https://www.calameo.com/read/00072308558ed20d410e7/

Activity:

Worksheets for relevant topics

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	MAHENDRA ENGINEERING COLLEGE (Autonomous)	

Syllabus

Department	Mechanical Engineering	Programme Code	1081

I Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24GE23101	COMPUTER AIDED DESIGN AND DRAFTING LABORATORY	0	0	3	1.5	100

Objective(s)

- Develop skill to use software to create 2D and 3D models.
- Understanding the basic principles in drafting techniques
- To get the knowledge and practicing the advanced drafting software.

LIST OF EXPERIMENTS

1. INTRODUCTION to CAD
2. AutoCAD – Basics
   - Starting with AutoCAD
   - Layout and sketching
   - Drawing environment
   - Elements of drawing
   - Draw commands
   - 3D Functions
3. 2D – FIGURES for practice using Design Software
4. ISOMETRIC DRAWING for practice using Design Software
5. 3-D Solid Figures Using Design Software
   - Learning Different Operations like Threading, Sweep, Swept blend. Modeling

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Better hardware, with suitable graphics facility - 30 No.
2. Licensed software for Drafting and Modeling. - 30 Licenses
3. Laser Printer or Plotter to print / plot drawings - 1 No

TOTAL HOURS: 45

Outcome(s)

- Ability to use the software packers for drafting and modeling
- Ability to create 2D and 3D models of Engineering Components
- Ability to understand the dimensioning and different fits and tolerance techniques.

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MAHENDRA ENGINEERING COLLEGE
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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM

Regulation 2024

II-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24MA12201	Engineering Mathematics - II	BS	3	1	0	4
2	24PY12001	Engineering Physics	BS	3	0	0	3
3	24CS13001	Problem Solving Techniques Using C	ES	3	0	0	3
4	24EE13001	Basics of Electrical and Electronics Engineering	ES	2	0	2	3
5	24GE13201	Engineering Mechanics	ES	3	0	0	3
6	24HS11003	Tamils and Technology	MC	1	0	0	1
PRACTICAL							
7	24PY22001	Physics Laboratory	BS	0	0	3	1.5
8		Problem Solving Techniques Using C Lab	ES	0	0	3	1.5
9	24GE23001	Engineering Practices Laboratory	ES	0	0	3	1.5
Total				**15**	**1**	**11**	**21.5**

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MAHENDRA ENGINEERING COLLEGE
(Autonomous)

Syllabus

Department	Agricultural Engineering	Programme Code	1111

II - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24MA12201	ENGINEERING MATHEMATICS - II (Common to all Branches)	3	1	0	4	100

Objective(s)

To enable the students to:

- Define vector function, operators and working procedure to evaluate line, surfaceand volume integrals.
- Explain different types of higher order ordinary differential equations withvariable coefficients and various methods to solve the equations.
- Learn Laplace transform, inverse Laplace transform and its properties to solvedifferential equations.
- Know about functions of complex variables, properties and problems involvingconformal mapping.

➢ Learn about Taylor's and Laurent's series expansion of complex functions and the process of evaluating complex integrals.

UNIT I	VECTOR CALCULUS	9+3

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vectorintegration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs).Verification and application in evaluating line, surface and volume integrals.

UNIT II	ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS	9+3

Second and Higher order linear differential equations with constant coefficients– Method of variation of parameters – Cauchy Euler equation, Legendre's type differential equations – System of simultaneous linear differential equations with constant coefficients.

UNIT-III	LAPLACE TRANSFORM	9+3

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Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem, solving Initial value problems by Laplace Transform method.		
UNIT-IV	**ANALYTIC FUNCTIONS**	**9+3**
Functions of a complex variable, Cauchy-Riemann equations – Analytic functions – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w= z+c, cz, 1/z, and Bilinear transformationtunneling microscope.		
UNIT-V	**COMPLEX INTEGRATION**	**9+3**
Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula(without proof) – Taylor and Laurent expansions –Types of Singularities-Singular points – Residues – Residue theorem(without proof) – Application of residue theorem to evaluate real integrals – Contour integration		
Total hours to be taught		**(L:45+T:15): 60 Periods**

TEXT BOOK :	
1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017.
2	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018.
REFERENCES:	
1	Michael D. Greenberg, Advanced Engineering Mathematics, Pearson 2013.
2	Lokenath Debnath and Dambaru Bhatta,"Integral Transforms and Their Applications, CRC Press 2015.
3	Dennis G. Zill and Warren S. Wright "Advanced Engineering Mathematics", Jones and Bartlett 2014.

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	Programme Code	1111

II - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24PY12001	ENGINEERING PHYSICS	3	0	0	3	100

Objective(s)

- To provide fundamental knowledge about lasers, Ultrasonic's, Properties of Matter, Quantum Physics and different kinds of Engineering Materials.
- To correlate the principles with application oriented Engineering studies.

UNIT I **LASER AND FIBER OPTICS** 9 (Hrs)

Introduction – Principle of spontaneous emission, stimulated absorption and emission – Einstein's coefficient (derivation) – Types of lasers - CO_2, Nd: YAG – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index and mode) – losses associated with optical fibers - fiber optic sensors: pressure and displacement.

UNIT II **ULTRASONICS** (9 Hrs)

Introduction – Production – magnetostriction effect - magnetostriction generator – piezoelectric and inverse piezoelectric effect- piezoelectric generator – properties – Cavitations - Velocity measurement – acoustic grating – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays-Industrial Applications and medical applications-medical endoscope.

UNIT-III **PROPERTIES OF MATTER** (9 Hrs)

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams

UNIT-IV **QUANTUM PHYSICS** (9 Hrs)

Black body radiation – Planck's theory (derivation) –wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box– scanning tunneling microscope- electron tunneling microscope.

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UNIT-V	ADVANCED ENGINEERING MATERIALS	(9 Hrs)
Smart materials: Shape-memory alloys: Martensite, Austenite, Two way shape memory, characteristics and applications –Metallic glasses – Origin – Preparation – Structure, mechanical and electrical properties. **Biomaterials:** First, second and third generation biomaterials – Classification – Metals and alloys – Polymers – Hydrogels – Applications in medicine: Skin and Blood interfacing implants.		
Total hours to be taught		(45 Hrs)

Text book :	
1.	Dr. G. Senthil kumar - Engineering Physics-VRB Publication & Co, Chennai- Latest edition 2022.
2.	Dr. P.K. Palanisamy , "Engineering Physics", Sci tech Publications, Chennai, 2022.
3.	Biomaterial Science and Engineering- JB Park- Plenum Press, NewYork(2014).
4.	M N Avadhanulu, A Textbook of Engineering Physics (2008), S. Chand Publishing, New Delhi.
5.	Bhattacharya, D.K. & Poonam, T. ―Engineering Physics. Oxford University Press, 2015.
REFERENCES:	
1.	Pillai S O, "Engineering Physics" (2014), New Age International Publishers, New Delhi.
2.	Karl F Renk, Basics of Laser Physics (2017)-Springer International Publishing, Switzerland.
3.	Introduction to Quantum Mechanics- J Griffiths-2nd edition(2016).
4.	Halliday.D, Resnick.R. & Walker.J, Principles of Physics (2020), Wiley.
5.	Serway, R.A. & Jewett, J.W. ―Physics for Scientists and Engineers. Cengage Learning, 2010.
6.	William T. Silfvast, Laser Fundamentals (2014), Cambridge University Press.

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Mechanical Engineering	Programme Code	1081

II Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24GE13201	ENGINEERING MECHANICS (Common to Non Circuit Branches)	3	0	0	3	100

Objective(s)

Students should develop the ability to:

- Work comfortably with basic engineering mechanics concepts required for analyzing static structures.
- Model the problem using good free-body diagrams and accurate equilibrium equations.
- Apply pertinent mathematical, physical and engineering mechanical principles to the system to solve and analyze the problem.
- Understand the meaning of centers of gravity (mass)/centroids and moment of inertia using integration methods.
- Gain knowledge in basic design concepts of statics and dynamics of the particle.

UNIT-I	STATICS OF PARTICLE	9

Introduction to Mechanics – Fundamental Principles -Units and Dimensions – Laws of Mechanics- Principle of transmissibility- Lame's theorem, Parallelogram and triangular Law of forces- Vectorial representation of forces and moments, Coplanar forces– Resolution and Composition of forces – Equilibrium of particles - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Single equivalent force.

UNIT-II	STATICS OF RIGID BODY	9

Free body diagram – Types of supports and their reactions-requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis– Vectorial representation of moments and couples – Scalar components of a moment- Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions.

UNIT-III	PROPERTIES OF SECTIONS	9

Centroid – Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus and Guldinus – Second moment of area — Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula –Parallel axis theorem -perpendicular axis theorem – Product of inertia of plane areas -Polar moment of inertia – Principal axes- Mass moment of inertia of thin rectangular section.

UNIT-IV	DYNAMICS OF PARTICLES	9

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law- D'Alembert's principle – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies- Impact - direct and central impact – coefficient of restitution.

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UNIT-V	FRICTION	9
Friction force – Laws of sliding friction -Laws of Coloumb friction – equilibrium analysis of simple systems with sliding friction –wedge friction - equilibrium analysis of simple contact friction –ladder friction - Rolling resistance-Applications of screw jacks and belts.		
	Total hours	**45**

Outcome(s)	**End of the learning students will have an ability to:** • Analyze the engineering problems in case of equilibrium conditions. • Calculate the reaction forces of various supports on the structural members. • Evaluate various geometrical properties like centroid, centre of gravity, moment of inertia of various surfaces and solids. • Solve the problems involving dynamics of particles and rigid bodies. • Define the effects of friction and its applications, also compute various frictional components.

TEXT BOOK :

1	R.C. Hibbeller, "Engineering Mechanics – Statics and Dynamics", 11th ed., Pearson Education Asia Pvt. Ltd., 2009.
2	Ferdinand P. Beer, E. Russell Johnston, Vector Mechanics for Engineers: Statics and Dynamics (9th Edition), Tata McGraw-Hill International Edition, 2010.
3	Dr.N.Koteeswaran, "Engineering Mechanics Statics and Dynamics", Sri Balaji Publications 9th Rv.Ed., S.Chand & Co Ltd, 2013.
4	Vela Murali, "Engineering Mechanics", Oxford University Press 2010.

REFERENCES:

1	M.S. Palanichamy and S. Nagam, "Engineering Mechanics – Statics & Dynamics", 3rd ed., Tata McGraw-Hill, 2004.
2	S. Rajasekaran, G. Sankarasubramanian, "Fundamentals of Engineering Mechanics", 3rd ed., Vikas Publishing House Pvt. Ltd, 2009.
3	Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.
4	Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", 4th ed., – Pearson Education Asia Pvt. Ltd., 2005.

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	MAHENDRA ENGINEERING COLLEGE **(Autonomous)**	
Syllabus - Regulation 2024		
Department	SCIENCE & HUMANITIES	

SEMESTER – I & II

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24PY22001	PHYSICS LABORATORY	0	0	3	1.5	100
Objectives	To provide exposure to the students with hands on experience on various basic Physics practices for all branches.					
Outcomes	• The hands on exercises undergone by the students will help them to apply physics principles • Principles of optics and Liquid to evaluate engineering properties of materials					

LIST OF EXERCISES

1	(a) Determination of Wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber
2	Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3	Determination of Thickness of a thin wire-Air Wedge
4	Determination of wavelength of mercury spectrum – spectrometer grating
5	Determination of Young's modulus by Non uniform bending method
6	Determination of viscosity of liquid – Poiseuille's method
7	Determination of Rigidity modulus -Torsional Pendulum
8	Determination of Band gap of a semiconductor-PN Diode
9	Determination of Young's modulus by Uniform bending method
	(Choose Any 7 Experiments)

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REFERENCES	
1.	Physics Laboratory Manual (2023), Department of Physics, Mahendra Engineering College, Namakkal.
2	Geeta Sanon, B.Sc Practical Physics, 5th Edn. (2015), R. Chand & Co.
3	C. L. **Arora** B.Sc. Practical Physics (2001), S. Chand and Company Limited, New Delhi.
4	Indu Prakash and Ramakrishna, A. K. Jha (2012), A Text Book of Practical Physics, Kitab Mahal, New Delhi.
5	D. P. Khandelwal, A Laboratory Manual of Physics: For Undergraduate Classes (1985), Vani Educational books, New Delhi.

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HOD/Physics

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MAHENDRA ENGINEERING COLLEGE
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DEPARTMENT OF AGRICULTURAL ENGINEERING

CHOICE BASED CREDIT SYSTEM

Regulation 2024

III-Semester

Sl. No.	Course code	Course Title	CATEGORY	L	T	P	C
THEORY							
1	24MA12301	Transforms and Partial Differential Equations	BS	3	1	0	4
2	24AG14301	Crop Production Technology	PC	3	0	0	3
3	24AG14302	Strength of Materials for Agricultural Engineering	PC	3	0	0	3
4	24AG14303	Fluid Mechanics and hydraulics	PC	3	0	0	3
5	24AG14304	Surveying and Leveling	PC	3	0	0	3
6		Open Elective - I	OE	2	1	0	3
7	24CY11001	Environmental Science & Sustainability	HS	2	0	0	2
PRACTICAL							
8	24AG24301	Surveying and Leveling Laboratory	PC	0	0	3	1.5
9	24AG24302	Fluid Mechanics and Hydraulics Laboratory	PC	0	0	3	1.5
10	24AG24303	Crop Production Technology Laboratory	PC	0	0	3	1.5
TOTAL				**19**	**2**	**9**	**25.5**

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	ProgrammeCode	

III - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24MA12301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4	100

Objective(s)

To enable students to

- Acquire knowledge of Z- transform to solve difference equations.
- Learn about Fourier transforms, inverse Fourier transform and its properties and apply convolution theorem and Parseval's identity to various functions.
- Construct Fourier series of various functions and to compute harmonics of Fourier series.
- Understand the partial differential equation concepts.
- Study the method of separation of variables and solving boundary value problems using Fourier series.

UNIT-I	Z -TRANSFORMS AND DIFFERENCE EQUATIONS	9

Z-transforms - Elementary properties – Inverse Z-transform – Partial fraction and Residue method- Convolution theorem -Formation of difference equations – Solution of difference equations using Z-transform.

UNIT-II	FOURIER TRANSFORMS	9

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT-III	FOURIER SERIES	9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

UNIT-IV	PARTIAL DIFFERENTIAL EQUATIONS	9

Formation of partial differential equations – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Homogeneous linear partial differential equations of second and higher order with constant coefficients.

UNIT-V	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9

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Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

Total hours to be taught	**(L:45+T:15): 60 PERIODS**

Outcomes:

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

- Apply the knowledge of Z-transform to the analysis of digital filters and discrete signals.
- Solve the problems using Fourier integral and convolution theorem technique.
- Apply Fourier series techniques in solving heat flow problem used in various situations.
- Formulate and solve first and higher order partial differential equations.
- Solve real time Engineering problems using Partial differential equations.

TEXT BOOK :

1	Dr.P.Kandasamy , Dr.K.Thilagavathy and Dr.K.Gunavathy, " Engineering Mathematics Volume – III",S.Chand & company Ltd. New Delhi, 2012.
2	Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.

REFERENCES:

1	Erwin Kreyszig, Advanced Engineering Mathematics.2011, John Wiley & Sons, 2010.
2	Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Laxmi Publications Pvt Ltd., 2012.
3	Veerarajan.T, "Transforms and Partial Differential Equations" , Tata McGraw Hill, 2011.

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	ProgrammeCode	1111

III - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24AG14301	CROP PRODUCTION TECHNOLOGY	3	0	0	3	100

Objective(s)

- To know the various functions and processes related to crop production.
- To create awareness about organic farming.
- To classify different production practices involved in agricultural crops.
- To analyze the various practices in horticultural crop production.
- To impact knowledge on the protected cultivation of vegetables, fruits and flower crops.

UNIT-I	AGRICULTURE AND CROP PRODUCTION	9

Introduction to agriculture and its branches; Classification of crops; Seasonal selection of crops; Tillage; Sowing; Irrigation; Nutrient management, Intercultural practices; Harvesting.

UNIT-II	ORGANIC FARMING	9

Organic farming: Definition- Scope – principles and concepts – history of organic farming - global scenario: Integrated Farming System - Organic sources of nutrients – on farm and off farm sources – organic waste recycling methods.

UNIT-III	PRODUCTION PRACTICES OF AGRICULTURAL CROPS	9

Cultivation practices for important groups of field crops in Tamil Nadu: Cereal crops - rice, maize and sorghum; Pulses- red gram, green gram, black gram; Oil seed crops- groundnut and sunflower; Sugar crops-sugarcane; Fiber crops- cotton

UNIT-IV	PRODUCTION PRACTICES OF HORTICULTURAL CROPS	9

Cultivation practices of horticultural crops in Tamil Nadu: Vegetable crops- bhendi, brinjal, tomato; Fruit crops- mango, banana, sapota, papaya and grapes; Flower crops- rose, jasmine.

UNIT-V	PROTECTED CULTIVATION	9

Protected cultivation: definition - Importance and scope of protected cultivation - protected cultivation techniques for tomato, capsicum, cucumber, strawbery, cut rose, cut chrysanthemum, orchids.

Total	45 Periods

Outcomes:

- Acquire knowledge on agriculture and crop production factors.
- Identify the different systems of organic farming.
- Classify different production practices involved in agricultural crops.

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• Analyze the various horticultural crop production practices. • Understand the practices involved in protected cultivation of vegetables, fruits and flower crops.	
TEXT BOOK :	
1	B. Chandrasekaran K. Annadurai E. Somasundaram, A Textbook of Agronomy, New Age International (P) Limited, Publishers, New Delhi, 2018.
2	P. L. Maliwal, Principles of Organic Farming: Textbook, Scientific Publishers, Rajasthan, 2016
3	D.K. Singh & K.V.Peter, Protected Cultivation of Horticultural Crops, New India Publishing Agency, New Delhi, 2015.
REFERENCES:	
1	Shirley Doy, Crop Production: Principles and Practices, Callisto Reference, 2017
2	T. Yellamanda Reddy, G.H. Sankara Reddy, Principles of Agronomy, Kalyani Publishers, 2023.
3	Kumar Ratnesh Et Al, Practical Manual On Protected Cultivation And Secondary Agriculture, Jain Brothers

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Department	Agricultural Engineering	Programme Code	1111

III - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24AG14303	FLUID MECHANICS AND HYDRAULICS	3	0	0	3	100

Objective(s)

- To learn the fluid properties and fundamentals of fluid statics and fluid flow.
- To analyze the fluid flow and the concepts of momentum principles
- To introduce the flow measuring devices and velocity measuring devices
- To impart the knowledge on the flow in open channel
- To introduce the concepts of the working and design aspects of hydraulic machines like turbines and pumps and their applications.

UNIT-I PROPERTIES OF FLUIDS — 9

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

UNIT-II FLUID FLOW ANALYSIS — 9

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

UNIT-III FLOW MEASUREMENTS — 9

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

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Siphon – water hammer in pipes – gradual and sudden closure of valve

UNIT-IV	OPEN CHANNEL FLOW	9

Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific energy and critical depth - Flow measurement in channels – notches – rectangular, Cipolletti and triangular – float method - Non Uniform steady flow-equations for gradually varied flow-Direct Step method, Rapidly varied flow- Hydraulic jump.

UNIT-V	DIMENSIONAL ANALYSIS & PUMPS	9

Dimensional analysis – Fundamental dimensions – dimensional homogeneity – Rayleigh‟s method and Buckingham Pi-Theorem - concept of geometric, kinematic and dynamic similarity. Important non dimensional numbers – Reynolds, Froude, Euler, Mach and Weber –Pump - types of pumps- Centrifugal pumps – components – working Principals – selection of pump- capacity- Reciprocating pump-Introduction to other pumps.

Total	45 Periods

Outcomes:

- Identify importance of various fluid properties at rest and in transit.
- Derive and apply general governing equations for various fluid flows.
- Understand the concept of boundary layer theory and flow separation.
- Plot velocity and pressure profiles for any given fluid flow.
- Evaluate the performance characteristics of hydraulic turbines and pumps.

TEXT BOOK :

1	Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002.
2	R.K. Rajput “A text book of Fluid Mechanics and Hydraulic Machines”, 5th Edition, S.Chand & Company (Ltd), New Delhi, 2009.
3	R.S .Khurmi, Fluid Mechanics And Hydralic Machines, S.Chand & Co. Ltd. Edition, 2015.

REFERENCES:

1	D.S. Kumar, “Fluid Mechanics and Fluid Power Engineering”, 2nd Edition, SK. Katania and Sons, New Delhi, 2010
2	Pijush K Kundu , Irq M Cohen , Fluid Mechanics , Academic Press-2008.
3	Kumar. K.L., “Engineering Fluid Mechanics”, 14th Edition, Eurasia Publishing House (P) Ltd., New Delhi, New Edition -2016.
4	Ramamrutham. S, “Fluid Mechanics, Hydraulics and Fluid Machines”, Dhanpat Rai & Sons, Delhi, 2005.

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Department	Agricultural Engineering	Programme Code	1111

III Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24AG14304	Surveying and Leveling	3	0	0	3	100

Objective(s)

- To Understand the basics of Surveying and its related field application
- To Utilize their knowledge to solve field associated problems
- To carry out preliminary surveying in the field of civil engineering applications such as structural, highway engineering and geotechnical engineering
- plan a survey, taking accurate measurements, field booking, plotting and adjustment of traverse use various conventional instruments involved in surveying with respect to utility and precision plan a survey for applications such as road alignment and height of the building undertake measurement and plotting in civil engineering
- Familiarize with the latest surveying techniques using GPS and GIS

UNIT-I	FUNDAMENTALS AND CHAIN SURVEYING	9

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

UNIT-II	COMPASS AND PLANE TABLE SURVEYING	9

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

UNIT-III	LEVELLING	9

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

UNIT-IV	LEVELLING APPLICATIONS	9

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Longitudinal and Cross-section-Plotting - Contouring - Methods – Characteristics and uses of contours- Plotting – Methods of interpolating contours – computation of cross sectional area and volumes - Earthwork calculations - Capacity of reservoirs - Mass haul diagrams		
UNIT-V	**THEODOLITE AND MODERN SURVEYING**	**9**
Theodolite - Types - Description - Horizontal and vertical angles - Temporary and Permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense methods - Stadia constants - Anallactic lens - Traversing - Gale"s table - Total Station- Global Positioning System (GPS).		
	Total	**45 Periods**

Outcomes:

- Use all surveying equipments, prepare LS & CS, contour maps and carryout surveying works related to land.
- Build the principle of surveying, various methods and applications to Agricultural and Irrigation Engineering projects.
- Learn the modern surveying technology.
- Understand the levelling principles and procedure
- Apply the of the levelling procedure in various application

TEXT BOOK :

1	James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.
2	Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.

REFERENCES:

1	S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004.
2	A.M. Chandra, Plane Surveying, New Age International Publishers 2002.
3	Alak De, Plane Surveying, S. Chand & Company Ltd., 2000.

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Syllabus

Department	SCIENCE & HUMANITIE	Programme Code and name	CY& CHEMISTRY

SEMESTER-III (For Non Circuit Branches) & SEMESTER- IV (For Circuit Branches)

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24CY11001	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	2	0	0	2	100

Objective(s)	To make the students familiar with : 1. The importance of Environment, Ecosystem and Biodiversity. 2. The causes, effects and prevention measures of environmental pollution. 3. The social issues of the environment and National laws for environment protection. 4. The green environment and associated issues. 5. The concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze.

UNIT-I	ENVIRONMENT, ECOSYSTEM & BIODIVERSITY	12 Hrs

Definition, Scope and Importance of Environment – Need for public awareness – Ecosystem: concept of an ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – Biodiversity: Introduction – definition - genetic, species and ecosystem diversity – value of biodiversity – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity – Field visit to local area.

UNIT-II	ENVIRONMENTAL POLLUTION & DISASTER MANAGEMENT	9 Hrs

Definition – causes, effects and control measures of: (a) Air, (b) Water, (c) Soil, (d) Noise, (e) Thermal pollution– solid waste management: causes, effects and control methods of municipal solid wastes – disaster management: floods, earthquake and landslides– E-waste and plastic

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waste: recycling and reuse - role of an individual in prevention of pollution – pollution case studies (vizag gas leakage) – Field visit to local polluted area.		
UNIT-III	**SOCIAL ISSUES & ENVIRONMENTAL IMPACT ASSESMENT**	9 Hrs
Social issues – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies (Global warming). – EPA: Environment protection act - EIA: EIA structure- methods of baseline data acquisition. Planning and management of impact studies - operational aspects of EIA - methods for impact identification- Role of NGOs in creating awareness among people regarding environmental issues.		
UNIT-IV	**GREEN ENVIRONMENTAL ISSUES**	9 Hrs
Introduction – Clean development mechanism – carbon emission-carbon foot printing - carbon credits - carbon sequestration and Polluter pay principle – Sustainable green building practices – Carbon Neutrality in India - Geneva Conventions and their Additional Protocols.		
UNIT-V	**SUSTAINABILITY AND MANAGEMENT**	**6hrs**
Development , GDP ,Sustainability- concept, needs and challenges - economic, social and aspects of sustainability - from unsustainability to sustainability - millennium development goals, and protocols- Sustainable Development Goals - targets, indicators and intervention areas.		
	TOTAL	**45 Hrs**

OUTCOMES:

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

1. Explain the importance of Environment, Ecosystem and various types of Biodiversity.
2. Identify the different types of Pollution and be familiar with control measures.
3. List out the environmental issues and essential legislation on environmental laws.
4. Develop the concept of green synthesis method in environment and related problems.
5. Recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

TEXT BOOKS :

1.	Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University

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	Press (2015)
2.	Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill, New Delhi, 2017.
3.	Dr.A.Ravikrishnan, “Environmental Science and Engineering” , Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2014.
4.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.

REFERENCES	
1.	R.K. Trivedi, “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Enviro Media.
2.	Gilbert M.Masters, “Introduction to Environmental Engineering and Science”, 3nd Edition, Pearson Education, 2023.
3.	Dharmendra S. Sengar, “Environmental law”, Prentice hall of India PVT LTD, New Delhi, 2007.

MEMBERS

1. Dr.P.Dhanakodi
2 Dr.M.Gunasekaran
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SUBJECT EXPERT

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Syllabus

Department	Agricultural Engineering	Programme Code	1111

III –Semester

Course Code	Course Name	Hours/week			Credit	Maximum Marks
		L	T	P	C	
24AG24301	SURVEYING AND LEVELLING LABORATORY	0	0	3	1.5	100

Objective(s)	• Understand the application of chain and compass surveying in the appropriate field oriented problems in surveying • Familiarize the levelling in the appropriate field oriented surveying and contouring • To train the student to acquire skill in operation various surveying and levelling instruments
Outcome(s)	On completion of the course, the students will be able to: • Use conventional surveying tools such as chain/tape, compass, plane table, level in the field of agriculture engineering applications such as leveling and field layout. • apply the procedures involved in field work and to work as a surveying team • plan a survey appropriately with the skill to understand the surroundings

1.	**CHAIN SURVEYING**
	Ranging, chaining and pacing
	Chain surveying.
2.	COMPASS SURVEYING
	Triangulation problems
	Compass traversing
3.	PLANE TABLE SURVEYING
	Radiation
	Intersection – Triangulation problems
	Plane table traversing
4.	LEVELLING
	i).Fly leveling using dumpy level
	ii).Fly leveling using tilting level
	iii).Check leveling
	iv). Block contouring & Radial contouring
5.	**THEODOLITE SURVEYING**
	i) Study of Theodolite

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	ii) Measurements of Horizontal angles
	iii) Measurements of Vertical angles
	iv) Stadia Tacheometry
6.	Demonstration of Total station and GPS
Total hours to be taught	45 PERIODS

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Department	Agriculture Engineering	Programme Code	1111

III –Semester

Course Code	Course Name	Hours/Week			Credit	Maximum Marks
		L	T	P	C	
24AG24302	FLUID MECHANICS AND HYDRAULICS LABORATORY	0	0	3	1.5	100

Objective(s)	• To determine the discharge and coefficient of discharge of notches, mouth piece, venturimeter and orifice meter • To verify Bernoulli's theorem and calculate pipe friction coefficients • To assess the performance characteristics of pump

LIST OF EXPERIMENTS

1.	**Flow Measurement**
	1. Study of manometers and pressure gauges
	2. Calibration of Rotometer
	3. Flow through Venturimeter
	4. Flow through a circular Orifice
	5. Determination of mean velocity by Pitot tube
	6. Verification of Bernoulli's Theorem
	7. Flow through a Triangular Notch
	8. .Flow through a Rectangular Notch
2.	**Losses in Pipes**
	9. Determination of friction coefficient in pipes
3.	**Pumps**
	10. Characteristics of Jet pump
	11. Characteristics of Submersible pump
	12. Study of performance characteristics of centrifugal pump (constant speed)
	13. Study of performance characteristics of Reciprocating pump

Outcome(s)	• Develop characteristics of pumps. • Able to determine the friction losses. • Analysis the flow measurements with different method
Total hours to be taught	**45 PERIODS**

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Department	**Agriculture Engineering**	**Programme Code**	**1111**

III - Semester

COURSE CODE	**COURSE NAME**	**HOURS/WEEK**			**CREDIT**	**MAXIMUM MARKS**
		L	**T**	**P**	**C**	
24AG24303	**CROP PRODUCTION TECHNOLGY LABORATORY**	**0**	**0**	**3**	**1.5**	**100**

Objective(s)	• To introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.
Outcome(s)	At the end of the course • Students will able to get practical exposure on crop production practices and use of agricultural equipments and implements for agricultural and horticultural crop production practices. • Students will able to apply the knowledge of crop cultivation, crop improvement, soil and crop management for sustainable agricultural production and development. • Students will able to analyse and identify complex agricultural problems and formulating ethical solutions using principles of agricultural science

LIST OF EXPERIMENTS

1	Seed selection and seed treatment
2	Tillage operation
3	Seed bed preparation
4	Sowing / Transplanting
5	Irrigation management
6	Nutrient management
7	Integrated pest management
8	Intercultural practices
9	Maturity indices

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10	Harvesting	
11	Threshing	
	Total hours to be taught	**45 Periods**

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	DEPARTMENT OF AGRICULTURE ENGINEERING					
Regulation 2024						
IV Semester						
Sl. No.	**Course code**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
1	24MA12403	Probability Distributions and Statistics	3	1	0	4
2	24AG14401	Soil Mechanics	3	0	0	3
3	24AG14402	Theory of Machines	3	0	0	3
4	24AG14403	Tractor and Power Units	3	0	0	3
5		Open Elective -II	2	1	0	3
6		Open Elective - III	3	0	0	3
7	24HS11006	Universal Human Values	3	0	0	3
PRACTICAL						
8	24AG24401	Soil Mechanics Laboratory	0	0	3	1.5
9	24AG24402	Strength of Materials Laboratory	0	0	3	1.5
10	24HS60001	Professional Communication Skills	0	1	2	2
		TOTAL	**21**	**1**	**9**	**27**

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Department	**Agricultural Engineering**	**Programme Code**	

IV - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	**T**	**P**	**C**	
24MA12403	**PROBABILITY DISTRIBUTIONS AND STATISTICS**	3	1	0	4	**100**

Objective(s)	To enable the students to, • Gain knowledge of random variables and various standard distributions and their properties. • Familiarizes the students with two dimensional discrete and continuous random variables, correlation and regression analysis and central limit theorem. • Study the types of small sample tests. • Acquire the knowledge of design of experiment. • Study the concepts of statistical quality control

UNIT-I	**INTRODUCTION TO PROBABILITY AND RANDOM VARIABLE**	**9**
Probability-Axiom of probability- Conditional probability-Discrete and continuous random variables – Mathematical Expectation -Moments – Moment generating functions – Binomial, Poisson, Uniform, Exponential and Normal distributions.		
UNIT-II	**TWO - DIMENSIONAL RANDOM VARIABLES**	**9**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Central limit theorem (for independent and identically distributed random variables).		
UNIT-III	**TESTING OF HYPOTHESIS**	**9**
Sampling distributions –Test for single mean, proportion and difference of means (Large and small samples) – Test for single variance and equality of variances - Chi-Square Test for goodness of fit and independents of attributes.		
UNIT-IV	**DESIGN OF EXPERIMENTS**	**9**
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design – 2^k factorial design.		
UNIT-V	**STATISTICAL QUALITY CONTROL**	**9**

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Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.	
Total hours to be taught	**(L:45+T:15): 60 PERIODS**

Outcomes:

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

- Apply the ideas of probability and random variable and various discrete and continuous probability distributions and their properties which can describe real life phenomena.
- Solve the problems involving more than one random variable.
- Analyze testing of hypothesis.
- Apply the basic concepts of design of experiments.
- Apply the concepts of statistical quality control techniques in the real life problems.

TEXT BOOK :

1	Veerarajan T., Probability and Statistics, Random Processes and Queueing Theory Tata McGraw-Hill, New Delhi, 2018.
2	B.S.Grewal,Higher Engineering Mathematics,Khanna Publishers,2017.

REFERENCES:

1	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2010.
2	Richard A. Johnson, Irwin Miller, John E. Freund, "Introduction to Probability and Statistics for Engineers", Pearson Prentice Hall, 2004.
3	Shelton M. Ross, A First Course in Probability, Pearson Prentice Hall, 2020.

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Department	Agricultural Engineering	Programme Code	1111

IV - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24AG14401	Soil Mechanics	3	0	0	3	100

Objective(s)

- Know different engineering properties like moisture content, density, void ratio, porosity, grain size analysis etc.
- Know about different soil consistencies like Liquid limit, Plastic limit, and Shrinkage limit.
- Know about different stress conditions like shear stress, direct stress and stress due to different loading conditions
- Know about consolidation and compaction properties of soil
- Know about different stability conditions

UNIT-I	INTRODUCTION AND SOIL PHYSICS	9

Soil - definition - major components –Soil forming minerals and processes- soil profile –Physical properties - texture –density-porosity-consistence-colour- -specific gravity - capillary and non-capillary -plasticity. Soil air - soil temperature - soil water - classification of soil water- Movement soil water. Soil colloids – organic and inorganic matter-Ion exchange- pH – Plant nutrient availability

UNIT-II	SOIL CLASSIFICATION AND SURVEY	9

Soil taxonomy – Soils of Tamil Nadu and India. Soil survey - types and methods of soil survey – Field mapping- mapping units - base maps -preparation of survey reports - concepts and uses - land capability classes and subclasses - soil suitability -Problem soils – Reclamation.

UNIT-III	PHASE RELATIONSHIP AND SOIL COMPACTION	9

Phase relations- Gradation analysis- Atterberg Limits and Indices- Engineering Classification of soil – Soil compaction- factors affecting compaction- field and laboratory methods.

UNIT-IV	ENGINEERING PROPERTIES OF SOIL	9

Shear strength of cohesive and cohesion less - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Triaxial and vane shear test- -Permeability- Coefficient of Permeability-Darcy‟s law-field and lab methods - Assessment of seepage - Compressibility.

UNIT-V	BEARING CAPACITY AND SLOPE STABILITY	9

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Bearing capacity of soils - Factors affecting Bearing Capacity- Foundation design considerations for agricultural structures – shallow and deep foundation-Terzaghi‟s formula- BIS standards - Slope stability-Analysis of infinite and finite slopes- friction circle method- slope protection measures.	
Total	**45 Periods**

Outcomes:

- Explain principles of soil formation and classification and determine soil physical, chemical, and biological properties.
- Characterize and classify soils
- Analyze and compute principles of compaction and consolidation settlements of soil.
- Identify shear strength parameters for field conditions
- Ability to analyze to calculate bearing capacity, the stability of natural slopes safety and sustainability of the slopes.

TEXT BOOK :

1	Nyle C. Brady, “The Nature and Properties of Soil”, Macmillan Publishing Company, 10th Edition, New York, 2008.
2	Punmia, B.C., “Soil Mechanics and Foundation “Laxmi Publishers, New Delhi. 2007.

REFERENCES:

1	Edward J. Plaster., “Soil Science”, Cengage Learning India Ltd, New Delhi, 2009.
2	Arora, K.R. “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 2007.
3	Murthy, V.N.S. “Soil Mechanics and Foundation Engineering”, UBS Publishers and Distributors, New Delhi, 2007.

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	Programme Code	1111

IV - Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24AG14402	Theory of Machines	3	0	0	3	100

Objective(s)

- To understand the kinematics of different mechanism.
- To understand the principles of Sliding and Rolling friction.
- To understand the forces and power calculations for Cam and Follower.
- To determine the gear and gear trains for mechanical systems
- To understand the principles of Flywheel and Balancing

UNIT-I	TERMINOLOGY	9

Definitions - Kinematic links - Pairs - Chain - Machines and mechanism - Types and uses – Kinematic inversion of four bar chain and slider crank mechanism. Velocity and acceleration in simple mechanisms - Vector polygon and instantaneous centre methods – Coriolis component of acceleration.

UNIT-II	FRICTION AND APPLICATIONS	9

Sliding and rolling friction –friction in screw threads-Bearing and lubrication- Friction clutches- Belt drives- Friction aspects in brakes.

UNIT-III	MOTION OF CAM AND FOLLOWER	9

Cam and follower - types - application – displacement diagrams - profile layout for uniform velocity - Uniform acceleration and retardation - simple harmonic and cycloidal motion - Governors: introduction, Watt Governor - Porter Governor

UNIT-IV	GEARS AND GEAR TRAINS	9

Gears - classification - terminology -law of gearing - tooth profile - interference between rack and pinion. Gear trains - simple - compound reverted. Simple epicyclic gear trains.

UNIT-V	FLYWHEEL AND BALANCING	9

Inertia - turning moment - flywheel - fluctuation of speed and energy. Balancing of rotating masses and reciprocating masses.

Total	45 Periods

Outcomes:

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• Summarize different types of mechanisms and their inversions, and to calculate their degrees of freedom. • Apply the principles of Sliding and Rolling friction. • Design and develop a cam for a specified follower motion • Explain gear terminologies and to calculate velocity of gears in a gear train. • Balance Flywheel and Balancing and Balancing of rotating masses and reciprocating masses.	
TEXT BOOK :	
1	Rattan S.S, "Theory of Machines" Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition -2005.
2	Jagadish Lal, 'Theory of Machine', Dhanpat Rai Publications, New Delhi..
3	Sadhu Singh, "Theory of Machines," Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2ND Edi. 2006.
REFERENCES:	
1	Shigley. J. V. and Uickers, J.J., "Theory of Machines & Mechanisms" OXFORD University press.2004
2	"Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004

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Syllabus

Department	Agricultural Engineering	Programme Code	1111

IV Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24AG14403	TRACTOR AND POWER UNITS	3	0	0	3	100

Objective(s)

- Study the classification tractors components
- Understand the working principles of engine system
- Analyze tractor transmission system
- Recognize tractors hitching system and their operations
- Study the performance evaluation of power tiller

UNIT-I	FARM TRACTORS	9

Classification of tractors - Tractor engines – construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers, Valves-inlet and outlet valves – valve- timing diagram.

UNIT-II	ENGINE SYSTEMS	9

Intake System – Exhaust System - Cooling system - lubricating system - fuel supply system – governor- electrical system.

UNIT-III	TRANSMISSION SYSTEM	9

Clutch - gearbox - sliding mesh - constant mesh - synchromesh. Differential, final drive and wheels. Steering geometry - steering systems - front axle and wheel alignment. Braking system and its types.

UNIT-IV	HYDRAULIC SYSTEM AND TRACTOR ERGONOMICS	9

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

UNIT-V	POWER TILLERS; TESTING OF FARM TRACTOR AND POWER TILLER	9

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

Total hours to be taught	**(L:45): 45 PERIODS**

Outcome(s)

- Acquire the knowledge of construction and features of tractor engine components
- Analyze the inlet and out let valve timings
- Understand the power transmission principles
- Evaluate the efficiency of hydraulic system

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	• Explain power tillers test procedures
TEXT BOOK :	
1	Jain, S.C. and C.R. Rai. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi, 1999.
REFERENCES	
1	Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.
2	Domkundwar A.V. A course in internal combustion engines. Dhanpat Rai & Co. (P) Ltd., Educational and Technical Publishers, Delhi,1999.
3	Black, P.O. Diesel engine manual. Taraporevala Sons& Co., Mumbai, 1996.
4	Grouse, W.H. and Anglin, D.L. Automative mechanics. Macmillan McGraw- Hill, Singapore, Indian Standard Codes for Agricultural Implements Published by ISI, New Delhi, 1993.

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	Agricultural Engineering	Programme Code	1111

IV Semester

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24HS11006	UNIVERSAL HUMAN VALUES - II	3	0	0	3	100

Objective(s)

The objectives of the course are:

(i). Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

(ii). Understanding (or developing clarity) the harmony in the human being, family, society and nature/existence

(iii). Strengthening of self-reflection for harmonious relationship in family, society

(iv). Development of commitment and courage to act as human being in ensuring harmony in nature for co-existence.

(v). Development of holistic principles of harmony and professional ethics for natural acceptance of human values and observe ethical human conduct.

UNIT-I — **Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

L 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I (Induction Programme).

L 2. Self-Exploration–what is it? Its content and process; 'Natural Acceptance' and Experiential Validation-as the process for self-exploration.

L 3. Continuous Happiness and Prosperity - A look at basic Human Aspirations.

L 4. Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority.

L 5. Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario.

L 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

3 Practice sessions *(T1 to T3) - To discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.* .

UNIT-II — **Understanding Harmony in the Human Being - Harmony in Myself!**

L 7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

L 8. Understanding the needs of Self ('I') and 'Body'- happiness and physical facility

L 9. Understanding the Body as an instrument of 'I'(I being the doer, seer and enjoyer)

L 10.Understanding the characteristics and activities of 'I' and harmony in 'I'

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L 11.Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
L 12.Programs to ensure Sanyam and Health.

3 Practice sessions *(T4 to T6) - To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.*

UNIT-III	**Understanding Harmony in the Family and Society - Harmony in Human-Human Relationship**	

L 13. Understanding values in human-human relationship; meaning of Justice (Nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
L 14. Understanding the meaning of Trust; Difference between intention and competence.
L 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
L 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.
L 17. Visualizing a universal harmonious order in Society-Undivided Society, Universal Order-from family to world family.

3 Practice sessions *(T7 to T9): Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Discuss Gratitude as a universal value in relationships, scenarios. Elicit examples from students' lives.*

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UNIT-IV	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**	

L 18. Understanding the harmony in the Nature.
L 19. Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature.
L 20. Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
L 21. Holistic perception of harmony at all levels of existence.
2 Practice sessions *(T10 to T11): Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc.*

UNIT-V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	

L 22. Natural acceptance of human values.
L 23. Definitiveness of Ethical Human Conduct.
L 24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
L 25. Competence in professional ethics: (a). Ability to utilize the professional competence for augmenting universal human order (b). Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, (c). Ability to identify and develop appropriate technologies and management patterns for above production systems.

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L 26. Case studies of typical holistic technologies, management models and production systems.
L 27. Strategy for transition from the present state to Universal Human Order: (a). At the level of individual: as socially and ecologically responsible engineers, technologists and managers (b). At the level of society: as mutually enriching institutions and organizations.
L 28. Definition of Morals, Values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully.
L 29. Importance of Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality.
L 30. Introduction to Yoga and meditation for professional excellence and stress management.
Sum up.
4 Practice sessions *(T12 to T15) - Include Practice Exercises and Case Studies which will be taken up in Practice (Tutorial) Sessions.*
eg. To discuss the conduct as an Engineer or Scientist, etc.

	Total hours to be taught **(L:45): 45 PERIODS**
Outcome(s)	Upon completion of the Course the Learner will be able to: ➢ Distinguish between values and skills, and highlight the need for Universal Human Values. ➢ Describe the need for Harmony and distinguish between happiness and accumulation of physical facilities, etc. ➢ Relate the value of harmonious relationship in family, society based on trust and respect for happiness and prosperity in their life and profession. ➢ Outline the role of a human being in ensuring harmony in nature for co-existence. ➢ Apply the holistic principles of Harmony and Professional Ethics for natural acceptance of human values and observe Ethical Human Conduct.

TEXT BOOK :

1	1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

REFERENCES

1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3	The Story of My Experiments with Truth -by Mohandas Karamchand Gandhi
4	Small is Beautiful - E. F Schumacher.
5	Slow is Beautiful - Cecile Andrews.
6	Economy of Permanence - J C Kumarappa.
7	Bharat Mein Angreji Raj - Pandit Sunderlal.
8	Rediscovering India by Dharampal.
9	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
10	India Wins Freedom - Maulana Abdul Kalam Azad.
11	Vivekananda - Romain Rolland (English).
12	Mika Martin and Roland Scinger, 'Ethics in Engineering', Pearson Education/Prentice Hall, New York 1996.

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MAHENDRA ENGINEERING COLLEGE
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Syllabus

Department	**Agriculture Engineering**	**Programme Code**	**1111**

IV –Semester

Course Code	**Course Name**	**Hours/Week**			**Credit**	**Maximum Marks**
		L	**T**	**P**	**C**	
24AG24401	**SOIL MECHANICS LABORATORY**	**0**	**0**	**3**	**1.5**	**100**

Objective(s)	• To gain knowledge on various index properties of soil. • To study the density and compaction characteristics of soil. • To know about the engineering properties of soil.

LIST OF EXPERIMENTS

1.	DETERMINATION OF INDEX 1. Special gravity of soil solids 2. Grain size distribution – Sieve analysis 3. Liquid limit tests 4. Plastic limit tests 5. Water Content –(Oven Drying & Pycnometer)
2.	DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS 6. Field density Test (Sand replacement method) 7. Determination of moisture – density relationship using standard Proctor compaction test. 8. Determination of moisture – density relationship using Heavy Proctor compaction test. 9. Field density Test (Core Cutter method)
3.	DETERMINATION OF ENGINEERING PROPERTIES 10. Direct shear test in cohesion-less soil 11. Unconfined compression test in cohesive soil 12. Laboratory Vane Shear test in cohesive soil

Outcome(s)	At the end of the course the students will be able to: • Demonstrate the various index properties of soil. • Calculate the density and compaction properties of soil. • Estimate the shear strength of soil.
	Total hours to be taught **45 PERIODS**

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Syllabus

Department	Agriculture Engineering	Programme Code	1111

IV – Semester

COURSE CODE	COURSE NAME	HOURS/WEEK			Credit	Maximum Marks
		L	T	P	C	
24AG24402	STRENGTH OF MATERIALS LABORATORY	0	0	3	1.5	100

Objective(s)	• To determine experimental data include universal testing machines and torsion equipment. • To determine experimental data for spring testing machine, compression testing machine, impact tester, hardness tester. • To determine stress analysis and design of beams subjected to bending and shearing loads using several methods.
1.	To study the behaviour of materials (G.I. pipes, M.S., C.I.) under torsion and to evaluate various elastic constants
2.	To study load deflection and other physical properties of closely coiled helical spring in tension and compression
3.	Tension test on mild steel rod
4.	Compression test on wood
5.	Double shear test on metal
6.	Torsion test on mild steel rod
7.	Impact test on metal specimen (Izod and Charpy)
8.	Hardness test on metals (Rockwell and Brinell Hardness Tests)
9.	Deflection test on metal beam
10.	Compression test on helical spring
11.	Deflection test on carriage spring
12.	Test on Cement
Total hours to be taught	**45 Periods**
Outcome(s)	• Analyse and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behaviour of materials. • Perform stress analysis and design of beams subjected to bending

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	and shearing loads using several methods. • Calculate the stresses and strains in axially-loaded members subject to flexural loadings.
References	
1	Strenght of Materials Lab manual
2	"Strength of Material: S.I. Units" by S Ramamrutham

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Syllabus - Regulation 2024

Department	**English**

Semester – IV
(Common to all B.E./B.Tech. Programmes)

Course code	Course Name	Hours/week			Credit	Maximum marks
		L	T	P	C	
24HS21002	PROFESSIONAL COMMUNICATION SKILLS (Common to all B.E./B.Tech. Degree Programmes)	0	1	2	2	100

Objectives	➢ To familiarize students with the stage dynamics ➢ To help the learners to improve their creative skills ➢ To make them acquire the ability to speak effectively in real life situations
Outcomes	**At the end of the course, the learners will be able to :** ➢ Apply suitable vocabulary in academic and workplace contexts ➢ Demonstrate communication skills effectively in both oral and written formats ➢ Create documents professionally and make presentations effectively

LIST OF EXERCISES

11.	Introduction to Professional Communication and SWOT Analysis
12.	Soft Skills (Goal Setting, Empathy, Stress Management, Emotional Intelligence, Conflict Resolution)
13.	Building Vocabulary (Intermediate Level)
14.	Welcome Address and Vote of Thanks
15.	Stage Dynamics (Body Language and Paralanguage – Individual Presentation for 3 minutes)
16.	Framing Questions (WH Questions & 'Yes' or 'No' Questions)
17.	Narrative Techniques - Narrating the Experience
18.	Master of Ceremony Skills
19.	Picture Description
20.	Impromptu Speech (Just a Minute)

Total Hrs : 30

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DEPARTMENT OF AGRICULTURAL ENGINEERING

Consolidated value Added Courses

Academic Year 2024- 2025

S. No.	VAC Code	VAC title	Resource person
1	24AG01	Artificial Intelligence for Agriculture Monitoring	Mr. A. Kesavan
2	24AG02	Value Addition of Fruits and Vegetables	Dr. S. Naganandhini

Academic Year 2023- 2024

S. No.	VAC Code	VAC title	Resource person
1	24AG06	Seed testing and Quality Regulation	Dr. P. Venkatachalam
2	24AG04	Drone Application for Plants	Mr. A. Kesavan

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Programs during Odd Semester 2025-26

S.No	Dates of the event	Type of Event	Name of the Event	Resource Person Name & Designation
1.	08.10.2025	One Day Workshop	Operation and Maintenance of Tractors and Farm Equipments	Dr.T.Senthilkumar Principal Scientist (Farm Machinery and Power), Farm Machinery and Post Harvest Machinery & Equipment Testing Centre, ICAR-Central Institute of Agricultural Engineering, Regional Centre, Coimbatore – 641007.
2	30.10.2025	MILES	Digital Technologies in Precision Agriculture	Dr. Sunoj Shajahan Assistant professor, Department of Agricultural & Biological Engineering, University of Illinois, Urbana-Champaign, Urbana, Illinois – 61801, US
3	06.11.2025	MAILS	Bridging Learning and Application in Agri Engineering	Er. N. MUKILAN Assistant Professor Kongunadu College of Engineering and Technology, Tholurpatti - 621215

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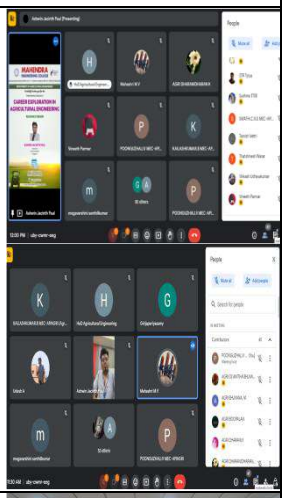
Department of Agricultural Engineering

MahendraAlumni Interactive Lecture Series (*MAILS*) Program Details

Sl. NO	Academic Year	Name of the Alumni	Contact Number & Mail ID	Passed out Year	Designation and Working organisation with Address	Topic of the Presentation	Date of the Event Conducted	Event Photo (Maximum 2 Nos)
1	2023-2024 ODD	MR. ASHWIN JACINTH PAUL	jacinthpaul6@gmail.com 8105058463	2018	Associate II, State Street Bank, Bangalore.	Career Exploration in Agricultural Engineering	21.09.2023	
2	2023-2024 ODD	GAYAN SARAVANAN	gayansiddhaarth@gmail.com 9843920299	2020	Design Engineer, Tractors and Farm Equipment Limited, Madhaavaram High Road, Moolakadai, Perambur, Chennai.	Contemporary Challenges in Agricultural and Aiding Technologies	16.10.2023	 

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3	2023-2024 EVEN	ER. A. SAMPATHKUMAR	asampathkumar15@gmail.com 9894535028	2018	Former Vocational Coordinator at Pipal Tree Ventures, (TN Educational Department), Founder of Adhi Technologies, NSDC Training Provider	Global Trends and Development in Biosystems Engineering	26.02.2024	 
4	2023-2024 EVEN	ER.S. VINOD KUMAR	9962282334 vinoddhivya05@gmail.com	2018	District In-Charge, Siri Polymers, Salem - 636308	Prospects of Undergraduate Agricultural Learning	28.03.2024	 
5	2024-2025	MR. RAGUL M	raghulm.info@gmail.com 9003604157	2022	JUNIOR FOOD TECHNOLOGIST LALAH'S INDIAN SPICES & FOOD Pvt Ldt. CHENNAI	Micronutrients in Ensuring Food and Nutritional Security	21.10.2024	 

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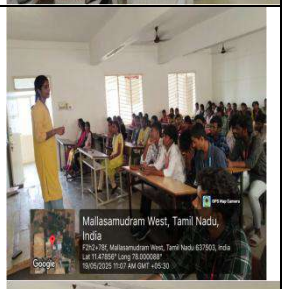
6	2024-2025	MR. KRISHNA KUMAR M	krishnakumaragritechnologist@gmail.com, 6369377230	2022	Assistant Professor Saraswathi college of Engineering and Technology, Tindivanam – 604001	Modern Agriculture: Scope, Future Planning, Commercial Farming, Gardening, and Organic Products	21.11.2024	 
7	2024-2025	MR. NIRMAL KALIANNAN	Nirmal.kaliannan@digite.com 8870880787	2020	Project & Customer success Engineer, AgWise – Smart Farming Solutions (Digital infotech Pvt Ltd), Bangalore.	Navigating the AgriTech Landscape A Career Roadmap for Agriculture Engineers	09.05.2025	 
8	2024-2025	MS. HEMADEVI SIVANESAN	hemanesan1999@gmail.com 9345301876	2021	Research Scholar, Center for water Resources,	Skill Development in Higher Education	19.05.2025	 

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