

# B.E. Agriculture Engineering

R-2020: Curriculum & syllabus



# Excël

## ENGINEERING COLLEGE (Autonomous)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

Accredited by NBA and NAAC with "A+" and Recognized by UGC (2f&12B)

KOMARAPALAYAM – 637303

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### B.E. AGRICULTURE ENGINEERING REGULATION – 2020 (Version - 2) CHOICE BASED CREDIT SYSTEM

#### I TO VIII SEMESTERS CURRICULUM AND SYLLABI

I SEMESTER									
Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>Theory Course (s)</b>									
20MA101	Mathematics - I for Bio Sciences	BS	3	2	0	4	40	60	100
20AG101	Basics of Agricultural Engineering	ES	3	0	0	3	40	60	100
<b>Theory with Practical Course (s)</b>									
20ENEXX	Language Elective - I*	HSS	2	0	2	3	50	50	100
20CH101	Chemistry for Bio Sciences	BS	3	0	2	4	50	50	100
20ME101	Engineering Graphics	ES	1	0	4	3	50	50	100
<b>Practical Course (s)</b>									
20AG102	Agriculture Engineering Practices Laboratory	ES	0	0	2	1	60	40	100
<b>Mandatory Course (s)</b>									
20MC101	Induction Programme	MC	2 Weeks			0	100	0	100
<b>Total</b>			<b>12</b>	<b>2</b>	<b>10</b>	<b>18</b>	<b>390</b>	<b>310</b>	<b>700</b>

Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>*Language Electives - I</b>									
20ENE01	Communicative English	HSS	2	0	2	3	50	50	100
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100

II SEMESTER									
Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>Theory Course (s)</b>									
20MA201	Mathematics - II for Bio Sciences	BS	3	2	0	4	40	60	100
20ME201	Engineering Mechanics	ES	3	2	0	4	40	60	100
<b>Theory with Practical Course (s)</b>									
20ENEXX	Language Elective - II*	HSS	2	0	2	3	50	50	100
20PH201	Physics for Bio Sciences	BS	3	0	2	4	50	50	100
20CS201	Problem Solving using Python	ES	3	0	2	4	50	50	100
<b>Practical Course (s)</b>									
20AG201	Crop Husbandry Laboratory	PC	0	0	4	2	60	40	100
<b>Mandatory Course (s)</b>									
20MC201	Environmental Sciences	MC	2	0	0	0	100	0	100
<b>Total</b>			<b>16</b>	<b>4</b>	<b>10</b>	<b>21</b>	<b>390</b>	<b>310</b>	<b>700</b>

Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>*Language Electives - II</b>									
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100
20ENE03	Hindi	HSS	2	0	2	3	50	50	100
20ENE04	French	HSS	2	0	2	3	50	50	100
20ENE05	German	HSS	2	0	2	3	50	50	100

III SEMESTER									
Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>Theory Course (s)</b>									
20MA301	Transforms and Boundary Value Problems	BS	3	2	0	4	40	60	100
20AG301	Engineering Thermodynamics for Agriculture Engineering	ES	3	0	0	3	40	60	100
20AG302	Theory of Machines	ES	3	0	0	3	40	60	100
<b>Theory with Practical Course (s)</b>									
20AG303	Fluid Mechanics and	PC	3	0	2	4	50	50	100

	Machineries for Agriculture Engineering								
20AG304	Soil Science and Engineering	PC	3	0	2	4	50	50	100
20AG305	Surveying and Levelling	PC	2	0	2	3	50	50	100
<b>Practical Course (s)</b>									
20AG306	Computer Aided Design and Drawing Laboratory	PC	0	0	2	1	60	40	100
<b>Mandatory Course (s)</b>									
20MC302	Interpersonnal Skills	MC	0	0	2	0	100	0	100
<b>Total</b>			<b>17</b>	<b>2</b>	<b>10</b>	<b>22</b>	<b>430</b>	<b>370</b>	<b>800</b>

<b>IV SEMESTER</b>									
Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>Theory Course (s)</b>									
20MA401	Numerical Analysis and Statistics	BS	3	2	0	4	40	60	100
20AG401	Heat and Mass Transfer for Agriculture Engineering	PC	3	2	0	4	40	60	100
20AG402	Electrical and Electronics for Agriculture Engineering	ES	3	0	0	3	40	60	100
<b>Theory with Practical Course (s)</b>									
20AG403	Tractor and Farm Engines	PC	3	0	2	4	50	50	100
20AG404	Strength of Materials for Agriculture Engineering	PC	3	0	2	4	50	50	100
20AG405	IoT in Agricultural Systems	PC	2	0	2	3	50	50	100
<b>Mandatory Course (s)</b>									
20MC401	Soft Skills	MC	2	0	0	0	100	0	100
<b>Total</b>			<b>19</b>	<b>4</b>	<b>6</b>	<b>22</b>	<b>370</b>	<b>330</b>	<b>700</b>

<b>V SEMESTER</b>									
Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>Theory Course (s)</b>									
20AG501	Farm Structures and Green House Technology	PC	3	0	0	3	40	60	100
20AG502	Farm Implements and Equipments	PC	3	2	0	4	40	60	100
20AGEXX	Professional Elective-I	PE	3	0	0	3	40	60	100
20YYOXX	Open Elective-I	OE	3	0	0	3	40	60	100
<b>Theory with Practical Course (s)</b>									

20AG503	Unit Operations in Agricultural Processing	PC	3	0	2	4	50	50	100
20AG504	Hydrology, Soil and Water Conservation Engineering	PC	3	0	2	4	50	50	100
<b>Practical Course (s)</b>									
20AG505	Farm Machinery Laboratory	PC	0	0	4	2	60	40	100
<b>Total</b>			<b>18</b>	<b>2</b>	<b>8</b>	<b>23</b>	<b>320</b>	<b>380</b>	<b>700</b>

<b>VI SEMESTER</b>									
Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>Theory Course (s)</b>									
20AG601	Agricultural Economics	HSS	3	0	0	3	40	60	100
20AGEXX	Professional Elective-II	PE	3	0	0	3	40	60	100
20YYOXX	Open Elective-II	OE	3	0	0	3	40	60	100
<b>Theory with Practical Course (s)</b>									
20AG602	Irrigation and Drainage Engineering	PC	3	0	2	4	50	50	100
20AG603	Food & Dairy Engineering	PC	3	0	2	4	50	50	100
20AG604	Renewable Energy Resources Technology	PC	3	0	2	4	50	50	100
<b>Employment Enhancement Course (s)</b>									
20AG611	Mini Project	EEC	0	0	2	1	50	50	100
20AG612	Internship	EEC	2 weeks			1	100	0	100
<b>Total</b>			<b>18</b>	<b>0</b>	<b>8</b>	<b>23</b>	<b>420</b>	<b>380</b>	<b>800</b>

<b>VII SEMESTER</b>									
Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>Theory Course (s)</b>									
20AG701	Entrepreneurship in Agricultural Engineering	HSS	3	0	0	3	40	60	100
20AG702	Groundwater and Well Engineering	PC	3	0	0	3	40	60	100
20AGEXX	Professional Elective-III	PE	3	0	0	3	40	60	100
20AGEXX	Professional Elective-IV	PE	3	0	0	3	40	60	100
20YYOXX	Open Elective-III	OE	3	0	0	3	40	60	100

<b>Theory with Practical Course (s)</b>										
20AG703	Post Harvest Technology	PC	3	0	2	4	50	50	100	
<b>Employment Enhancement Course (s)</b>										
20AG711	Design Project	EEC	0	0	2	1	50	50	100	
20AG712	Study Tour	EEC	1 Week			0	100	0	100	
<b>Total</b>			<b>18</b>	<b>0</b>	<b>4</b>	<b>20</b>	<b>400</b>	<b>400</b>	<b>800</b>	

<b>VIII SEMESTER</b>										
Sub Code	Course	Category	Periods/Week			C	Maximum Marks			
			L	T	P		CA	FE	Total	
<b>Theory Course (s)</b>										
20AGEXX	Professional Elective-V	PE	3	0	0	3	40	60	100	
20AGEXX	Professional Elective-VI	PE	3	0	0	3	40	60	100	
<b>Employment Enhancement Course (s)</b>										
20AG811	Major Project	EEC	0	0	20	10	50	50	100	
<b>Total</b>			<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>	<b>130</b>	<b>170</b>	<b>300</b>	

## PROFESSIONAL ELECTIVE COURSES (PE)

Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
<b>STREAM-I AGRICULTURAL PROCESS ENGINEERING</b>									
20AGE01	Agricultural By Products and Management	PE	3	0	0	3	40	60	100
20AGE02	Sustainable Agriculture and Food Security	PE	3	0	0	3	40	60	100
20AGE03	Refrigeration and Air Conditioning for Agricultural Engineering	PE	3	0	0	3	40	60	100
20AGE04	Storage and Packaging Technology	PE	3	0	0	3	40	60	100
20AGE05	Seed Processing Technology	PE	3	0	0	3	40	60	100
20AGE06	Process Engineering of Fruits and Vegetables	PE	3	0	0	3	40	60	100
20AGE07	Fundamentals of Nano Science	PE	3	0	0	3	40	60	100
20AGE08	Agricultural Structures and Environmental Control	PE	3	0	0	3	40	60	100
20AGE09	Food Plant Design and Management	PE	3	0	0	3	40	60	100
20AGE10	Waste and By-products Utilization	PE	3	0	0	3	40	60	100
20AGE11	Processing of Fats and Oils	PE	3	0	0	3	40	60	100
20AGE12	Fish Production and Processing	PE	3	0	0	3	40	60	100
20AGE13	Food Safety Regulations and Standards	PE	3	0	0	3	40	60	100
<b>STREAM-II SOIL AND WATER CONSERVATION ENGINEERING</b>									
20AGE21	Watershed Management	PE	3	0	0	3	40	60	100
20AGE22	Micro Irrigation	PE	3	0	0	3	40	60	100
20AGE23	On Farm Water Management	PE	3	0	0	3	40	60	100
20AGE24	Automation in Irrigation	PE	3	0	0	3	40	60	100
20AGE25	Agricultural Waste Management	PE	3	0	0	3	40	60	100
20AGE26	Climate Change and adaptation	PE	3	0	0	3	40	60	100
20AGE27	Disaster Management	PE	3	0	0	3	40	60	100

20AGE28	Water Harvesting and Soil Conservation Structures	PE	3	0	0	3	40	60	100
20AGE29	Landscape Irrigation Design and Management	PE	3	0	0	3	40	60	100
20AGE30	Remote Sensing and GIS Applications	PE	3	0	0	3	40	60	100
20AGE31	Command Area Development	PE	3	0	0	3	40	60	100
20AGE32	Land Reclamation Techniques	PE	3	0	0	3	40	60	100
20AGE33	Advanced Drainage Engineering	PE	3	0	0	3	40	60	100
<b>STREAM-III : FARM MACHINERY AND POWER</b>									
20AGE41	Agricultural Economics and Farm Management	PE	3	0	0	3	40	60	100
20AGE42	Mechanics of Tillage and Traction	PE	3	0	0	3	40	60	100
20AGE43	Special Farm Equipment	PE	3	0	0	3	40	60	100
20AGE44	Ergonomics and Safety in Agricultural Engineering	PE	3	0	0	3	40	60	100
20AGE45	Energy Auditing and Management	PE	3	0	0	3	40	60	100
20AGE46	Bio-energy Systems: Design and Applications	PE	3	0	0	3	40	60	100
20AGE47	Tractor Design and Testing	PE	3	0	0	3	40	60	100
20AGE48	Thermal Power Engineering	PE	3	0	0	3	40	60	100
20AGE49	Human Engineering and Safety	PE	3	0	0	3	40	60	100
20AGE50	Farm Machinery Design and Production	PE	3	0	0	3	40	60	100
20AGE51	Testing of Farm Machineries	PE	3	0	0	3	40	60	100
20AGE52	Blue Print of Machines	PE	3	0	0	3	40	60	100
20AGE53	Modern Applications of Sensors	PE	3	0	0	3	40	60	100



## OPEN ELECTIVE COURSES (For Other Branches)

Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20AGO01	Air Pollution and Control Engineering	OE	3	0	0	3	40	60	100
20AGO02	Principles of Food Preservation	OE	3	0	0	3	40	60	100
20AGO03	Introduction to Bio Energy and Bio Fuels	OE	3	0	0	3	40	60	100
20AGO04	Energy Technology	OE	3	0	0	3	40	60	100
20AGO05	Green Building Design	OE	3	0	0	3	40	60	100
20AGO06	Low Cost Automation	OE	3	0	0	3	40	60	100
20AGO07	Process Modelling and Simulation	OE	3	0	0	3	40	60	100
20AGO08	Supply Chain Management	OE	3	0	0	3	40	60	100
20AGO09	Systems Engineering	OE	3	0	0	3	40	60	100

## ONE CREDIT COURSES

Sub Code	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20AGA01	Plastic - Processing & Testing	EEC	0	0	2	1	100	0	100
20AGA02	Mushroom Cultivation Techniques	EEC	0	0	2	1	100	0	100
20AGA03	Honey Bee Keeping Techniques	EEC	0	0	2	1	100	0	100
20AGA04	Web Design and Internet Applications	EEC	0	0	2	1	100	0	100
20AGA05	Staad Pro. software course	EEC	0	0	2	1	100	0	100
20AGA06	Solidworks software course	EEC	0	0	2	1	100	0	100
20AGA07	Ansys software course	EEC	0	0	2	1	100	0	100
20AGA08	Research Methodology	EEC	1	0	0	1	100	0	100

## SUMMARY

Sl. No.	Category	Credits per Semester								Total Credits (AICTE)	Credits in %
		I	II	III	IV	V	VI	VII	VIII		
1	HSS	3	3				3	3		12 (10-14)	7.27%
2	BS	8	8	4	4					24 (22-28)	14.54%
3	ES	7	8	6	3					24 (24)	14.54%
4	PC		2	12	15	17	12	7		65 (48)	39.39%
5	PE					3	3	6	6	18 (18)	10.90%
6	OE					3	3	3		9 (9)	5.45%
7	EEC						2	1	10	13 (12-16)	7.87%
8	MC	0	0	0	0					0	0.00%
	<b>Total</b>	<b>18</b>	<b>21</b>	<b>22</b>	<b>22</b>	<b>23</b>	<b>23</b>	<b>20</b>	<b>16</b>	<b>165</b>	<b>100%</b>

- HSS - Humanities and Social Sciences  
 BS - Basic Sciences  
 ES - Engineering Sciences  
 PC - Professional Core  
 PE - Professional Electives  
 OE - Open Electives  
 EEC - Employability Enhancement Courses  
 MC - Mandatory Courses (Non-Credit Courses)  
 CA - Continuous Assessment  
 FE - Final Examination

## I SEMESTER

20MA101	Mathematics - I for Bio Sciences (Common to AGRI and FOOD TECH)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

**Course Objectives**

The course is intended to

1. Acquire the concept of matrix algebra techniques.
2. Acquaint the mathematical tools needed in evaluating limits, derivatives and differentiation of one variable.
3. Learn the concept of calculus for solving the problems mathematically and obtaining solutions.
4. Learn the concepts of algebraic and transcendental functions.
5. Introduce the concept of evaluating multiple integrals and their usage in find the area and volume of two and three dimensional objects.

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Apply the idea of reducing complex problems into simple form using matrix technique.	Apply
CO2	Use both the limit definition and rules of differentiation to differentiate functions.	Understand
CO3	Identify the circle of curvature, evaluate and envelope of the curves.	Understand
CO4	Explain different methods of Integration used in Engineering problems	Understand
CO5	Apply Double and Triple integrals in Engineering real life problems.	Apply

**Course Contents:****Unit – I Matrices****12**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties(statement only) – Cayley-Hamilton theorem and its applications – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

**Unit –II Limits and Continuity****12**

Representation of functions – Limit of a function – continuity – derivatives-Differentiation rules – Maxima and Minima of a function of one variables

**Unit – III Differential Calculus****12**

Curvature – Curvature in Cartesian Co-ordinates Centre and Radius of curvature–Circle of curvature –Evolute and Involute – envelope

**Unit – IV Integral Calculus I****12**

Basic integration formulae for algebraic and transcendental functions - Integration by special devices - integration by parts - rationalizing substitution or trigonometric substitution - partial fractions - reduction formulas - improper integrals - convergence tests.

**Unit –V Integral Calculus II****12**

Basic integration formulae for algebraic and transcendental functions-Integration by special devices: enclosed by plane curves - Change of variables in double integrals(Polar coordinates) - Triple integrals - Volume of solids.

**Total: 60 Periods**

**Text Books:**

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, 44<sup>th</sup> Edition, 2019
2. Veerarajan.T, "Engineering Mathematics for Semester I and II", Tata McGraw Hill, 3<sup>rd</sup> Edition, 2014.
3. Smith RT and Minton RB, Calculus, , McGraw Hill, 2nd Edition, 2002

**Reference Books:**

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Company, 1<sup>st</sup> Edition, 2018
2. Bali.N.P and Manish Goyal N.P, "A text book of Engineering Mathematics", Laxmi Publications, 6<sup>th</sup> Edition, 2015

**Additional References:**

1. <https://nptel.ac.in/courses/111/105/111105121>
2. <https://nptel.ac.in/courses/122101003/2>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										2		
CO2	3	3	2										1		
CO3	3	2	2										1		
CO4	3	2	1										2		
CO5	3	3	2										1		
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Exam			Final Examination (60)
	IAE I (5)	IAE II (10)	IAE III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

  
**CHAIRMAN - BOARD OF STUDIES**

20AG101	Basics of Agricultural Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Engineering Sciences				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. enhance the fundamental knowledge in Soil and Water Conservation and its applications relevant to various streams of Engineering and Technology.
2. gain knowledge on Farm Machinery and Power and its applications relevant to various streams of Engineering and Technology
3. learn about the basics of Agricultural Process Engineering
4. understand the scope of Civil engineering in Agriculture
5. recognize the scope of Mechanical engineering in Agriculture

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Gain knowledge on the basics of soil and water conservation engineering	Understand
CO2	Acquire knowledge on the basics of farm machinery and power	Understand
CO3	Have adequate knowledge on the concepts of agricultural process engineering	Understand
CO4	Understand the scope of civil engineering in agriculture	Understand
CO5	Understand the scope of mechanical engineering in agriculture	Understand

### Course Contents:

#### Unit - I Soil and Water Conservation

9

Soil: Definition, Properties of Soil and Types - Geology: Introduction, Classifications of Rocks and formation of Rocks - Surveying and Leveling: Definition and types of Surveying - Geoinformatics - Land Clearing - Soil Erosion: Principles - Processes – Types – Irrigation and Drainage Engineering - Rain water harvesting.

#### Unit - II Farm Machinery and Power

9

Farm Machineries - Farm Tractor - Power Tiller - Plant production equipments - Sowing equipments - tillage practices and equipments - harvesting equipments - Operation and maintenance of farm machineries and equipments

#### Unit - III Agricultural Process Engineering

9

Introduction – Engineering properties of foods - Seed processing techniques – Crop Processing Techniques – Vegetable processing techniques - Dairy process Techniques – Agricultural processing byproducts – Food preservation -

#### Unit - IV Scope of Civil Engineering in Agriculture

9

Civil Engineering materials: Bricks - stones - sand - cement - concrete - steel - timber - modern materials - Foundations: Types of foundations - Requirement of good foundations. Civil Engineering Structures: Brick masonry - stone masonry - beams - columns - lintels - roofing - flooring - plastering - floor area, carpet area and floor space index - introduction to high way and rail way.

#### Unit - V Scope of Mechanical Engineering in Agriculture

9

Internal combustion engines - Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines - Terminology of Refrigeration and Air Conditioning - Classification of Power Plants

**Total: 45 Periods**

**Text Books**

1. T.P.Ojha and A.M.Micheal., "Principles of Agricultural Engineering Vol-I", Jain Brothers Publications, 10<sup>th</sup> Edition, 2018
2. A.M.Micheal and T.P.Ojha., "Principles of Agricultural Engineering Vol-II", Jain Brothers Publications, 2018
3. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd.1999.
4. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000.

**Reference Books:**

1. Jagdishwar Sahay, "Elements of Agricultural Engineering", 4<sup>th</sup> Edition, Standard Publishers Distributors, 2006
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
3. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.

**Web References:**

1. <https://nptel.ac.in/courses/126/105/126105009/>
2. <https://nptel.ac.in/courses/126/105/126105012/>

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3											
CO2	3	2	3											
CO3	3	2	3											
CO4	3	2	3											
CO5	3	2	1											
	<b>3</b>	<b>High</b>			<b>2</b>	<b>Medium</b>			<b>1</b>	<b>Low</b>				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	20
Understand	20	20	20	70
Apply	10	10	10	10
Analyze				
Evaluate				
Create				

20CH101	CHEMISTRY FOR BIOSCIENCES (Common to Agriculture Engineering and Food Technology)	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Prerequisites	Nil				

### Course Objectives

The course is intended to

1. Learn the basic principles of analytical techniques.
2. Introduce the students to dairy industry, properties and processing of milk.
3. Understand the chemistry of sugar.
4. Learn about the nature, types and problems of the soil.
5. Gain knowledge about suitable fertilizers for different types of soil.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Implement the analytical techniques like filtration and evaporation	Understand
CO2	Interpret the properties of proteins	Understand
CO3	Summarize the chemistry of sugar	Understand
CO4	Identify the nature and problems of the soil	Understand
CO5	Decide fertilizer for a particular soil depending on its nature	Apply

### Course Contents

#### Unit-I Analytical Techniques 9

Basic Principles: Precipitation, filtration, sample drying, transfer of precipitates. Distillation, vacuum distillation, fractional distillation and steam distillation, sublimation and crystallization.

#### Unit-II Proteins 9

Chemistry of proteins: structure, N-terminal and C-terminal, hydrogen bond, disulphide bond and salt linkages. Outlines of primary, secondary and tertiary structure of proteins. Physical properties of milk proteins: electrical properties, hydration and solubility.

#### Unit-III Chemistry of Sugar 9

Manufacture of sucrose from cane sugar, purification, concentration, crystallization, separation and refining of crystals, recovery of sucrose from molasses. Properties and uses of sucrose. Fermentation process: manufacture of alcohol from molasses.

#### Unit-IV Soil Chemistry 9

Types of soil: saline soil, acidic soil and alkaline soil. Formation: acid, acid sulphate, salt affected and calcareous soil. Characteristics and Reclamation. Methods of reclamation: mechanical, chemical and biological methods. Chemistry of submerged soils.

#### Unit-V Fertilizers 9

Effect of N, P, K, Secondary nutrients and micronutrients on plant growth and development. Importance of nitrogenous fertilizers. Nitrogen cycle and fixation of atmospheric nitrogen. Uses of mono and diammonium phosphates, super phosphates and triple super phosphates. Potassium fertilizers: examples and uses. Green manuring: definition and examples (red-clover and peas).

**Total: 45 Periods**

**Laboratory Component**

S.No.	Name of the Experiment	CO Mapping	RBT
1	Potentiometric precipitation titration of bariumchloride and sodium sulphate	CO1	Apply
2	Finding out the melting point of ice and boiling point of water	CO1	Understand
3	Identification of the type of hardness of water by EDTA method	CO2	Understand
4	Determination of calcium in milk by EDTA method	CO2	Apply
5	Conduct metric titration of strong acid vs strong base	CO3	Apply
6	Determination of strength of HCl by pH metry	CO3	Apply
7	Measurement of pH of different soil samples using litmus paper and pH strips to classify the nature of the soil	CO4	Apply
8	Determination of the nature of sample solution of fertilizer(acidic, alkaline, neutral) using universal indicator	CO5	Apply

**Total: 30 Periods****TextBooks**

1. A. Tolanur, "Soil Chemistry, CBS Publishers, 2<sup>nd</sup> edition, 2015.
2. B. S. Bahl and ArunBahl, "Advanced Organic Chemistry", S.Chand& Company Ltd, 22<sup>nd</sup> Edition, 2010.

**Reference Books**

1. HavlinTisda, "Soil Fertility and Fertilizers", Pearson Publishers, 2<sup>nd</sup> edition, 2013.
2. G. C. Banerjee, "The Text Book of Animal Husbandry", Oxford Book Company, 1<sup>st</sup> Edition, 2010.
3. N. S. R. Sastry and C. K. Thomas, "Livestock Production Management", Kalyani Publishers, 4<sup>th</sup> Edition, 2005.

**Additional Resources**

1. [https://fac.ksu.edu.sa/sites/default/files/9\\_determination\\_of\\_calcium\\_in\\_milk.pdf](https://fac.ksu.edu.sa/sites/default/files/9_determination_of_calcium_in_milk.pdf)
2. <https://www.youtube.com/watch?v=xIz2YPBXuZU>
3. <https://www.youtube.com/watch?v=jFQeDef6bug>

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2									1				
CO2	3	2									1				
CO3	3	2									1				
CO4	3	2									1				
CO5	3	2									1				
	3	High				2	Medium				1	Low			



Summative Assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50]
	Theory				Practicals		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10]	Model Examination [10Marks]	
Remember	30	20	10		20	20	40
Understand	10	20	30		20	10	40
Apply	10	10	10		10	20	20
Analyze							
Evaluate							
Create							

  
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20ME101	Engineering Graphics (Common to Aeronautical, Agriculture, Civil, Mechanical, Safety and Fire Engineering & Food Technology)	L	T	P	C
		1	0	4	3
Nature of Course	Engineering Sciences				
Pre requisites	Nil				

**Course Objectives:**

The course is intended to

1. Understand technical drawings in various fields of engineering
2. Imagine and visualize the geometric details of engineering objects.
3. Translate the geometric information of engineering objects into engineering drawings.
4. Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings.
5. Visualize and draw isometric and perspective views

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Develop the conic sections, special curves, and draw orthographic views from pictorial views.	Apply
CO 2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in first quadrant.	Apply
CO 3	Construct the projections of simple solids like prisms, pyramids, cylinder and cone.	Apply
CO 4	Build the sectional views of solids like cube, prisms, pyramids, cylinders & cones and development of its lateral surfaces.	Apply
CO 5	Organize and draw isometric and perspective sections of simple solids.	Apply

**Course Contents****Concepts and Conventions (Not for Examination)**

1

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

**UNIT -I Plane Curves and Free Hand Sketching****(3+12)**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. 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****(3+12)**

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

**UNIT –III Projection of Solids (3+12)**

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

**UNIT- IV Projection of Sectioned Solids and Development of Surface (3+12)**

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

**UNIT -V Isometric and Perspective Projections (3+12)**

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

**TOTAL: (15+60) Periods**

**TEXT BOOKS**

1. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2011
2. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2012.

**REFERENCE BOOKS**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. BasantAgarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. ParthasarathyN S and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.

**Web References**

1. [http://nptel.ac.in/courses/112103019/Engineering drawing](http://nptel.ac.in/courses/112103019/Engineering%20drawing)
2. <http://pioneer.netserv.chula.ac.th/~kjiapon/self-practice.html>

**Publication of Bureau of Indian Standards**

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

**Special points applicable only to Final Examinations of Engineering Graphics:**

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

  
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Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	3										1	2		
CO5	3	2										1	2		
	3	High				2	Medium				1	Low			

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory				Practical		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examinaion [10 Marks]	
Remember	10	10	10		2		20
Understand	20	20	20		4		40
Apply	20	20	20		4		40
Analyse							
Evaluate							
Create							

  
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20AG102	Agriculture Engineering Practices Laboratory	L	T	P	C
		0	0	2	1
Nature of Course	Engineering Science				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. To learn about basic Agricultural tools working and trouble shooting.
2. To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry.
3. To develop general machining skills among the students

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Identify and solve the plant protection tools and weeding practices	Understand
CO2	Gain knowledge on soil management practices	Understand
CO3	Identify and solve the basic engineering problems at home and in workplace	Understand
CO4	Develop the surfaces and make simple components like tray and funnel. Prepare pipe connections and sand moulds.	Understand
CO5	Make simple metal joints using welding equipment and wooden joints using carpentry tools. Demonstrate the fundamentals of machining.	Understand

### Course Content:

#### GROUP A (AGRICULTURE ENGINEERING)

Basic Weed tools: Hoe, Spade, Crow bar, Axe. Plant Protection: Different types of sprayers, nozzles, Duster, Plunger, pumps. Cultivation practices: Ploughing – One way ploughing, Two way Ploughing. Soil Management Practices – Intercultural operations.

#### List of Exercises

S.No	List of Exercises	CO Mapping	RBT
1	Study and identification of different weeding tools with specification	4	Understand
2	Study and identification of various plant protection tools	4	Understand
3	Demonstration of Cultivation practices	1	Understand
4	Soil Management Practices	2	Understand
5	Study and identification of different intercultural operation tools	3	Understand

  
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**GROUP B (CIVIL & MECHANICAL)**

Manufacturing Methods –Sheet metal operations - Welding - arc welding, gas welding, TIG & MIG welding - basic machining using lathe - metal casting - Carpentry work using power tools - Plumbing components and pipelines

**List of Exercises**

S.No	List of Exercises	CO Mapping	RBT
1	Preparation of butt joints and lap joints using arc welding and TIG / MIG welding.	3	Understand
2	Sheet metal Forming and Bending, Model making – Trays and funnels.	2	Understand
3	Preparation of wooden joints by sawing, planning and cutting.	3	Understand
4	Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.	2	Understand
5	Basic machining - simple turning operations.	1	Understand
6	Demonstration of foundry operations like mould preparation for solid and split piece pattern.	3	Understand

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	3	2											
CO2	2	1	3	2											
CO3	2	1	3	2											
CO4	2	2	3	2											
CO5	2	2	3	2											
	3	High				2	Medium				1	Low			

Summative assessment				
Bloom's Level	Rubric based Continuous Assessment [30 marks]	Preparatory Examination [25 Marks]	Attendance [5]	End Semester Examination [40 marks]
Remember	30	40		30
Understand	70	60		70
Apply				
Analyze				
Evaluate				
Create				

  
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<b>20MC101</b>	<b>Induction Programme</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Nature of Course</b>	Mandatory, Non Credit				
<b>Pre requisites</b>	Completion of Schooling at Higher Secondary Level				

### Course Objectives

The course is intended to

1. To nurture the character and behavior as a student.
2. To have broad understanding of society and relationships.
3. To impart interpersonal and soft skills.
4. To inspire the students in the field of engineering.
5. To provide exposure to industries.

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Perform curricular and co-curricular activities excellently.	Knowledge
CO 2	Do the skill based training with excellence.	Understand
CO 3	Work as team for the given task	Apply
CO 4	Gain character and behaviour	Knowledge
CO 5	Demonstrate the acquired skills effectively	Apply

### Course Contents

#### PHYSICAL ACTIVITY

Yoga, Sports

#### CREATIVE ARTS (students can select any one of their choice)

Painting, sculpture, pottery, music, craft making and so on

#### UNIVERSAL HUMAN VALUES

Enhancing soft skills

#### LITERARY AND PROFICIENCY MODULES

Reading, Writing, Speaking- Debate, Role play etc., Communication and computer skills

#### LECTURES BY EMINENT PEOPLE

Guest lecture by subject experts

#### VISIT TO LOCAL CITIES

Meditation centers / Industry

#### FAMILARIZATION TO DEPARTMENT / BRANCH INNOVATION

Lectures by Departments Head and senior faculty members

**Total Hours: 45**

  
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## Mapping of COs with POs and PSOs

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)																
COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1						2	1	2				3	2			
CO2						2	1	2				3	2			
CO3						2	1	2				3	2			
CO4						2	1	2				3	2			
CO5						2	1	2				3	2			
	3	High				2	Medium					1	Low			

Bloom's Level	Continuous Assessment (Non-Credit, Mandatory)				
	Test -I [20 ]	Test -II [20]	Test - III [20]	Assignment/ Activity [20]	Attendance [20]
Remember	10	10	10		
Understand	20	20	20	10	
Apply	20	20	20	10	
Analyse					
Evaluate					
Create					

  
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20ENE01	<b>COMMUNICATIVE ENGLISH</b> (Common to all B.E. / B.Tech. Programmes)	L	T	P	C
		2	0	2	3
<b>Nature of Course</b>	Humanities and Social Science				
<b>Pre requisites</b>	Nil				

**Course Objectives**

The course is intended to

- Improve lexical, grammatical and semantic competence.
- Enhance communicative skills in real life situations.
- Augment thinking in all forms of communication.
- Equip with oral and written communication skills.
- Gain employability skills.

**Course Outcomes**

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Use effectively the lexical, grammatical and semantic knowledge	Remember
CO2	Communicate with clarity using intentional vocabulary in English	Apply
CO3	Articulate perfectly and express their opinions confidently using communicative strategies	Remember
CO4	Accomplish listening and reading skills for lifelong learning	Understand
CO5	Comprehend, interpret and present data	Understand

**Course Contents****Unit - I Basic structure and Usage****6**

Parts of Speech -- Articles – Tenses - Subject-Verb Agreement – Different Grammatical forms of the same word - Listening to Speeches and Conversations from Communication software – Listening to Announcements – Listening and Gap Filling.

**Unit - II Vocabulary and Language Development****6**

Intentional vocabulary used in and around Airport, Hospital, Hotel, Court – Abbreviations and acronyms - One Word Substitution - Compound words – Homophones and Homonyms – Types of sentences - Ordering Jumbled Sentences Letter writing – informal.

**Unit –III Oral Communication Skills****6**

Improving fluency – Articulation with pronunciation – Voice modulation in Speaking – One minute talk -Self Introduction and introducing ones friend – Telephonic conversations – Group Discussion – Modal Auxiliaries – discourse markers.

**Unit –IV Comprehensive Listening and Reading****6**

Effective listening Strategies — Listening to Interviews from Communication software– Phrasal verbs – Reading Comprehension – “An Astrologer’s Day” by R.K.Narayan and “Building a New State” by Dr. A.P.J. Abdul Kalam.

**Unit – V Effective Writing****6**

Interpretation and presentation of data – developing Hints – general essays and paragraph writing – Report Writing – survey report and accident report - Instructions and Recommendations.

**Total:30 Periods**

  
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**Laboratory Components**

S.No	List of Exercises	CO Mapping	RBT
1	Role-play – One minute talk	3	Understand
2	Role-play – Telephonic conversations	3	Understand
3	Listening to speeches and lectures and gap filling	4	Understand
4	Group Discussion.	4	Understand
5	Articulation with pronunciation practice	3	Apply
6	Listening to Announcements – Listening and Gap Filling	4	Understand
7	Listening to Interviews & Native speakers' Conversations	4	Understand
8	Reading practice with articles in magazine and news papers.	4	Understand
9	Model – Job Interviews	4	Understand
10	Introspective report – Personal analysis	5	Understand
11	Telephone etiquette	3	Remember
12	Reading – Shorter texts and News Articles	4	Understand
13	Role Play – Getting and Giving Permission	3	Remember
14	Self Introduction( Formal )	3	Understand
15	Recommendations/Suggestions	3	Apply

**Total: 30 Periods****Text Books**

1. Rizvi, Ashraf M., "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5<sup>th</sup> Edition, 2007.
2. Board of Editors, "Using English – A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2<sup>nd</sup> Edition, 2017.

**Reference Books:**

1. MeenakshiRaman andSangeethaSharma, "Technical Communication",Oxford University Press, USA, 10<sup>th</sup> Edition, 2007.
2. John CunnisonCatford, "A Practical Introduction to Phonetics", Clarendon Press, Jamaica, 2<sup>nd</sup> Edition, 2001.
3. Hewings. M, "Advanced English Grammar",Cambridge University Press, Chennai, 3<sup>rd</sup> Edition, 2000.
4. S P Dhanavel "English and Soft Skills", Orient BlackSwan Private Limited, Hyderabad, 1<sup>st</sup> Edition, 2010.

**Web reference:**

[https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwIj4dCTucfsAhXE1pYKHch4ABMYABAGgJ0bA&ohost=www.google.com&cid=CAASEuRo76H-Vx9BpazOOBfXeJSKVQ&sig=AOD64\\_3O-HNEuUO4A5sc31MsUfaTBGG-dQ&q&adurl&ved=2ahUKEwjC3ceTucfsAhXBeisKHatIBewQ0Qx6BAgfEAE](https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwIj4dCTucfsAhXE1pYKHch4ABMYABAGgJ0bA&ohost=www.google.com&cid=CAASEuRo76H-Vx9BpazOOBfXeJSKVQ&sig=AOD64_3O-HNEuUO4A5sc31MsUfaTBGG-dQ&q&adurl&ved=2ahUKEwjC3ceTucfsAhXBeisKHatIBewQ0Qx6BAgfEAE)

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							1			3	2	2	2		
CO2							1			3	2	2	2		
CO3							1			3	2	2	2		
CO4							1			3	2	2	2		
CO5							1			3	2	2	2		
	<b>3</b>	<b>High</b>				<b>2</b>	<b>Medium</b>				<b>1</b>	<b>Low</b>			

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory Marks				Practical		
	IAE-I [5]	IAE-II [10]	IAE -III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10Marks]	
Remember	20	20	20		40	40	40
Understand	20	20	20		40	40	40
Apply	10	10	10		20	20	20
Analyze							
Evaluate							
Create							

  
**CHAIRMAN - BOARD OF STUDIES**

20ENE02	<b>Advanced Communicative English</b> (Common to all B.E./ B.Tech Programmes)	L	T	P	C
		2	0	2	3
<b>Nature of Course</b>	Humanities and Social Sciences				
<b>Pre requisites</b>	Basics of Communicative English				

**Course Objectives**

The course is intended to

- Demonstrate satisfactory control over complex structures and mechanics in English.
- Develop fluency and accuracy in oral communication.
- Communicate effectively and actively in social interactions.
- Read English at inspectional level.
- Face interviews with confidence.

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Apply knowledge of English grammar for effective communication	Remember
CO2	Make use of common English phrases and vocabulary strength.	Understand
CO3	Build self-confidence and enhance professionalism	Apply
CO4	Implement listening, reading and writing skills in real - life situations	Apply
CO5	Speak fluently in English with proper pronunciation, intonation, tone and accent.	Understand

**Course Contents****Unit – I Grammar and usage****6**

Active voice and passive voice – Prefixes and suffixes – Connotation – Clauses - If conditionals – Idioms & Phrases - Right forms of verbs– Modal Auxiliaries - Spotting errors.

**Unit - II Lexical competence****6**

Technical Vocabulary- Expressions – Frequency – Cause and effect - Words often Miss-spelled – Syntax and structure - Homophones and Homonyms- Verbal analogy - Idioms and Phrases.

**Unit - III Conversational etiquette****6**

Processes description– Tone and accent in speech– Role-play (Job-Interview) – Presentation skills – Mechanics of presentation - Telephone etiquette – Group Discussion strategy - Formal & Informal subjective and objective introduction – Body Language – Mock Interview.

**Unit – IV Listening reading and writing****6**

Listen to Scientific/Technical talks and gap filling – Listening to TED/INK Talks – Reading – “Water: The Elixir of Life” by Sir. C.V.Raman. “Progress” by St. John Ervine - Instructions and Recommendations – Letter writing formal –Job application- Report writing–Introspective report – Creative writing – Essays and Paragraphs.

**Unit – V Phonetics****6**

Production and classification of speech sound – International Phonetic Alphabet and transcriptions – Phonological rules – way and Place of articulation – Vowels, consonants and diphthongs. Specific characteristics feature of vowel sounds.

**Total: 30 Periods**

**Laboratory Components**

S.No	List of Exercises	CO Mapping	RBT
1	Role-play – Processes Description	2	Remember
2	Listening to TED/INK Talks and gap filling	4	Understand
3	Group Discussion	3	Understand
4	Articulation with pronunciation practice	3	Apply
5	Reading – Longer texts and Technical Articles (Skimming & Scanning).	4	Apply
6	Presentation skills – Mechanics of presentation	5	Understand
7	Individual presentation on given topics	5	Remember
8	Telephone etiquette	5	Understand
9	Instructions and Recommendations	5	Remember
10	Writing – General Essays.	4	Apply
11	Report writing technique- write up	4	Remember
12	Introspective report – Personal analysis	4	Understand
13	Model Job Interviews	3	Understand
14	Job Interviews(Role play)	3	Apply
15	Body Language	3	Understand

**Total: 30 Periods****Text Books**

- Rizvi, Ashraf.M, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5<sup>th</sup> Edition, 2007.
- Hewings. M, "Advanced English Grammar", 3rd Edition, Cambridge University Press, Chennai, 5<sup>th</sup> Edition, 2000.
- Board of Editors, "Using English – A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2<sup>nd</sup> Edition, 2017.

**Reference Books:**

- Raman M &Sangeetha Sharma, "Technical Communication",Oxford University Press,USA,10<sup>th</sup>Edition,2007.
- John CunnisonCatford, "A Practical Introduction to Phonetics",Clarendon Press, Jamaica,2<sup>nd</sup> Edition, 2001.
- Norman Whitby, Business Benchmark – "Pre-Intermediate to Intermediate, Students Book", Cambridge University Press, 1<sup>st</sup> Edition, 2006.
- DhanavelS. P., "English and Soft Skills", 1<sup>st</sup>Edition,OrientBlackSwan Private Limited, Hyderabad, 1<sup>st</sup> Edition, 2010.

**Web reference:**

1. [https://www.coursera.org/lecture/tesol-speaking/video-2-listening-strategies-for-learners-3AeBL?utm\\_source=mobile&utm\\_medium=page\\_share&utm\\_content=vlp&utm\\_campaign=top\\_button](https://www.coursera.org/lecture/tesol-speaking/video-2-listening-strategies-for-learners-3AeBL?utm_source=mobile&utm_medium=page_share&utm_content=vlp&utm_campaign=top_button)
2. blob:<https://www.youtube.com/73f7256d-d302-4563-bed5-9e84c94a26ac>

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3	1	2	2		
CO2										3	1	2	2		
CO3										3	1	2	2		
CO4										3	1	2	2		
CO5										3	1	2	2		
	3	High				2	Medium				1	Low			

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory Marks				Practical		
	IAE-I [5]	IAE-II [10]	IAE -III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10Marks]	
Remember	20	20	20		40	40	40
Understand	20	20	20		40	40	40
Apply	10	10	10		20	20	20
Analyze							
Evaluate							
Create							

## II SEMESTER

20MA201	Mathematics-II for Bio Sciences (Common to AGRI and FOOD TECH)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

**Course Objectives**

The course is intended to

1. Acquire the mathematical skills to solve the differential equations.
2. Acquaint the concept of Vector calculus needed in Agriculture engineering field.
3. Acquire knowledge of analytic approach to analyze the conformal mapping.
4. An understanding of Fourier Series to solve real world problems
5. Learn the mathematical analysis to understand the sequences.

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain various techniques in solving Ordinary differential equations with constant coefficients	Understand
CO2	Apply complex variables in finding ,Gradient, divergence, curl of a vector point function	Apply
CO3	Identify the concepts of analytic functions and its properties and apply it in conformal mapping.	Apply
CO4	Represent periodic functions using Fourier series	understand
CO5	Observe how the term of a sequence is represented graphically.	Understand

**Course Contents:****Unit – I Ordinary Differential Equations**

12

First order linear Differential equations- Exact differential equations- Second order linear differential equations with constant coefficients – Method of variation of parameters – Homogenous equation of Euler's and Legendre's Equations.

**Unit - II Vector calculus**

12

Differentiation of vectors -scalar and vector point functions - Gradient of a scalar point function - Divergence and Curl of a vector point function operator – line - surface and volume integrals - Stoke's - divergence and Green's theorems (Statement only) and applications.

**Unit - III Complex Differentiation and Conformal Mapping**

12

Functions of a complex variable – Analytic functions –Statement of Cauchy –Riemann equations – Harmonic functions–Harmonic conjugate –Construction of analytic functions –Conformal mapping :  $w = z+c$ ,  $cz$ ,  $1/z$  and Bilinear transformation.

**Unit IV Fourier Series**

12

Fourier series - Euler's formulae – Dirichlet's conditions - functions having arbitrary period- even and odd functions - half range series - Harmonic analysis -Fourier Sine and Cosine Series - Fourier series for function having period  $2L$  .

**Unit – V Sequence and Series**

12

Sequences and series - convergence and divergence of series - absolute convergence- conditional convergence - test for convergence and divergence - Power series for functions- interval of convergence - Taylor and Maclaurin series - Taylors Theorem with remainder.

**Total: 60 Periods**

**Text Books:**

1. Grewal B.S, "Higher Engineering Mathematics", KhannaPublishers,Delhi, 44<sup>th</sup> Edition, 2019.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Limited, 10<sup>th</sup> Edition, 2016.

**Reference Books:**

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, 1<sup>st</sup> Edition, 2018.
2. Bali.N.P and ManishGoyal N.P, "A text book of Engineering Mathematics",8<sup>th</sup>Laxmi Publications, 6<sup>th</sup> Edition, 2015.

**Additional References:**

1. [https://onlinecourses.nptel.ac.in/noc16\\_ma05](https://onlinecourses.nptel.ac.in/noc16_ma05)
2. <https://nptel.ac.in/courses/122/104/122104017>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										2		
CO2	2	3	2										1		
CO3	3	2	1										2		
CO4	3	2	1										1		
CO5	3	1	1										1		
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Exam			Final Examination (60)
	IAE I (5)	IAE II (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

  
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20ME201	<b>Engineering Mechanics</b> (Common to Aeronautical, Agriculture, Civil, Mechanical and Safety and Fire Engineering)	L	T	P	C
		3	2	0	4
<b>Nature of Course</b>	Engineering Sciences				
<b>Pre requisites</b>	Fundamentals of Basic Mathematics and Physics				

### Course Objectives

The course is intended to

1. Develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.
2. Make the students understand the vector and scalar representation of forces and Moments and the static equilibrium of particles and rigid bodies.
3. Understand the effect of friction on equilibrium, laws of motion, kinematics of motion and the interrelationship.
4. Make the students understand the properties of surfaces and solids, prediction of behavior of particles and rigid bodies under motion.
5. Make the students familiar with frictional laws and its application

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO 1	Illustrate the vectorial and scalar representation of forces and moments	Apply
CO 2	Find the rigid body in equilibrium.	Apply
CO 3	Determine the properties of surfaces and solids.	Apply
CO 4	Calculate dynamic forces exerted in rigid body	Apply
CO 5	Determine the friction and the effects by the laws of friction	Apply

### Course Contents

#### UNIT - I Statics of Particles

12

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

#### UNIT - II Equilibrium of Rigid Bodies

12

Free body diagram – Types of supports – Action and reaction forces – 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 – Equilibrium of Rigid bodies in three dimensions.

#### UNIT- III Properties of Surfaces and Solids

12

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

  
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**UNIT – IV Dynamics of Particles**

**12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton’s laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

**UNIT - V Friction and Elements of Rigid Body Dynamics**

**12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder and fly wheel

**TOTAL: 60 Periods**

**Text Books**

1. Rajasekaran, S. and Sankarasubramanian. G, “Fundamentals of Engineering 17 Mechanics”, Vikas Publishing House Pvt. Ltd., New Delhi, 2009
- 2.Kumar, K.L., “Engineering Mechanics”, Tata McGraw-Hill Publishing Company, New Delhi, 3rd Revised Edition, 2008

**References**

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition 2004
2. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, Pearson Education, 11th Edition, 2010

**Web References**

1. <http://nptel.ac.in/courses/122104015/>
2. <http://nptel.ac.in/courses/112103109/>

**Online Resources**

1. <https://ocw.mit.edu/courses>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2		1									3		
CO2	3	2		1									3		
CO3	3	2		1									3		
CO4	3	2		1									3		
CO5	3	2		1									3		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom’s Level	Assessment Component	Marks	Total marks
Remember	Online Quiz or Tutorial Class	5	15
Understand	Assignment	5	
	Attendance	5	

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Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	20	20	20	40
Analyse				
Evaluate	10	10	10	20
Create				

  
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20PH201	<b>Physics for Bio Sciences</b> (Common to Agricultural Engineering & Food Technology)	L	T	P	C
		3	0	2	4
<b>Nature of Course</b>	Basic Sciences				
<b>Pre requisites</b>	Fundamentals of Basic Physics				

**Course Objectives:** The course is intended to

1. Impart knowledge of properties of matter like elasticity and its applications
2. Provide knowledge of optics, especially laser and their applications in fiber optics.
3. Understand the thermal properties of materials and their applications.
4. Develop the clear understanding about the concept of crystal structure.
5. Deliver knowledge on basic concept of seismic and flood hazard.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the knowledge about elastic modulus	Understand
CO2	Compare the working of lasers and propagation of light through optical fibers and its applications	Understand
CO3	Demonstrate the thermal conductivity of good and bad Conductors.	Understand
CO4	Demonstrate about the atomic arrangement in crystals	Understand
CO5	Classify the natural calamities like seismic hazards, flood hazards in detail	Understand

### Course Contents:

#### UNIT I Properties of Matter 9

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 – uniform and non-uniform bending - I-shaped girders - stress due to bending in beams.

#### UNIT II Laser and Fiber Optics 9

Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index, mode) – optical fiber communication system- fiber optic endoscope.

#### UNIT III Thermal Physics 9

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 – uniform and non-uniform bending - I-shaped girders - stress due to bending in beams.

#### UNIT IV Crystal Physics 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures.

#### UNIT V Hazards 9

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

**Total : 45 Periods**

  
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## Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Determination of rigidity modulus – Torsion pendulum	CO1	Apply
2	Determination of Young's modulus by non-uniform Bending method.	CO1	Apply
3	Determination of wavelength, and particle size using Laser	CO2	Apply
4	Determination of acceptance angle in an optical fiber	CO2	Apply
5	Determination of thermal conductivity of a bad conductor by Lee's Disc method	CO3	Apply
6	Determination of velocity of sound and compressibility of liquid - Ultrasonic interferometer	CO1	Apply
7	Determination of Coefficient of viscosity of liquid	CO1	Apply

Total 30 Periods

## TEXT BOOKS:

1. Bhattacharya, D.K and Poonam, T, "Engineering Physics", 2nd edition, Oxford University Press, 2015.
2. M.N. Avadhanulu, M.N. & Kshirsagar PG. "A Text book of Engineering Physics", 10th edition, S.Chand and company, Ltd., New Delhi, 2014.
3. Ulrich Ranke., "Natural Disaster Risk management", Springer International Publishing, 1<sup>st</sup> Edition, 2016

## REFERENCES:

1. David Halliday. Robert Resnick. and Jearl Walker., "Principles of Physics", Wiley, 10<sup>th</sup> Edition, 2014.
2. Raymond A Serway. and John W Jewett., "Physics for Scientists and Engineers", Cengage Learning, 9<sup>th</sup> Edition, 2019.

## Web References:

1. <https://nptel.ac.in/courses/115/107/115107095/>
2. <https://scienceworld.wolfram.com/physics/TorsionalPendulum.html>
3. <https://spaceplace.nasa.gov/laser/en/>
4. <https://www.youtube.com/watch?v=uv0LxMoalEQ>

## Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2	1													
CO2	3	1	1													
CO3	3	2	1													
CO4	3	1	1													
CO5	3	2	2													
	3	High				2	Medium				1	Low				

  
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Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50marks]
	Theory Marks				Practical		
	IAE-I [5 ]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10 Marks]	
Remember	10	10	10		-		20
Understand	35	35	35		40		70
Apply	5	5	5		60		10
Analyse	-	-	-		-		-
Evaluate	-	-	-		-		-
Create	-	-	-		-		-

20CS201	PROBLEM SOLVING USING PYTHON ( Common to all Branches)	L	T	P	C
		3	0	2	4
Nature of Course	Engineering Sciences				
Pre requisites	Mathematical and Logical Knowledge				

### Course Objectives

The course is intended

1. To think logically and write algorithm and draw flow charts for problems.
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures -- lists, tuples, dictionaries and files.

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Develop algorithmic solutions to simple computational problems and read, write, execute by simple python programs.	Apply
CO2	Structure simple python programs for solving problems.	Understand
CO3	Administer the role of control statements and functions involving the idea of modularity.	Apply
CO4	Represent compound data using python strings and lists.	Apply
CO5	Read and write data from/to files in python Programs.	Understand

### Course Contents:

- Unit I Basics of Computers & Problem Solving 9**  
Computer Basics – Components-Computer organization - Computer Software- Types of software - Software Development steps -Need for logical analysis and thinking- Algorithms – Flowchart - Number system.
- Unit II Introduction of Python Programming 9**  
Introduction-Python Interpreter-Interactive and script mode -Values and types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, Input and Output Statements.
- Unit III Control statements and Functions 9**  
Conditional (if), alternative (if-else), chained conditional (if-elif-else)-Iteration-while, for, break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.
- Unit IV Strings and Lists 9**  
Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions-list processing-list comprehension, searching and sorting.
- Unit V Tuples, Dictionaries and Files 9**  
Tuples- Tuple assignment, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Files and Exception-Text files, reading and writing files, format Operator, Exception handling.

**TOTAL : 45 Periods**

**Laboratory Components**

S.No	List of Experiments	COMapping	RBT
1	Write a algorithm & draw flowchart for simple computational problems	CO1	Understand
2	Write a program to perform different arithmetic operations on numbers in python.	CO2	Understand
3	Write a python program to implement the various control structures	CO3	Apply
4	Write a python program for computational problems using recursive function.	CO3	Apply
5	Demonstrate use of list for data validation.	CO4	Apply
6	Develop a python program to explore string functions	CO4	Analyze
7	Implement linear search and binary search.	CO4	Apply
8	Develop a python program to implement sorting methods	CO4	Analyze
9	Develop python programs to perform operations on dictionaries.	CO5	Analyze
10	Write a python program to read and write into a file	CO5	Apply

**TOTAL: 30 Periods****Text Books:**

1. ReemaThareja, "Problem Solving and Programming with Python", Oxford University Press, 2018
2. Dr. R. NageswaraRao, "Core Python Programming", Dreamtech Press, 2017 Edition

**Reference Books:**

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012
2. Ashok NamdevKamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018.
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		



Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory Marks				Practical		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10 Marks]	
Remember	10	10	10			30	20
Understand	20	20	20		30	50	50
Apply	20	20	20		50	20	30
Analyse	-	-	-		20		-
Evaluate	-	-	-		-		-
Create	-	-	-		-		-

20AG201	Crop Husbandry Laboratory	L	T	P	C
		0	0	4	2
Nature of Course	Professional Core				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. introduce the different crop production practices in wet land, dry land and garden land through hands on experience and demonstrations.
2. understand the field preparation techniques
3. get knowledge on sowing and transplanting techniques
4. visualize the water and nutrients management in crop cultivation
5. learn the various harvesting techniques

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Identify and selection of seeds	Understand
CO2	Prepare the seed bed and sowing/transplanting techniques	Understand
CO3	Analyze the biometric observation measurements	Understand
CO4	Explain the Weed, Water and Nutrients management	Understand
CO5	Knowledge on Harvesting techniques	Understand

### List of Exercises

S.No	List of Exercises	CO Mapping	RBT
1	Field preparation studies	2	Understand
2	Seed selection and seed treatment procedures	1	Understand
3	Seed bed and nursery preparation	1	Understand
4	Sowing / Transplanting	4	Understand
5	Biometric observation for crops	4	Understand
6	Nutrient management studies	4	Understand
7	Water management and irrigation scheduling	4	Understand
8	Weed management studies	4	Understand
9	Integrated Pest Management studies	5	Understand
10	Harvesting and Post Harvesting Techniques	5	Understand

**Total: 60 Periods**

### List of Equipments:

- A wet land / garden land for a minimum of 5 cents area for each / group of students.
- An open / borewell as water source to support cultivation
- Required quantity of seeds, nutrients and other materials for filed preparation

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	3							2					
CO2	2	1	3							2					
CO3	2	1	3							2					
CO4	2	1	3							2					
CO5	2	1	3							2					
	3	High				2	Medium				1	Low			

Summative assessment				
Bloom's Level	Rubric based Continuous Assessment [30 marks]	Preparatory Examination [25 Marks]	Attendance [5]	End Semester Examination [40 marks]
Remember	30	40		30
Understand	70	60		70
Apply				
Analyze				
Evaluate				
Create				

20MC201	ENVIRONMENTAL SCIENCE (Common to Agriculture, Food Technology, Aero, Civil, Mechanical and Fire&Safety Engineering)	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory				
Prerequisites	Nil				

### Course Objectives

The course is intended to

1. Understand the concept of eco system and environment.
2. Become conversant with ecological balance and values of bio diversity.
3. Know the role of human in prevention of pollution and making a clean environment.
4. Get knowledge about conservation of non conventional energy resources.
5. Study about the nature and management of e-waste and solid waste.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Describe the ecosystem and environment	Understand
CO2	Understand the ecological balance and preservation of bio diversity	Understand
CO3	Demonstrate various types of pollution in order to control pollution	Apply
CO4	Classify the energy sources for the conservation of non conventional energy sources	Understand
CO5	Identify the nature and management of e-waste and solid waste	Apply

### Course Contents

#### Unit-I Ecosystem

6

Eco system-Food chains, Food webs and Ecological pyramids. Ecosystem-(a) Forest eco system, (b) Aquatic eco system (pond ecosystem and marine ecosystem).

#### Unit-II Biodiversity

6

Introduction to Bio diversity, Values of Bio diversity, Threats to Bio diversity, Endangered and Endemic species of India, Hotspots of biodiversity. Conservation of Bio diversity: In-Situ and Ex-Situ conservation of bio diversity.

#### Unit-III Environmental Pollution

6

Definition, Causes, Effects and Control of (a) Air pollution (b) Water pollution (c) Soil pollution. Electrostatic Precipitator for controlling air pollution.

#### Unit-IV Non Conventional Energy Resources

6

Introduction, Types: Solar Energy, Wind Energy and Geo Thermal Energy.

#### Unit-V Environmental Management

6

Sustainable Development, Role of Information technology in Environment and Human. HIV and AIDS: causes and control measures. Green chemistry: Definition and Principles

### Activity Component

S.No	Name of the Experiment	CO Mapping	RBT
1	Field study of simple eco system: pond, river and hill slopes	CO1	Understand
2	Case study regarding environmental management	CO5	Apply

Total: 30 periods

  
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**TextBooks**

1. AnubhaKaushik and C.P. Kaushik, "Environmental Science and Engineering, New Age International Publishers, New Delhi, 2<sup>nd</sup> Edition, 2015.
2. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. Reprint Edition, 2010.

**Reference Books**

1. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2<sup>nd</sup> Edition, 2012.
2. Santosh Kumar Garg and Rajeshwari Garg "Ecological and Environmental Studies", Khanna Publishers, Nai Sarak, Delhi, 2<sup>nd</sup> Edition, 2014.

**Additional Resources**

1. <https://nptel.ac.in/courses/122103039/38>
2. <https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909>
3. [https://nptel.ac.in/courses/105102089/air%20pollution%20\(Civil\)/Module-3/3a.htm](https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm)
4. [www.vssut.ac.in/lecture\\_notes/lecture1428910296.pdf](http://www.vssut.ac.in/lecture_notes/lecture1428910296.pdf)
5. [nptel.ac.in/courses/120108004/module7/lecture8.pdf](https://nptel.ac.in/courses/120108004/module7/lecture8.pdf)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							3					3			
CO2							3					3			
CO3							3					3			
CO4							3					3			
CO5							3					3			
	3	High					2	Medium				1	Low		

Bloom's Level	Continuous Assessment				
	IAE-I [20]	IAE-II [20]	IAE-III [20]	Attendance [10]	Activity [30]
Remember	30	20	20		
Understand	10	20	20		
Apply	10	10	10		
Analyze					
Evaluate					
Create					

  
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20ENE02	<b>Advanced Communicative English</b> (Common to all B.E./ B.Tech Programmes)	L	T	P	C
		2	0	2	3
<b>Nature of Course</b>	Humanities and Social Sciences				
<b>Pre requisites</b>	Basics of Communicative English				

**Course Objectives**

The course is intended to

- Demonstrate satisfactory control over complex structures and mechanics in English.
- Develop fluency and accuracy in oral communication.
- Communicate effectively and actively in social interactions.
- Read English at inspectional level.
- Face interviews with confidence.

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Apply knowledge of English grammar for effective communication	Remember
CO2	Make use of common English phrases and vocabulary strength.	Understand
CO3	Build self-confidence and enhance professionalism	Apply
CO4	Implement listening, reading and writing skills in real - life situations	Apply
CO5	Speak fluently in English with proper pronunciation, intonation, tone and accent.	Understand

**Course Contents****Unit – I Grammar and usage****6**

Active voice and passive voice – Prefixes and suffixes – Connotation – Clauses - If conditionals – Idioms & Phrases - Right forms of verbs– Modal Auxiliaries - Spotting errors.

**Unit - II Lexical competence****6**

Technical Vocabulary- Expressions – Frequency – Cause and effect - Words often Miss-spelled – Syntax and structure - Homophones and Homonyms- Verbal analogy - Idioms and Phrases.

**Unit - III Conversational etiquette****6**

Processes description– Tone and accent in speech– Role-play (Job-Interview) – Presentation skills – Mechanics of presentation - Telephone etiquette – Group Discussion strategy - Formal & Informal subjective and objective introduction – Body Language – Mock Interview.

**Unit – IV Listening reading and writing****6**

Listen to Scientific/Technical talks and gap filling – Listening to TED/INK Talks – Reading – “Water: The Elixir of Life” by Sir. C.V.Raman. “Progress” by St. John Ervine - Instructions and Recommendations – Letter writing formal –Job application- Report writing–Introspective report – Creative writing – Essays and Paragraphs.

**Unit – V Phonetics****6**

Production and classification of speech sound – International Phonetic Alphabet and transcriptions – Phonological rules – way and Place of articulation – Vowels, consonants and diphthongs. Specific characteristics feature of vowel sounds.

**Total: 30 Periods**

**Laboratory Components**

S.No	List of Exercises	CO Mapping	RBT
1	Role-play – Processes Description	2	Remember
2	Listening to TED/INK Talks and gap filling	4	Understand
3	Group Discussion	3	Understand
4	Articulation with pronunciation practice	3	Apply
5	Reading – Longer texts and Technical Articles (Skimming & Scanning).	4	Apply
6	Presentation skills – Mechanics of presentation	5	Understand
7	Individual presentation on given topics	5	Remember
8	Telephone etiquette	5	Understand
9	Instructions and Recommendations	5	Remember
10	Writing – General Essays.	4	Apply
11	Report writing technique- write up	4	Remember
12	Introspective report – Personal analysis	4	Understand
13	Model Job Interviews	3	Understand
14	Job Interviews(Role play)	3	Apply
15	Body Language	3	Understand

**Total: 30 Periods****Text Books**

1. Rizvi, Ashraf.M, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5<sup>th</sup> Edition, 2007.
2. Hewings. M, "Advanced English Grammar", 3rd Edition, Cambridge University Press, Chennai, 5<sup>th</sup> Edition, 2000.
3. Board of Editors, "Using English – A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2<sup>nd</sup> Edition, 2017.

**Reference Books:**

1. Raman M &Sangeetha Sharma, "Technical Communication",Oxford University Press,USA,10<sup>th</sup>Edition,2007.
2. John CunnisonCatford, "A Practical Introduction to Phonetics",Clarendon Press, Jamaica,2<sup>nd</sup> Edition, 2001.
3. Norman Whitby, Business Benchmark – "Pre-Intermediate to Intermediate, Students Book", Cambridge University Press, 1<sup>st</sup> Edition, 2006.
4. DhanavelS. P., "English and Soft Skills", 1<sup>st</sup>Edition,OrientBlackSwan Private Limited, Hyderabad, 1<sup>st</sup> Edition, 2010.

**Web reference:**

1. [https://www.coursera.org/lecture/tesol-speaking/video-2-listening-strategies-for-learners-3AeBL?utm\\_source=mobile&utm\\_medium=page\\_share&utm\\_content=vlp&utm\\_campaign=to\\_p\\_button](https://www.coursera.org/lecture/tesol-speaking/video-2-listening-strategies-for-learners-3AeBL?utm_source=mobile&utm_medium=page_share&utm_content=vlp&utm_campaign=to_p_button)
2. <blob:https://www.youtube.com/73f7256d-d302-4563-bed5-9e84c94a26ac>

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3	1	2	2		
CO2										3	1	2	2		
CO3										3	1	2	2		
CO4										3	1	2	2		
CO5										3	1	2	2		
	3	High				2	Medium				1	Low			

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory Marks				Practical		
	IAE-I [5]	IAE-II [10]	IAE -III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10 Marks]	
Remember	20	20	20		40	40	40
Understand	20	20	20		40	40	40
Apply	10	10	10		20	20	20
Analyse							
Evaluate							
Create							



20ENE03	HINDI	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basic Perceptive of Language				

**Course Objectives**

The course is intended for learners.

1. To help students acquire the basics of Hindi
2. To teach them how to converse in Hindi on simple day-to-day situations
3. To help students acquire the ability to understand a simple technical text in Hindi

**Course Outcomes**

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO.1	Construct simple sentences and use vocabulary required for day-to-day conversation	Remember
CO.2	Distinguish and understand the basic sounds of Hindi language.	Remember
CO.3	Appear for Hindi examinations conducted by Dakshin Bharat Hindi Prachar Sabha.	Remember

**Course Contents:****UNIT I: Introduction**

6

Hindi Alphabet: Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - owl Signs- Chandra Bindu & Visarg - Table of Alphabet - Vocabulary.

**UNIT II: Reading**

6

Nouns: Genders (Masculine & Feminine Nouns long vowels and short vowels - Masculine & Feminine - Reading Exercises

**UNIT III: Grammar**

6

Pronouns and Tenses: Categories of Pronouns - Personal Pronouns - Second person you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences – Interrogative Sentences.

**UNIT V : Vocabulary**

6

Classified Vocabulary: Parts of body - Relatives - Spices - Eatables - Fruit & Vegetables - Clothes - Directions - Seasons - Professions

**UNIT V: Speaking**

6

Speaking: Model Sentences and Rhymes - Speaking practice for various occasions.

**Total: 30 Periods**

**Reference:**

1. Hindi Prachar Vahini-1 by Dakshin Bharat Hindi Prachar Sabha Chennai
2. B.R.Kishore, Self Hindi Teacher for Non-Hindi Speaking People, VeeKumar Publications(P)Ltd., New Delhi, 2009
3. Videos, Stories, Rhymes and Songs.

  
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20ENE04	FRENCH	L	T	P	C
		2	0	2	0
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basic Perceptive of Language				

### Course Objectives

The course is intended for learners.

1. To prepare the students for DELFA1 Examination
2. To teach them to converse fluently in French in day-to-day scenarios

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	To help students acquire familiarity in the French alphabet & basic vocabulary	Remember
CO2	listen and identify individual sounds of French	Remember
CO3	Use basic sounds and words while speaking	Remember
CO4	Read and understand short passages on familiar topics	Understand
CO5	Understand and use basic grammar and appropriate vocabulary in completing language tasks	Understand

### Course Contents:

#### UNIT I : Entrer En Contact

6

La langue française, alphabets, les numéros, les jours, les mois. Grammaire Les verbes s'appeler, être, avoir, les articles définis, indéfinis Communication - Saluer, s'informer sur quelqu'un, demander de se présenter Lexique - Les alphabets, les nationalités, âge, les pays, les couleurs, les jours de la semaine, les mois de l'année, les professions

#### UNIT II : Partager Son Lieu De Vie

6

Les français et leur habitat, des habitations insolites Grammaire- Verbes - Conjugaison : Présent (Avoir / être / ER, IR, RE : Régulier et Irrégulier) – Adjectifs de lieu Communication - Chercher un logement, s'écrire son voisin, s'informer sur un logement Lexique - L'habitat, les pièces, l'équipement, la description physique

#### UNIT III: Vivre Au Quotidien

6

Grammaire - Articles contractés, verbes vouloir, pouvoir, devoir, adjectifs interrogatifs, future proche Communication- Exprimer ses goûts, parler de ses loisirs, justifier un choix, exprimer un envie Lexique - le temps libre et les loisirs, les saisons, les activités quotidiennes, le temps (le matin, le soir, la nuit)

#### UNIT IV: Comprendre Son Environnement Ouvrir La Culture

6

Grammaire - Verbes- Finir, Sortir, les adjectifs démonstratifs, le passé composé, l'imparfait Communication - Proposer à quelqu'un de faire quelque chose, raconter une sortie au cinéma, parler d'un film Lexique - Les sorties, la famille, art, les vêtements et les accessoires

  
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**UNIT V: GouterALaCampagne**

Grammaire La forme negative, les verbes acheter, manger, payer, articles partitifs, le pronom de quantite  
 Communication Accepter et refuse une invitation, donner des instructions, commander au restaurant  
 Lexique Les services et les commerces, les aliments, les ustensiles, argent.

**Total: 30 Periods**

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										2					
CO2										2					
CO3										3					
CO4										3					
CO5										2					
	3	High				2	Medium				1	Low			

*Signature*  
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20ENE05	GERMAN	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Social Sciences				
Pre requisites	Basic Perceptive of Language				

### Course Objectives

The course is intended for learners.

1. To help students appear for the A1 level Examination
2. To teach them how to converse fluently in German in day-to-day scenarios

### Course Outcome

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	listen and identify individual sounds of German	Remember
CO2	use basic sounds and words while speaking	Remember
CO3	read and understand short passages on familiar topics	Remember
CO4	use basic sentence structures while writing	Understand
CO5	understand and use basic grammar and appropriate vocabulary in completing language tasks	Understand

### Course Contents:

#### UNIT I Introduction

6

Introduction to German language: Alphabet - Numbers - Greetings - Days and Seasons- Working with Dictionary

#### UNIT II Pronunciation

6

Nouns - articles - Speaking about one self - Listening to CD supplied with the books, paying special attention to pronunciation

#### UNIT III Basic Syntax

6

Regular & Irregular verbs - Personal pronouns - family - Introduction to type's of sentences

#### UNIT IV Vocabulary

6

Question words-Types of Questions - Nominative case- Verb Conjugation - country - nationalities

#### UNIT V: Action Words

6

Verbs - to be & to have - conjugation - Hobbys - Framing basic Questions and answers

**Total: 30 Periods**

### Reference(s)

1. Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALS FREMDSPRACHE, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2015
2. Langenscheidt Eurodictionary - German - English / English - German, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009
3. Grundkurs, DEUTSCH Lehrbuch Hueber München, 2007

  
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Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										2					
CO2										2					
CO3										3					
CO4										3					
CO5										2					
	3	High				2	Medium				1	Low			

  
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## III SEMESTER

20MA301	Transforms and Boundary Value Problems (Common to Aero, Mech, Civil, FDT, S&F and Agri.)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

**Course Objectives****The course is intended to**

1. Familiarize linear and non-linear partial differential equations with different methods.
2. Acquire the knowledge of Fourier series and harmonic analysis.
3. Acquaint with the Fourier series techniques in solving one dimensional wave and heat equations.
4. Learn the concept of Fourier transforms and it's inverse.
5. Introduce the concept of Z-transforms and difference equations.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Classify the linear and non-linear partial differential equations.	Understand
CO2.	Illustrate the Fourier series expansion and harmonic analysis	Understand
CO3.	Interpret the solution of boundary value problems.	Understand
CO4.	Apply transform techniques to solve engineering problems.	Apply
CO5.	Determine the Z-transforms and difference equations.	Apply

**Course Contents:****UNIT I Partial Differential Equations**

12

Solution of standard types of first order non-linear partial differential equations: (i)  $f(p,q)=0$ , (ii) Clairaut's type - Lagrange's linear equation - Homogeneous linear partial differential equations of second and higher order with constant coefficients (R.H.S =Constant,  $e^{ax+by}$ ,  $\cos(ax + by)$ ,  $\sin(ax + by)$ ).

**UNIT II Fourier series and Harmonic Analysis**

12

Dirichlet's conditions – General Fourier series – Even and Odd functions - Half range Expansions – Harmonic analysis:  $\pi$ , degree and T- forms.

**UNIT III Boundary Value Problems**

12

Classification of Partial differential equations – Method of separation of variables – Solutions of one dimensional wave equation – Solutions of one dimensional heat equation.

**UNIT IV Fourier Transforms**

12

Statement of Fourier integral theorem – Fourier transforms pair: Fourier transforms and Inverse Fourier transforms – Fourier sine transforms -Fourier cosine transforms – Transforms of simple functions – Parseval's identity.

**UNIT V Z - Transforms and Difference Equations**

12

Z-transforms - Properties – Inverse Z-transform: partial fraction and Convolution theorem - Formation of difference equations –Solution of difference equations using Z – transform.

**Total: 60 Periods**

  
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**Text Books:**

1. Veerarajan. T., "Transforms and Partial Differential Equations", 3<sup>rd</sup> edition, Tata McGraw Hill Education Pvt. Ltd., 2016.
2. Grewal B.S, "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna Publishers, 2017.

**Reference Books:**

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", 9<sup>th</sup> Edition, Lakshmi Publications Pvt Ltd, 2016.
2. Ramana.B.V,"Higher Engineering Mathematics", 10<sup>th</sup> Edition, Tata Mc-Graw Hill Publishing Company Limited, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, Wiley India Publications, 2015.

**Additional References:**

1. <https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html>
2. <https://reference.wolfram.com/language/tutorial/DSolvePartialDifferentialEquations.html>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

*Signature*  
**CHAIRMAN - BOARD OF STUDIES**

20AG301	Engineering Thermodynamics for Agriculture Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Engineering Sciences				
Pre requisites	Physics for Bio-Sciences				

### Course Objectives

The course is intended to

1. Enhance the basic concepts of thermodynamics.
2. Gain knowledge on first and second law of thermodynamics
3. Learn about the basics of heat engines
4. Understand the properties of gases and vapour mixtures
5. Visualize heat transfer in thermodynamics

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the basic concepts of Thermodynamics	Understand
CO2	Illustrate the first and second law of thermodynamics	Understand
CO3	knowledge on the concepts of heat engines	Understand
CO4	Identify the properties of gases and vapour mixtures	Understand
CO5	Apply the heat transfer concepts in thermodynamics	Apply

### Course Contents:

#### Unit - I Basic Concepts of Thermodynamics

9

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

#### Unit - II First and Second Law of Thermodynamics

9

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

#### Unit – III Heat Engines

9

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

#### Unit - IV Gases and Vapour Mixtures

9

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

#### Unit - V Heat Transfer

9

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

**Total: 45 Periods**

  
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**Text Books**

1. Yunus A. Cengel and Michael A.Boles, “Thermodynamics: An Engineering Approach”, Ninth Edition, Tata McGraw-hill, 2019.
2. Michael J.Moran, Howard N.Shapiro, “Fundamentals of Engineering Thermodynamics”, Ninth Editon, John wiley & Sons, 2018.

**Reference Books:**

1. R.K.Rajput, “A Text book of Engineering Thermodynamics”, Fifth Edition, Laxmi publication (P) Ltd., 2016.
2. Nag.P.K., “Engineering Thermodynamics”, Sixth Edition, Tata McGraw hill, 2017.
3. Domkundwar.S., C.P.Kothandaraman “A course in Thermal engineering”, Sixth Edition, Dhanpatrai & co (p) Ltd, 2016.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												
CO2	3	2												
CO3	3	2												
CO4	3	2												
CO5	3	2												
	<b>3</b>	<b>High</b>			<b>2</b>	<b>Medium</b>			<b>1</b>	<b>Low</b>				

Formative assessment			
Bloom’s Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	20
Understand	30	30	20	70
Apply			10	10
Analyze				
Evaluate				
Create				

*Handwritten Signature*  
**CHAIRMAN - BOARD OF STUDIES**

20AG302	Theory of Machines	L	T	P	C
		3	0	0	3
Nature of Course	Engineering Sciences				
Prerequisites	Engineering Mechanics				

### Course Objectives

The course is intended to

1. Learn the basic terminologies in theory of machines
2. Visualizing the frictional forces and lubrication in machines.
3. Understand the velocity acceleration in machines and engines.
4. Learn about the gear and gear trains in machines.
5. Gain knowledge about flywheel and balancing in machines.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the basic terminologies in machines	Understand
CO2	Interpret the friction and lubrication in machines	Understand
CO3	Summarize the motion of cam and follower in machines	Understand
CO4	Identify the types of gears and gear trains in engines	Understand
CO5	Apply speed and energy in flywheel and their balancing in machines	Apply

### Course Contents

#### 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.

#### 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**

#### TextBooks

1. Rattan, S.S, Theory of Machines, 5th Edition, Tata McGraw-Hill, 2019.
2. Khurmi, R.S. and Gupta, J.K, Theory of Machines, 14th Edition S.Chand Publishing, 2020.

#### Reference Books

1. Bansal R.K. and Brar J.S, A Textbook of Theory of Machines, Fifth Edition, Laxmi publication (P) Ltd., 2016.
2. Cleghorn W.L, Mechanisms of Machines, Oxford University Press, 2014.
3. Thomas Beven, Theory of Machines, Third Edition, Pearson Education India, 2009.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	20
Understand	30	30	20	70
Apply			10	10
Analyze				
Evaluate				
Create				

  
**CHAIRMAN - BOARD OF STUDIES**

20AG303	Fluid Mechanics and Machineries for Agriculture Engineering	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Engineering Mechanics				

**Course Objectives:**

The course is intended to

1. Understand the properties of the fluids, behaviour of fluids under static conditions
2. Learn about the dynamics of fluids through control volume approach which gives an integrated understanding of the transport of mass, momentum and energy
3. Expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes
4. Introduce the students to various hydraulic engineering problems like open channel flows
5. Relate the theory and practice of problems in dimensional analysis and hydraulic pumps

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Identify the properties and behaviours of fluids under static condition	Understand
CO 2	Apply the dynamics of fluids through control volume approach	Apply
CO 3	Apply principles of conservation laws	Apply
CO 4	Construct the various hydraulic engineering problems	Understand
CO 5	Develop the dimensional analysis in fluid mechanics and pumps	Apply

**Course Contents****UNIT - I Properties of Fluids****9**

Definition, units of measurement - Properties of fluids: Mass density, specific weight, specific volume, specific gravity, Viscosity, vapour pressure, compressibility and elasticity, surface tension and capillarity - equation of state – perfect gas. Fluid pressure and measurement – simple and differential manometers - Mechanical gauges – calibration. Hydrostatic forces on surfaces – total pressure and centre of pressure – Horizontal, vertical and inclined plane surface - Pressure diagram – total pressure on curved surface. Archimedes principles, buoyancy, meta centre and metacentric 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 Measurement****9**

Bernoulli's equation – Applications: Venturimeter, Orifice meter, Nozzle meter, rotameter, elbow meter and pitot tube – Orifice and mouth piece – Types - Time of emptying a tank with and without inflow. Flow through pipes – Reynold's experiment – Darcy-Weisbach equation for friction head loss, Chezy's formula, Manning's formula and Hazen-William's formula - Major and minor losses in pipes – hydraulic and energy gradient line. Siphon – water hammer in pipes – gradual and sudden closure of valves

**UNIT- IV Open Channel Flow****9**

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

  
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**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 terminology: suction lift, suction head, delivery head, discharge, Priming, cavitation, specific speed and water horse power - selection of pump capacity. Types of Pumps - Centrifugal pumps: components, working, types of pumps and impellers - characteristic curves - Hydraulic ram.

**TOTAL: 45 Periods****Laboratory Components**

S.No.	List of Experiments	CO Mapping	RBT
1	Determination of mean velocity by Pitot tube	CO1	Understand
2	<b>Losses in Pipes</b> <ul style="list-style-type: none"> <li>▪ Determination of friction coefficient in pipes</li> <li>▪ Determination of losses due to bends, fittings and elbows</li> </ul>	CO2	Understand
3	<b>Flow Measurement</b> <ul style="list-style-type: none"> <li>▪ Calibration of Rotameter</li> <li>▪ Flow through Venturimeter and circular Orifice</li> </ul>	CO3	Apply
4	Flow through a Triangular Notch Flow through a Rectangular Notch	CO4	Apply
5	<b>Pumps</b> <ul style="list-style-type: none"> <li>▪ Characteristics of Centrifugal pump</li> <li>▪ Characteristics of Submersible pump</li> <li>▪ Characteristics of Reciprocating pump</li> </ul>	CO5	Apply

**TOTAL: 30 Periods****TEXT BOOKS**

1. Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machines, Tenth Edition, Laxmi Publications (P) Ltd., New Delhi, 2019.
2. Modi, P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Publishers Distributors, New Delhi, 2010.

**REFERENCE BOOKS**

1. Jain, A.K., “Fluid Mechanics” (Including Hydraulic Machines), Twelfth Edition, Khanna Publishers, 2016.
2. Garde, R.J., Fluid Mechanics through problems. New Age International Publishers (P) Ltd., New Delhi, 2011.
3. Michael A.M. Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 2008.

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs</b>															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1	2		
CO2	3	2	1									1	2		
CO3	3	2	1									1	2		
CO4	3	3	1									1	2		
CO5	3	2	1									1	2		
	3	High				2	Medium				1	Low			

<b>Summative assessment</b>							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory				Practical		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10 Marks]	
Remember	10	10	10			20	20
Understand	30	20	20			40	40
Apply	10	20	20			40	40
Analyse							
Evaluate							
Create							

20AG304	Soil Science and Engineering	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Basics of Agricultural Engineering				

**Course Objectives**

The course is intended to

1. expose the students to the fundamental knowledge on Soil physical parameters
2. learn about soil classification and their survey
3. understand the phase relationships of soil and soil compaction
4. learn the use shear strength of soil
5. develop the bearing capacity and slope stability of soils

**Course Outcomes**

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain physical properties of soil	Remember
CO2	Identify the soil classification and soil survey	Understand
CO3	develop the phase relationship of soil and soil compaction	Understand
CO4	Summarize the engineering properties of soil	Understand
CO5	Design of bearing capacity and slope stability of the soil	Apply

**Course Content:****UNIT -I Introduction and Soil Physics****9**

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

**UNIT –II Soil Classification and Survey****9**

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

**UNIT –III Phase Relationship and Soil Compaction****9**

Phase relations- Gradation Analysis- Atterberg Limits and Indices- Engineering Classification of soil – Soil compaction- factors affecting compaction- field and laboratory methods.

**UNIT- IV Engineering Properties of Soil****9**

Shear strength of cohesive and cohesionless - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Triaxial and vane shear test- -Permeability- Coefficient of Permeability- Darcy's law-field and lab methods - Assessment of seepage - Compressibility.

**UNIT - V Bearing Capacity and Slope Stability****9**

Bearing capacity of soils - Factors affecting Bearing Capacity- Shallow foundations-Terzaghi's formula- BIS standards - Slope stability-Analysis of infinite and finite slopes- friction circle method-slope protection measures.

**TOTAL: 45 Periods**

**Laboratory Components**

S.No.	List of Experiments	CO Mapping	RBT
1	Identification of rocks and minerals	CO1	Understand
2	Collection and processing of soil samples		
3	Determination of soil moisture, EC and pH		
4	Field density determination by Core Cutter and Sand Replacement method		Understand
5	Specific gravity determination by Pycnometer		Apply
6	Textural analysis of soil by International Pipette method		Apply
7	Grain size analysis by using Mechanical shaker		Apply
8	Determination of Organic carbon		Apply
9	Estimation of Gypsum requirements		Apply

**TOTAL: 30 Periods****TEXT BOOKS**

1. Modi, P.N., "Soil Mechanics and Foundation Engineering", Standard Book House, 5<sup>th</sup> Edition, New Delhi, 2019.
2. Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 16<sup>th</sup> Edition, 2017.

**REFERENCE BOOKS**

1. Alam Singh, Soil Engineering in Theory and Practice, Vol-II, CBS Publishers and Distributors, 2<sup>nd</sup> Edition, 2019.
2. Arora, K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7<sup>th</sup> Reprint 2019.
3. Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1										1	2		
CO2	3	1										1	2		
CO3	3	1										1	2		
CO4	3	1										1	2		
CO5	3	2										1	2		
	3	High				2	Medium				1	Low			

Summative assessment								
Bloom's Level	Continuous Assessment							Final Examination (Theory) [50 marks]
	Theory				Practical			
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examinations [10 Marks]		
Remember	20	20	20			20	20	
Understand	30	30	20			40	40	
Apply			10			40	40	
Analyse								
Evaluate								
Create								

*Push*  
**CHAIRMAN - BOARD OF STUDIES**

<b>20AG305</b>	<b>Surveying and Levelling</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	Basics of Agricultural Engineering				

### Course Objectives

The course is intended to

1. Introduce the principle of surveying
2. Know compass and plane table surveying in Agriculture
3. Learn about the uses of theodolite and modern surveying in irrigation projects
4. Provide knowledge on levelling in agriculture
5. Learn levelling applications in agriculture and irrigation projects

### Course Outcomes

On successful completion of the course, students will be able to

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Identify the fundamentals of surveying	Understand
CO2	Apply the compass and plane table survey in agriculture	Apply
CO3	Apply the theodolite and modern surveying in irrigation projects	Apply
CO4	Describe the levelling and its types	Understand
CO5	Apply the levelling technology in agriculture	Apply

### Course Content:

#### **UNIT - I Fundamentals and Chain Surveying 6**

Definition, Classifications and Basic principles - Equipment and accessories for ranging and chaining - Methods of ranging - Errors in linear measurement and their corrections - Traversing and Plotting - Areas enclosed by straight lines and Irregular figures - digital Planimeter.

#### **UNIT – II Compass and Plane Table Surveying 6**

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

#### **UNIT – III Theodolite and Modern Surveying 6**

Theodolite Description and Types - Horizontal and vertical angles - Temporary and Permanent adjustments - Tangential and Stadia Tacheometry – Subtense methods - Stadia constants - Traversing - Total Station- Global Positioning System (GPS).

#### **UNIT- IV Levelling 6**

Level line, Horizontal line, Datum and Bench marks - temporary and permanent adjustments – Methods of leveling: Fly levelling - Check levelling - Procedure in levelling - Reduction - Curvature and refraction - Reciprocal levelling - sources of errors in leveling- Precise levelling - Types of instruments.

#### **UNIT - V Levelling Applications 6**

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

**TOTAL: 30 Periods**



**Laboratory Components**

S.No.	List of Experiments	CO Mapping	RBT
1	<b>CHAIN SURVEYING</b> <ul style="list-style-type: none"> <li>▪ Ranging, Chaining and Pacing</li> <li>▪ Chain traversing</li> </ul>	CO1	Understand
2	<b>COMPASS SURVEYING</b> <ul style="list-style-type: none"> <li>▪ Triangulation Problem</li> <li>▪ Compass traversing</li> </ul>	CO2	Understand
3	<b>PLANE TABLE SURVEYING</b> <ul style="list-style-type: none"> <li>▪ Radiation</li> <li>▪ Intersection - Triangulation problem</li> <li>▪ Plane table traversing</li> </ul>	CO3	Apply
4	<b>THEODOLITE SURVEYING</b> <ul style="list-style-type: none"> <li>▪ Measurement of horizontal &amp; vertical angles</li> <li>▪ Tangential &amp; Stadia Tacheometry</li> </ul>	CO4	Apply
5	<b>LEVELLING</b> <ul style="list-style-type: none"> <li>▪ Fly levelling using Dumpy level</li> <li>▪ Fly levelling using Tilting level</li> <li>▪ Check levelling</li> <li>▪ Block Levelling</li> <li>▪ Radial Contouring</li> <li>▪ Demonstration of Total Station and Gps</li> </ul>	CO5	Apply

**TOTAL: 30 Periods****TEXT BOOKS**

1. Basak, N.N, Surveying and Levelling, Mc Graw Hill 2001, New Delhi, 2<sup>nd</sup> Edition 2017.
2. Punmia, P.C., Surveying, Laxmi Publications, New Delhi, 17<sup>th</sup> Edition, 2016.

**REFERENCE BOOKS**

1. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India, 2010.
2. A.M. Chandra, Plane Surveying, New Age International Publishers, 2015.
3. Rangwala, S.C., Surveying and Levelling, Charutar Publishing House, Anand, 6<sup>th</sup> Revised Edition, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	2										1	2		
CO5	3	1										1	2		
	3	High				2	Medium				1	Low			

Summative assessment								
Bloom's Level	Continuous Assessment							Final Examination (Theory) [50 marks]
	Theory				Practical			
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examinations [10 Marks]		
Remember	10	10	10			20	20	
Understand	20	20	20			40	40	
Apply	20	20	20			40	40	
Analyse								
Evaluate								
Create								

20AG306	Computer Aided Design and Drawing Laboratory	L	T	P	C
		0	0	2	1
Nature of Course	Professional Core				
Pre requisites	Engineering Graphics				

### Course Objectives

The course is intended to draft the agricultural engineering related machineries and structures manually and also by computer aided methods

1. Gain knowledge on basic drawings and design of underground pipe systems
2. Acquire knowledge on design and drawing of check dams
3. Be aware on creating various types of ploughs
4. Understand the design and drawing of post harvest technology units
5. Draw biogas plants

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Create basic drawings the underground pipeline system	Apply
CO2	Organize drawing objects on check dams	Understand
CO3	Create multiline text and hatch objects various types of poloughs	Apply
CO4	Describe dimensioning and working of Post harvest technology units	Understand
CO5	Emphasis the drawing additional objects of Biogas plant	Understand

### List of Exercises

S.No	List of Exercises	CO Mapping	RBT
1	Design and Drawing of Underground pipeline system	1	Apply
2	Design and Drawing of Check dam	2	Understand
3	Design and Drawing of Mould board plough	3	Apply
4	Design and Drawing of Disk plough	3	Understand
5	Design and Drawing of Post harvest technology units (threshers and winnowers)	4	Understand
6	Design and Drawing of Biogas plant	5	Apply

Total: 30 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1									1	2		
CO2	3	2	2									1	2		
CO3	3	2	2									1	2		
CO4	3	2	2									1	2		
CO5	3	1	1									1	2		
	3	High				2	Medium				1	Low			

Summative assessment				
Bloom's Level	Rubric based Continuous Assessment [30 marks]	Preparatory Examination [25 Marks]	Attendance [5]	End Semester Examination [40 marks]
Remember	30	40		30
Understand	70	60		70
Apply				
Analyze				
Evaluate				
Create				

20MC302	<b>INTERPERSONAL SKILLS</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
				<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Nature of Course</b>	Mandatory, Non Credit						
<b>Pre requisites</b>	Nil						

### Course Objectives

The course is intended to

1. Use interpersonal communication skills to influence and build good relationships.
2. Identify and pursue personal learning goals.
3. Obtain feedback skills in service of evolving learning goals.
4. Learn about group dynamics, behaviors and feelings
5. Enhance the communication process in both formal and informal contexts

### Course Outcomes

On successful completion of the course, students will be able to

CO.No	Course Outcome	Bloom's Level
CO1	Practice interpersonal communication skills to influence and build good relationships	Understand
CO2	Identify and pursue personal learning goals.	Understand
CO3	Give evident feedback	Understand
CO4	Reveal group dynamics and amiable behavior	Understand
CO5	Emphasis the communication process	Understand

### Course Contents:

#### Unit I: Fundamentals of Interpersonal Communication

6

Facts of communication and Interpersonal communication – culture and gender – Communication and Self disclosure – Presentation of Interpersonal perception - Learning goals – Feeling and feedback.

#### Unit II: Interpersonal communication in action

6

Nature of language – language and culture – usage and abuse of language –Positive communication -Non verbal communication - Listening strategies – Barriers of listening.

#### Unit III: Emotional Intelligence

6

Influence of emotional experience and expressions – Accepting the responsibilities and changes - Negotiation tactics - Dealing with criticism and appreciation - Collaborative Problem Solving - Resilience Building.

#### Unit IV: Transactions

6

Different types of transactions - Building Positive Relationship - Managing Conflict – Connecting across Difference –Factors hampering Interpersonal interactions – Assertiveness in communication.

#### Unit V: Essential Interpersonal Competencies

6

Behaviour – Understanding limiting behaviour - Interpersonal and small group behavior – Critical and lateral thinking-Win –Win attitude – Positive thinking – Stress management – Assertive feedback - Personal Evaluation of Interpersonal Relationship Skills

**Total 30 Periods**

## Activity Component

S.No	Name of the Exercises	CO Mapping	RBT
1	Self-Introduction	1	Remember
2	Presentation of Individual perception	2	Understand
3	Role play - Non-verbal communication - Body language	4	Apply
4	Role play - Interpersonal interactions & Assertive feedback	3	Remember
5	Group Discussion	4	Apply
6	Role play - Situational conversation ( On spot )	5	Understand

## Text Books

1. Bozeman, Jeanine C and Argile Smith, "Interpersonal Relationship Skills for Ministers" Gretna, LA: Pelican Publishing Company, 1<sup>st</sup> Edition, 2004.
2. Floyd, Kory, "Interpersonal Communication", 2d. Boston: McGraw-Hill, 2<sup>nd</sup> Edition, 2011.

## Reference Books:

1. Augsburger, David, "Caring Enough to Confront How to Understand and Express Your Deepest Feelings Towards Others", updated ed. Ventura, CA: Regal Books, 2<sup>nd</sup> Edition 2009.
2. Vohs, Kathleen D., and Eli J., Finkel, eds, "Self and Relationships: Connecting Intrapersonal and Interpersonal Processes", New York: Guilford Press, 1<sup>st</sup> Edition, 2006.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3	2	1			
CO2										3	2	1			
CO3										3	2	1			
CO4										3	2	1			
CO5										3	2	1			
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	20	20
Understand	10	10
Apply	20	20
Analyze		
Evaluate		
Create		

## IV SEMESTER

20MA401	NUMERICAL ANALYSIS AND STATISTICS (Common to Aero, Mech, S&F, Civil and Agri)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Mathematics –I & II for Mechanical, Building and Bio Sciences				

**Course Objectives****The course is intended to**

1. Introduce the basic concepts of algebraic and transcendental equations.
2. Acquire the concept of numerical techniques of differentiation and integration.
3. Study the numerical techniques in solving ordinary differential equations.
4. Acquaint with the knowledge of testing of hypothesis for small and large samples.
5. Familiarize with the basic concept on types of design of experiments used in the field of engineering.

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Illustrate the algebraic and transcendental equations.	Understand
CO2	Apply the numerical techniques of interpolation and error approximations in various intervals in real life situations.	Apply
CO3	Classify the numerical techniques for solving first and second order ordinary differential equations.	Understand
CO4	Interpret the testing of hypothesis for small and large samples.	Apply
CO5	Explain the basic concepts of classifications of design of experiments in the field of engineering	Understand

**Course Contents:****Unit I: Fundamentals of Interpersonal Communication**

6

Facts of communication and Interpersonal communication – culture and gender – Communication and Self disclosure – Presentation of Interpersonal perception - Learning goals – Feeling and feedback.

**Unit II: Interpersonal communication in action**

6

Nature of language – language and culture – usage and abuse of language –Positive communication -Non verbal communication - Listening strategies – Barriers of listening.

**Unit III: Emotional Intelligence**

6

Influence of emotional experience and expressions – Accepting the responsibilities and changes - Negotiation tactics - Dealing with criticism and appreciation - Collaborative Problem Solving - Resilience Building.

**Unit IV: Transactions**

6

Different types of transactions - Building Positive Relationship - Managing Conflict – Connecting across Difference –Factors hampering Interpersonal interactions – Assertiveness in communication.

**Unit V: Essential Interpersonal Competencies**

6

Behaviour – Understanding limiting behaviour - Interpersonal and small group behavior – Critical and lateral thinking-Win –Win attitude – Positive thinking – Stress management – Assertive feedback - Personal Evaluation of Interpersonal Relationship Skills

**Total: 60 Periods****Text Books:**

1. Grewal B.S, and Grewal J.S ” Numerical methods in engineering and science “Khanna Publishers, 10<sup>th</sup> Edition,2015.
2. Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.

**Reference Books:**

4. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, 9<sup>th</sup> Edition, 2016.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8<sup>th</sup> Edition, 2007.
6. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, New Delhi, 3<sup>rd</sup> Edition,2007.

**Additional References:**

3. <https://pvpsitrealm.blogspot.com/2016/09/higher-engineering-mathematics-by-bs.html>
4. [https://reference.wolfram.com/language/tutorial/Numerical methods.html](https://reference.wolfram.com/language/tutorial/Numerical%20methods.html)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)																
Cos	Pos												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	High				2	Medium				1	Low				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE -I (5)	IAE-II (10)	IAE-III (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

<b>20AG401</b>	<b>Heat and Mass Transfer for Agriculture Engineering</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	Engineering Mechanics				

### Course Objectives

The course is intended to

1. Understand the heat transfer mechanism and basic heat transfer laws
2. Learn about the convective heat transfer concepts
3. Expose to the applications of heat exchangers
4. Introduce the students to radiation in heat transfer
5. Able to know about the mass transfer mechanisms

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the basic heat transfer laws	Understand
CO2	Illustrate the concepts of convective heat transfer	Understand
CO3	Apply the knowledge on heat exchangers in heat transfer	Apply
CO4	Identify the radiation heat transfer techniques in agriculture engineering	Understand
CO5	Interpretation of mass transfer in agriculture engineering	Apply

### Course Contents

#### UNIT - I Conduction

**12**

Basic concepts – Mechanism of heat transfer – Conduction, convection and radiation – General differential equation of heat conduction – Fourier law of conduction – Cartesian and cylindrical coordinates – one dimensional steady state heat conduction – Conduction through plane walls, cylinders and spherical systems – Composite systems – Conduction with internal heat generation – Extended surfaces – Unsteady heat conduction – Lumped analysis – Use of Heislers chart.

#### UNIT - II Convection

**12**

Basic concepts – Convective heat transfer coefficients – Boundary Layer concept – Types of convection – Forced convection – Dimensional analysis – External flow – Flow over plates, Cylinders and spheres – Internal flow – Laminar and turbulent flow – Combined Laminar and turbulent flow – Flow over bank of tubes – Free convection - Dimensional analysis – Flow over vertical plates, horizontal plate, inclined plate, cylinders and spheres.

#### UNIT- III Phase Change Heat Transfer and Heat Exchangers

**12**

Nusselts theory of condensation – Pool boiling, flow boiling, correlations in boiling and condensation, types of heat exchangers – LMTD method of heat exchanger analysis – Overall heat transfer coefficient – Fouling Factors.

#### UNIT – IV Radiation

**12**

Basic concepts, law of radiation – Stefan Boltzmann law, Kirchoff law – Block body radiation – Grey body radiation shape factor algebra – Electrical analogy – Radiation shields – introduction to gas radiation.

#### UNIT – V Mass Transfer

**12**

Basic concepts – Diffusion mass transfer – Fick's Law of diffusion – Steady state molecular diffusion – Convective mass transfer – Momentum, heat and mass transfer analogy – Convective mass transfer correlations.

**TOTAL: 60 Periods**

### Text Books

1. Yunus A. Cengel, "Heat Transfer A Practical Approach", Fifth Edition, Tata McGraw Hill, 2015
2. Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International, New Delhi, 2009.

**References**

1. Holman, J.P., Heat and Mass transfer, Tenth Edition, McGraw Hill Education, 2017.
2. Nag, P.K., "Heat Transfer", Third Edition, Tata McGraw Hill Book Co., New Delhi, 2011.
3. Rajput, R.K., "Heat and Mass Transfer", New Edition, S.Chand Publishing, 2008.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2		1									3		
CO2	3	2		1									3		
CO3	3	2		1									3		
CO4	3	2		1									3		
CO5	3	2		1									3		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	30
Understand	20	20	20	30
Apply	10	10	10	40
Analyse				
Evaluate				
Create				



20AG402	Electrical and Electronics for Agriculture Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Engineering Sciences				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. Provide logical thinking on electrical circuits and their measurements.
2. Understand the electrical machines in Agriculture Engineering.
3. Learn semiconductor devices in Agriculture
4. Develop the digital electronics in Agriculture Engineering
5. Define the fundamentals of communication engineering

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Illustrate the electrical circuits and their measurements	Understand
CO2	Identify the various electrical machines for Agriculture	Understand
CO3	Apply the knowledge on semiconductor devices in agriculture	Apply
CO4	Test digital electronics for agriculture	Understand
CO5	Explain the communication engineering in agriculture	Understand

### Course Contents:

#### Unit I Electrical Circuits and Measurements

9

Fundamental laws of electric circuits– Steady State Solution of DC Circuits – Introduction to AC Circuits –Sinusoidal steady state analysis– Power and Power factor – Single Phase and Three Phase Balanced Circuits. Classification of instruments – Operating Principles of indicating Instruments.

#### Unit II Electrical Machines

9

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

#### Unit III Semiconductor Devices and Applications

9

Introduction - Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

#### Unit IV Digital Electronics

9

Binary Number System – Boolean Algebra theorems – Digital circuits - Introduction to sequential Circuits– Flip-Flops – Registers and Counters – A/D and D/A Conversion –digital processing architecture.

#### Unit V Fundamentals of Communication Engineering

9

Introduction – Elements of Communication Systems– Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Digital Communication - Communication Systems: Radio, Antenna, TV, Fax, ISDN, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

**TOTAL : 45 Periods**

### Text Books:

1. Kothari, D.P and I.J.Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, 4<sup>th</sup> Edition, 2019
2. Bhattacharya, S.K "Basic Electrical and Electronics Engineering", Pearson India, 1<sup>st</sup> Edition 2019

**Reference Books:**

1. Fitzgerald, A.E., David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education (India) Private Limited, 5<sup>th</sup> Edition (pdf) 2021
2. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2<sup>nd</sup> Edition, 2015
3. Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, 2013

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												
CO2	3	2												
CO3	3	2												
CO4	3	2												
CO5	3	2												
	<b>3</b>	<b>High</b>			<b>2</b>	<b>Medium</b>			<b>1</b>	<b>Low</b>				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	20
Understand	30	30	20	70
Apply			10	10
Analyze				
Evaluate				
Create				

20AG403	Tractor and Farm Engines	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Basics of Agricultural Engineering				

### Course Objectives

The course is intended to

1. Gain knowledge on tractors and their parts
2. Understand about the engine systems in agricultural machineries
3. Learn about the transmission systems in agricultural machineries
4. Exposer on hydraulic systems in agricultural machineries
5. Know about the hi-tech machineries in agriculture

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain on tractor engine and its parts	Remember
CO2	Interpretation of cooling, lubrication, fuel and electrical systems in engines	Understand
CO3	Apply the knowledge on transmission systems in engine	Apply
CO4	Illustrate the hydraulic system in agriculture machineries	Understand
CO5	Testing of tractor, power tiller and bull dozer	Understand

### Course Content:

#### UNIT – I Tractors

9

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

#### UNIT – II Engine Systems

9

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

#### UNIT – III Transmission Systems

9

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

#### UNIT- IV Hydraulic Systems

9

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

#### UNIT - V Power Tiller, Bulldozer and Tractor Testing

9

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

**TOTAL: 45 Periods**

### Laboratory Components

S.No	List of Experiments	COMapping	RBT
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.	CO1	Understand
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.	CO2	Understand

3	Field operation and adjustments of ploughs, cultivators and harrows	CO3	Apply
4	Field operation of sowing and planting equipment and their adjustments	CO3	Apply
5	Field operation of plant protection equipment	CO4	Apply
6	Field operation of threshers and their performance evaluation	CO4	Analyze
7	Studies on methods of repair, maintenance and off-season storage of farm equipment	CO4	Apply
8	Opening and reassembly of disc harrows, determination and adjustment of tilt and disc angles	CO4	Analyze
9	Hitching of agricultural implements and trailers	CO5	Analyze
10	Study and operation of bulldozer	CO5	Apply
11	Visit to agro-manufacturers	CO5	Apply

**TOTAL: 30 Periods**

**TEXT BOOKS**

1. Jain, S.C. and C.R. Rai. Farm Tractor Maintenance and Repair. Standard Publishers and Distributors, New Delhi, 2017.
2. Jagadeeshwar Sahay, Elements of Agricultural Engineering, Standard Publishers Co., New Delhi, 3<sup>rd</sup> Edition 2020.

**REFERENCE BOOKS**

1. Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.
2. Basavaraj and Srigriri. Farm Machinery and Power. New India Publishing Agency, Nipa. 2019.
3. Haynes Manuals. Cummins Diesel Engine Manual. Haynes Manuals N.America, 2020.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	2										1	2		
CO5	3	1										1	2		
	3	High				2	Medium				1	Low			

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory				Practical		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examinations [10 Marks]	
Remember	10	10	10			30	30
Understand	30	30	30			50	50
Apply	10	10	10			30	30
Analyse							
Evaluate							
Create							

20AG404	Strength of Materials for Agriculture Engineering	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Engineering Mechanics				

### Course Objectives

The course is intended to

1. Learn the fundamental concepts of Stress, Strain and deformation of solids.
2. Gain knowledge on the analysis of trusses.
3. Know the mechanism of load transfer in beams.
4. Understand the effect of torsion on shafts and springs.
5. Analyze the beam for determining slope and deflection of beams.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Determine stress and strain, principal stresses and principal planes.	Understand
CO2	Analyze plane trusses	Analyze
CO3	Determine Shear force and bending moment in beams and understand the concept of theory of simple bending.	Apply
CO4	Apply theory of torsion in analysis of circular shafts and helical springs.	Apply
CO5	Calculate the slope and deflection of beams by various methods.	Apply

### Course Content:

#### UNIT – I Stress, Strain and Deformation of Solids

9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains - Thin shells - circumferential and longitudinal stresses in thin cylinders - deformation of thin cylinder – stresses in spherical shells – Deformation of spherical shells.

#### UNIT – II Analysis of Plane Trusses

9

Determinate and indeterminate plane trusses – determination of member forces by method of joints, method of sections and method of tension coefficient.

#### UNIT – III Transverse Loading and Stresses in Beam

9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over-hanging beams. Theory of simple bending – bending stress distribution – Shear stress distribution - Flitched beams – carriage springs.

#### UNIT- IV Torsion

9

Torsion formula - stresses and deformation in circular and hollow shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs - carriage springs.

#### UNIT - V Deflection of Beams

9

Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay's method – Area moment method – Conjugate beam method.

**TOTAL: 45 Periods**

**Laboratory Components**

S.No	List of Experiments	COMapping	RBT
1	Tension test on steel rod	CO1	Understand
2	Compression test on wood	CO2	Understand
3	Double shear test on metal	CO3	Apply
4	Torsion test on mild steel rod	CO3	Apply
5	Impact test on metal specimen (Izod and Charpy)	CO4	Apply
6	Hardness test on metals (Rockwell and Brinell Hardness Tests)	CO4	Analyze
7	Deflection test on metal beam	CO4	Apply
8	Compression test on helical spring	CO4	Analyze
9	Deflection test on carriage spring	CO5	Analyze

**TOTAL: 30 Periods****TEXT BOOKS**

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013.

**REFERENCE BOOKS**

1. Rajput, R.K., "Strength of Materials", Sixth Edition, S.Chand Publishing, 2015.
2. Ramamrutham, S and Narayanan, R., "Strength of Materials", Dhanpat Rai Publishing Company (P) Ltd, 2011.
3. Subramanian, R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	3										1	2		
CO5	3	2										1	2		
	3	High				2	Medium				1	Low			

Summative assessment								
Bloom's Level	Continuous Assessment							Final Examination [50 marks]
	Theory				Practical			
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examinations [10 Marks]		
Remember	10	10	10			20	20	
Understand	30	30	30			40	40	
Apply	10	10	10			40	40	
Analyse								
Evaluate								
Create								

<b>20AG405</b>	<b>IoT in Agricultural Systems</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	Basics of Agricultural Engineering				

**Course Objectives**

The course is intended to

1. Learn the concepts of precision farming in modern agriculture.
2. Gain knowledge on the environment control systems.
3. Knowledge on agricultural systems management.
4. Understand the weather prediction models in agriculture.
5. Applications of e-governance in agriculture system.

**Course Outcomes**

On successful completion of the course, students will be able to

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Explain the concepts of remote sensing and crop modellings	Understand
CO2	Apply greenhouse and automation in agriculture	Understand
CO3	Identify the various agricultural system management	Understand
CO4	Determination of weather prediction models and forecasting	Understand
CO5	Analyze the e-governance in agricultural system	Apply

**Course Content:****UNIT – I Precision Farming****6**

Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

**UNIT – II Environment Control Systems****6**

Artificial light systems, management of crop growth in greenhouses, simulation of CO<sub>2</sub> consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

**UNIT – III Agricultural Systems Management****6**

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.

**UNIT- IV Weather Prediction Models****6**

Importance of climate variability and seasonal forecasting, Understanding and predicting world's climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.

**UNIT - V E-Governance in Agricultural Systems****6**

Expert systems, decision support systems, Agricultural and biological databases, e-commerce, e-business systems & applications, Technology enhanced learning systems and solutions, e-learning, Rural development and information society.

**TOTAL: 30 Periods**

**Laboratory Components**

S.No	List of Experiments	COMapping	RBT
1	Configuring timers for automatic switching “on and off” of irrigation systems	CO1	Understand
2	Experience with solenoid valves for pressurized irrigation	CO2	Understand
3	Using sensors for Agro meteorological measurements	CO3	Apply
4	Employing Printed Circuit Board (PCB) or Breadboard for controlling or triggering an agricultural system	CO3	Apply
5	Use of mobile apps for controlling or triggering an agricultural system	CO4	Apply
6	Construction of crop growth functions (best fit) for crop yields simulations	CO4	Analyze
7	Image processing as tool for biotic and abiotic stress identification	CO4	Apply
8	Experience with existing open source crop simulation models	CO4	Analyze
9	Exposing cloud resources for agricultural applications	CO5	Analyze
10	Developing automated agro advisory systems	CO5	Analyze

**TOTAL: 30 Periods****TEXT BOOKS**

1. Rajesh Singh. “Internet of Things (IoT) Enabled Automation in Agriculture, New India Publishing Agency, Nipa, 2018
2. Prasant Kumar Pattanaik. “Internet of Things and Analytics for Agriculture”, Springer Publishers, 1<sup>st</sup> Edition 2020.

**REFERENCE BOOKS**

1. Sriram, K Vasudevan. “Internet of Things”, Wiley India Private Limited, Noida , 2<sup>nd</sup> Edition 2020
2. Pandey, P.K. “Internet of Things and Its Application”, T.Balaji Publications, Alahabad, 2020.
3. Prasanth Goad. “Automations in Farm System”, LAP Lambert Academic Publishing, United States, 2020.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	2										1	2		
CO5	3	2										1	2		
	3	High				2	Medium				1	Low			

Summative assessment								
Bloom's Level	Continuous Assessment							Final Examination (Theory) [50 marks]
	Theory				Practical			
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examinations [10 Marks]		
Remember	20	20	20				50	50
Understand	30	30	30				50	50
Apply								
Analyse								
Evaluate								
Create								



<b>20MC401</b>	<b>SOFT SKILL</b> (Common to All Branches of B.E., / B.Tech.)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Nature of Course</b>	Mandatory Course				
<b>Pre requisites</b>	Nil				

### Course Objectives

The course is intended to

1. Improve language skills in personal and professional life.
2. Equip students with the vital communication and soft skills to succeed in the highly competitive international arena.
3. Focus on the fundamental soft skills and of their practical social and work place usage.
4. Learn to identify and overcome the barriers in interpersonal relationships.
5. Enhance employability skills and ensure career success.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Relate the significance and fundamental nature of soft skills.	Remember
CO2	Take part in a wide range of Publicspeaking and professional groupdiscussions.	Understand
CO3	Plan one's time effectively and productively, especially at work.	Apply
CO4	Make use of leadership skills to manage stress & conflict.	Apply
CO5	Organize presentation effectively and participate in interview with confidence.	Apply

### Course Contents

**Unit - I Introduction to soft skills and Interpersonal Communication** **6**  
An Introduction – Definition and Significance of Soft Skills; Interpersonal communication-types of interpersonal communication.

**Unit - II Public Speaking and Oral Communication skills** **6**  
Public Speaking: Skills, Methods, Strategies Group Discussion: Importance, Planning, Elements.

**Unit – III Time Management and Personality Development** **6**  
Time Management – concepts and essentials tips. Personality-development – meaning, SWOT analysis & goal setting- Stress and conflict management.

**Unit – IV Leadership skills and Emotional intelligence** **6**  
Leadership skills: Concept of Leadership and honing Leadership Skills- Problem-Solving Skills - Group and Ethical Decision-Making. Emotional Intelligence: Strategies to enhance Emotional Intelligence.

**Unit-V Interview Skills** **6**  
Interviewer - Interviewee perspectives - Self Introduction and Presentation: Types, Content and Essential Tips–before, during and after a presentation, Overcoming Nervousness - Mock Interview.

**Total: 30 Periods**

### Text Books

1. Managing Soft Skills for Personality Development–edited by B.N.Ghosh, McGraw Hill India, 2018.
2. English and Soft Skills–S.P. Dhanavel, Orient Black swan India, 2017

### Reference Books:

1. Soft Skill Business and Professional Communication Book by Sutapa Banerjee, 2016
2. Communication Skills Book by PushpLata and Sanjay Kumar, 2015

### WEB REFERENCE:

- <https://nptel.ac.in/courses/109/107/109107121/>

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								1	2	3		2			
CO2								1	2	3		2			
CO3								1	2	3		2			
CO4								1	2	3		2			
CO5								1	2	3		2			
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

## V SEMESTER

20AG501	Farm Structures and Green House Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Bascis of Agricultural Engineering				

**Course Objectives:**

The course is intended to

1. understand the armstead and grain storage strutures
2. design the Dairy and poulr barns
3. learn the farm feed storage structures
4. introduce the design of farm roads, water supply and sewage disposal
5. able to know about the green houses and their construction techniques

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Identify the different ypes of farm buildings	Understand
CO 2	Apply the design of dairy and poultry housings	Apply
CO 3	Applications of ffarm feed storage structures	Apply
CO 4	Construct the rural roads, waer supply and sewage disposal	Understand
CO 5	Develop the green houses and constructions	Apply

**Course Contents****UNIT - I Farmstead Planning and Grain Storage**

9

Different types of farm buildings- farm site selection- building arrangement- indigenous food grain storage structures- need for good storage- modern grain storage and concrete bins- threshing and drying floors.

**UNIT - II Housing of Dairy Cattle and Poultry**

9

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 - III Farm Feed Storage Structures and Machinery Shed**

9

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- Fencing, types of fences-fence posts.

**UNIT - IV Green Houses**

9

Importance and scope of protected cultivation - Types - Functional design - Structural material and design - Orientation, ventilation, cooling and types of cladding material - cultivation systems - nutrient film technique / hydroponics / aeroponic culture - Water management in green houses.

**UNIT- V Protected Cultivation of Vegetable and Flower Crops**

9

Protected cultivation technology for vegetable and Flower crops - Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons - Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliage and fillers – integrated pest and disease management – post harvest handling management.

**TOTAL: 45 Periods**

**TEXT BOOKS**

1. T.P. Ojha and Michael, A. M. Principles of Agricultural Engineering, Vol.-I (Sixth Edition), Jain Brothers, New Delhi. 2012.

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. II Animal Production and Aquacultural Engineering, ASAE, USA. 1999.

**REFERENCE BOOKS**

1. M.Raghupathi, Design of steel structures Tata McGraw Hill Pub. Com. New Delhi 110006, 2005  
 B.C.Punmia, Reinforced concrete structures Vol. I Laxmi publications, 7/21, Ansari Road, Dhryaganj, New Delhi 110 002, 2005.

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs</b>															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	3										1	2		
CO5	3	2										1	2		
	3	High				2	Medium				1	Low			

<b>Formative assessment</b>			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

<b>Summative Assessment</b>				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	20
Understand	20	20	20	70
Apply	10	10	10	10
Analyze				
Evaluate				
Create				

20AG502	Farm Implements and Equipments	L	T	P	C
		3	2	0	4
Nature of Course	Professional Core				
Pre requisites	Bascis of Agricultural Engineering and Crop Husbandry Laboratory				

### Course Objectives

#### The course is intended to

1. introduce the students to the working principles of farm equipments, tillage implements.
2. expose the students to farm mechanization benefits and constraints
3. Identification of components of primary and secondary tillage implements
4. utilise the power tools and mounted implements with the tractor
5. know about the tools and techniques used for a wide variety of different types of farming operations and landscaping

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	The students will be able to understand the mechanization and various equipment used in the farm for different field operations.	Understand
CO2.	Understand the different tillage implements.	Understand
CO3.	Understand the Fertilizing equipment.	Understand
CO4.	Knowledge on the different types of plant protection equipments.	Understand
CO5.	Able to effectively utilize the implements for better production	Understand

### Course Contents:

#### UNIT - I Farm Mechanization

12

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

#### UNIT - II Primary and Secondary Tillage Implements

12

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

#### UNIT - III Sowing and Fertilizing Equipment

12

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

#### UNIT - IV Weeding and Plant Protection Equipment

12

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

#### UNIT - V Harvesting Machinery

12

Harvesting - types of harvesting machinery, - Combine harvester - paddy, sugarcane, maize - grains harvester - thresher - multi crop thresher - digger - tapioca, potato, onion - cotton picker, groundnut harvester - fruit harvesting equipment,, balers, threshers.

Passed by Board of Studies meeting

*Chaitanya*  
CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

**Text Books**

1. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.,2010.
2. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005 3. Ojha T.P. and A.M. Michael. 2018. Tenth edition. Principles of Agricultural Engineering, Vol – 1. Jain Brothers, New Delhi.

**Reference(s)**

1. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.
2. Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.

**Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)**

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO2	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO3	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO4	3	3	2	2	-	3	3	2	-	-	-	-	2	-	-
CO5	3	3	2	2	-	2	2	1	-	-	-	-	2	2	-
	3	High				2	Medium				1	Low			

**Formative assessment**

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

**Summative Assessment**

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20AG503	Unit Operations in Agricultural Process Engineering	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Bascis of Agricultural Engineering				

**Course Objectives**

**The course is intended to**

1. Introduce scope, importance and key concepts of agro processing.
2. To expose the fundamentals of various unit operations of processing industries such as evaporation, concentration, mechanical separation,
3. learn about the size reduction equipments
4. knowledge on Contact equilibrium separation
5. Acquire the knowledge on distillation, membrane separation needed for the extraction of liquid fuels such as ethanol, methanol, etc.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Examine the evaporation process and types of evaporators for food industry	Understand
CO2.	Analyze the principles of filtration and mechanical separation equipment	Understand
CO3.	Identify size reduction and grinding equipment and understand the factors affecting the process	Understand
CO4.	Identify the gas-liquid and solid-liquid equilibrium concepts and factors influencing equilibrium separation process.	Understand
CO5.	Differentiate crystallization and distillation processes and identify processing equipment.	Understand

**Course Contents:**

**UNIT - I Evaporation and Concentration**

9

Unit operations in food processing - conservation of mass and energy - overall view of an engineering process- evaporation - definition - liquid characteristics -single and multiple effect evaporation- types of evaporators performance of evaporators and boiling point elevation - capacity - economy and heat balance - evaporation of heat sensitive materials.

**UNIT - II Mechanical Separation**

9

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

**UNIT - III Size Reduction and Mixing**

9

Size reduction - grinding and cutting - crushing efficiency - Rittinger's, Bond's and Kick's laws for crushing-size reduction equipment - crushers- jaw crusher, gyratory crusher-crushing rolls - grinders - hammer mills-rolling compression mills -attrition, rod, ball and tube mills - construction and operation. Mixing -Characteristics of mixtures -Measurement of mixing sample size sample compositions - Particle mixing - mixing index - Rates of Mixing - mixing times - Energy Input in mixing equipment.

**UNIT - IV Contact Equilibrium Separation**

Contact equilibrium separation processes - concentrations - gas-liquid and solid-liquid equilibrium - equilibrium concentration relationships - operating conditions-calculation of separation in contact equilibrium processes-gas absorption - rate of gas absorption - stage - equilibrium gas absorption and equipment-properties of tower packing - types - construction - flow through packed towers-extraction -rate of extraction stage equilibrium extraction.

**UNIT - V Crystallization and Distillation**

Crystallization - equilibrium -solubility and equilibrium diagram - rate of crystal growth – equilibrium crystallization-crystallization equipment - classification - construction and operation-tank, agitated batch, Swenson-Walker vacuum crystallizers-distillation - binary mixtures - flash and differential distillation-steam distillation - theory - consumption - continuous distillation with rectification - vacuum distillation - batch distillation - operation and process - advantages and limitations - distillation equipment - construction and operation - factors influencing the operation.

**Total: 45 Periods****Laboratory component**

S.No	Name of the Experiment	CO Mapping	RBT
1	Determination of thermal efficiency and economy of Tray dryer	1	Understand
2	Determination of thermal efficiency of Thin layer dryer	1	Understand
3	Determination of thermal efficiency of Solar dryer	2	
4	Determination of collection efficiency in Rubber roll Sheller	2	Understand
5	Determination of efficiency of Groundnut separation by Groundnut Decorticator	3	Understand
6	Determination of energy requirement in size reduction using the Rubber roll Sheller	3	Understand
7	Determination of energy requirement in size reduction using the Maize Sheller	4	Understand
8	Visit to a solvent extraction industry	4	Understand
9	Visit to a membrane separation based industry	5	Understand
10	Visit to a sugar industry	5	Understand

**Total: 30 Periods****Text Books:**

1. Geankoplis, C.J. 2017, Fourth edition, Transport Process and Separation process principles, Pearson India Education Service Private Limited, UP
2. K. M. Sahay and K.K. Singh, Unit operations of Agricultural Processing, Vikas Publishing house Pvt. Ltd., New Delhi, 2004. (Second revised and enlarged edition).

**Reference Books:**

1. W.L. McCabe, J.C. Smith and P. Harriot, unit operations of chemical engineering, McGraw-Hill, Inc. Kosaido printing private Ltd., Tokyo, Japan, 2001.
2. Geankoplis, C.J., Transport Process and Unit Operations, Prentice-Hall of India Private Limited, New Delhi, 1999
3. Coulson, J.M. and J.F. Richardson, Chemical Engineering, Volume I to V. The Pergamon Press, New York, 1999



**Web References:**

1. <https://www.nzifst.org.nz/resources/unitoperations/index.htm>
2. [www.nzifst.org.nz/resources/foodreactiontechnology/index.htm](http://www.nzifst.org.nz/resources/foodreactiontechnology/index.htm)
3. [www.nzifst.org.nz/resources/creatingnewfoods/index.htm](http://www.nzifst.org.nz/resources/creatingnewfoods/index.htm)
4. [www.nzifst.org.nz/resources/foodproductdevelopment/index.htm](http://www.nzifst.org.nz/resources/foodproductdevelopment/index.htm)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
	3	High				2	Medium					1	Low		

Summative Assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50]
	Theory				Practicals		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10]	Model Examination [10Marks]	
Remember	30	20	10		20	20	40
Understand	10	20	30		20	10	40
Apply	10	10	10		10	20	20
Analyze							
Evaluate							
Create							

20AG504	Hydrology, Soil and Water Conservation Engineering	L	T	P	C
		3	0	2	4
<b>Nature of Course</b>		Professional Core			
<b>Pre requisites</b>		Bascis of Agricultural Engineering			

**Course Objectives**

The course is intended to

1. gain knowledge on meterological measurements
2. enhance the basic concepts of runoff in hydrology
3. learn about the basics of flood and drought
4. understand the properties of reservoir
5. visualization of groundwater and their management

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Gain knowledge on the basic concepts of precipitation	Understand
CO2	Acquire knowledge on runoff	Understand
CO3	Have adequate knowledge on the concepts of flood and drought	Understand
CO4	Understand the properties of reservoir	Understand
CO5	Understand the groundwater status and their management	Understand

**Course Contents:**

**UNIT - I Precipitation and Abstractions**

9

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

**Unit - II Runoff**

9

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation - Strange’s table and SCS methods - Stage discharge relationships - flow measurements - Hydrograph - Unit Hydrograph - IUH

**Unit - III Flood and Drought**

9

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

**Unit - IV Reservoirs**

9

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

**Unit - V Groundwater and Management**

9

Origin of groundwater - Classification and types - properties of aquifers - governing equations - steady and unsteady flow - groundwater flow estimation - artificial recharge - RWH in rural and urban areas.

**Total: 45 Periods**

**Laboratory Components**

S.No.	List of Experiments	CO Mapping	RBT
1	1. Visit to meteorological observatory and study of different instruments 2. Design of rain gauge network 3. Exercise on intensity-duration-frequency curves	CO1	Understand

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	4. Exercise on depth-area-duration and double mass curves		
2	5. Analysis of rainfall data and estimation of mean rainfall by different methods 6. Exercise on frequency analysis of hydrological data	CO2	Understand
3	7. Estimation of erosivity index and erodibility index 8. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE	CO3	Apply
4	9. Determination of rate of sedimentation and storage loss in reservoir/tanks	CO4	Apply
5	10. Field visit to study different soil conservation structures & gully control structures	CO5	Apply

**TOTAL: 30 Periods**

**Text Books**

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

**Reference Books:**

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)**

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3											
CO2	3	2	3											
CO3	3	2	3											
CO4	3	2	3											
CO5	3	2	1											
	<b>3</b>	<b>High</b>			<b>2</b>	<b>Medium</b>			<b>1</b>	<b>Low</b>				

**Summative Assessment**

Bloom's Level	Continuous Assessment						Final Examination (Theory) [50]
	Theory				Practicals		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10]	Model Examination [10Marks]	
Remember	30	20	10		20	20	40
Understand	10	20	30		20	10	40
Apply	10	10	10		10	20	20
Analyze							
Evaluate							
Create							

20AG505	Farm Machinery Laboratory	L	T	P	C
		0	0	4	2
Nature of Course	Professional Core				
Pre requisites	Bascis of Agricultural Engineering				

**Course Objectives**

**The course is intended to**

1. introduce the students to the working principles of farm equipments, tillage implements.
2. expose the students to farm mechanization benefits and constraints
3. Identification of components of primary and secondary tillage implements
4. utilise the power tools and mounted implements with the tractor
5. know about the tools and techniques used for a wide variety of different types of farming operations and landscaping .

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	The students will be able to understand the mechanization and various equipment used in the farm for different field operations.	Understand
CO2.	Understand the different tillage implements.	Understand
CO3.	Understand the Fertilizing equipment.	Understand
CO4.	Knowledge on the different types of plant protection equipments.	Understand
CO5.	Able to effectively utilize the implements for better production	Understand

**Course Contents:**

1. Familiarization with different makes and models of agricultural tractors
2. Identification of functional systems including fuels system, cooling system
3. Identification of functional systems including transmission system, steering and hydraulic systems
4. Study of maintenance points to be checked before starting a tractor
5. Dismantling, parts identification and assembly of different components of knapsack power sprayer.
6. Dismantling and assembling of different types of disc harrows and study of parts - Operation in the field.
7. Design of manually operated planters – power transmission system and furrow opener.
8. Practice of operating a tillage tool (mould-board plough/ disc plough/ Harrow/ Cultivator)
9. Study of field patterns while operating a tillage implement
10. Dismantling and assembling of different types of disc harrows and study of parts - Operation in the field.
11. Hitching & De-hitching trail type implement to the tractor
12. Fuel saving tips. Preparing the tractor for storage.

**Total: 30 Periods**

**LIST OF EQUIPMENT REQUIRED**

1. Tractor – 1 no.
2. Disc plough – 1 no
3. Disc harrow – 1 no.
4. Paddy Transplanter – 1 no.
5. Seed drill – 1 no.
6. Sprayer – 1 no.
7. Mower – 1 no.
8. Weeder -1 no.
9. Combine harvester -1 no. (optional) – can be had as demonstration

**Text Books :**

1. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.,2010.
2. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005 3. Ojha T.P. and A.M. Michael. 2018. Tenth edition. Principles of Agricultural Engineering, Vol – 1. Jain Brothers, New Delhi.

**Reference(s) :**

1. Donnell Hunt. 2013. Farm power and machinery management. Scientific International Pvt. Ltd. New Delhi.
2. Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO2	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO3	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO4	3	3	2	2	-	3	3	2	-	-	-	-	2	-	-
CO5	3	3	2	2	-	2	2	1	-	-	-	-	2	2	-
	3	High				2	Medium				1	Low			

Summative assessment				
Bloom's Level	Rubric based Continuous Assessment [30 marks]	Preparatory Examination [25 Marks]	Attendance [5]	End Semester Examination [40 marks]
Remember	30	40		30
Understand	70	60		70
Apply				
Analyze				
Evaluate				
Create				

## VI SEMESTER

20AG601	Agricultural Economics	L	T	P	C
		3	0	0	3
Nature of Course	Humanities and Social Sciences				
Pre requisites	Nil				

**Course Objectives:**

The course is intended to

1. Understand the nature and scope of economics and agricultural economics.
2. Learn about the basic concepts of utility and demand.
3. Gain knowledge about the concept of production and supply.
4. Understand the concept of distribution and profit.
5. Learn about the concept and characteristics of Macroeconomics.

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the basics of economics and Agricultural economics.	Understand
CO2	Constructing the consumption theory- utility and demand.	Understand
CO3	Illustrate about theory of production and supply.	Understand
CO4	Infer about the theory of exchange and distribution.	Understand
CO5	Summarize the basics of macroeconomics.	Understand

**Course Contents****UNIT - I Introduction**

9

Nature and Scope of economics-Definitions of Economics-Divisions of Economics - Microeconomics and Macroeconomics- Agricultural Economics: Definition and scope - Basic concepts- Goods and services- Characteristics and classification.

**UNIT - II Theory of Consumption**

9

Utility: Definition, Measurement: Cardinal and ordinal utility- Marginal utility - Law of Diminishing Marginal Utility and Law of Equi-marginal Utility- Demand: Definition, Kinds of demand, Law of Demand- Determinants of demand- Elasticity of Demand- Factors influencing elasticity of demand- Importance of elasticity of demand- Consumer surplus: Definition and Importance.

**UNIT - III Theory of Production**

9

Concept of production- Factors of production- Land: Characteristics of land - Labour: Characteristics of labour, Division of labour- Capital: Characteristics of capital, Capital formation - Entrepreneur: Characteristics and functions of entrepreneur- Supply: definition, Law of Supply- Factors influencing supply - Elasticity of Supply.

**UNIT - IV Exchange and Theory of Distribution**

9

Exchange- Distribution- basic concept of distribution- Pricing of factors of production - Marginal productivity theory of distribution - Rent and Quasi rent - Wages: Real wage and money wage - Interest: Pure interest and gross interest - Profit: Meaning of economic profit.

**UNIT - V Macroeconomic Concepts**

9

Macroeconomics: Definition and concept - National Income: Concepts - GNP, GDP, NNP- Disposable income and Per capita income - Money: Definition, Types and functions of money - Inflation: Meaning, types of inflation - Public Finance: Meaning, Principles - Public Revenue: Meaning, Classification of taxes- Welfare Economics.

**TOTAL: 45 Periods**

Passed by Board of Studies meeting

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Approved in Academic Council Meeting

**Text Books:**

1. Subba Reddy, S., Raghu Ram, P., Neelakanta Sastry T.V and Bhavani Devi, I., "Agricultural Economics" Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.
2. Singh, C.B., Singh, R.K., " A Text book of Agricultural Economics" Laxmi Publications pvt. Ltd., New Delhi, 2011.

**REFERENCES:**

1. Dewett, K. K. 2004. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Samuelson, P. 2004. Economics, (18/e), Tata Mc-graw-Hill, New Delhi
3. Seth, M. L. 2005. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi.

**WEB SOURCE:**

1. <https://courses.lumenlearning.com/boundless-economics/chapter/introduction-to-the-agriculture-economics/>
2. [https://www.iari.res.in/index.php?option=com\\_content&view=article&id=621&Itemid=243](https://www.iari.res.in/index.php?option=com_content&view=article&id=621&Itemid=243)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	3													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	20
Understand	30	30	20	70
Apply			10	10
Analyze				
Evaluate				
Create				

<b>20AG602</b>	<b>Irrigation and Drainage Engineering</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	Basics of Agricultural Engineering				

**Course Objectives**

The course is intended to

1. Gain knowledge on Irrigation requirement
2. Understand about the method of irrigation system
3. Learn about the diversion structures in agriculture
4. Exposer on canal irrigation and command area development
5. Know about the agriculture drainage and system

**Course Outcomes**

On successful completion of the course, students will be able to

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Explainthe irrigation requirement	Remember
CO2	Interpretation of method of irrigation system	Understand
CO3	Apply the knowledge on diversion structure in agriculture	Apply
CO4	Illustrate the canal irrigation and command area developepment	Understand
CO5	Know about thr agriculture drainage and system	Understand

**Course Content:**

**UNIT - I Irrigation Requirement** 9

Introduction- Development and Utilization in India and Tamil Nadu-Irrigation –duty and delta - Moisture use of crop, Cropwater requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency,Irrigationefficiencies.

**UNIT - II Methods of Irrigation** 9

Methods of Irrigation – Surface and Subsurface methods – Drip and Sprinkler - Hydraulics anddesign - Materials for lining watercourses and field channel,- Water control and diversion structure - Underground pipeline irrigationsystem

**UNIT - III Diversion and Impounding Structures** 9

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

**UNIT - IV Canal Irrigation and Command Area Development** 9

Classification of canals- Alignment of canals – Design of irrigation canals - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlet, Escapes–Lining and maintenance of canals – Excess irrigation and water logging problem - Command area - Concept, Components of CADP – Role of water distribution system and operation – rotational irrigation system.

**UNIT - V Agricultural Drainage and System** 9

Agriculturaldrainage-Drainagecoefficient;principlesofflowthroughsoils,Darcy" slaw –i nfiltrationtheory, 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**



**TEXTBOOKS:**

1. DilipKumarMajumdar, "IrrigationWaterManagement", Prentice-HallofIndia, NewDelhi, 2008.
2. Michael, A.M., "IrrigationEngineering", VikasPublishers, NewDelhi, 2008.
3. Garg, S.K., "IrrigationEngineering", LaxmiPublications, NewDelhi, 2008.

**REFERENCES:**

1. Basak, N.N., "IrrigationEngineering", TataMcGraw-HillPublishingCo, NewDelhi, 2008.
2. Murthy, V.V.N. Landandwatermanagement, Kalyanipublishing, NewDelhi, 1998.
3. Bhattacharya, A.K., andMichael, A.M., "LandDrainage–Principles, MethodsandApplications", KonarkPublishersPvt.Ltd., NewDelhi, 2003.

**WEBSITE REFERENCES**

1. <https://www.agriculturejournals.cz/web/rae/>
2. <https://sciendo.com/journal/AGRICENG>

**Laboratory Components**

S.No	List of Experiments	COMapping	RBT
1	To study various instruments in the Meteorological Laboratory	CO1	Understand
2	Determination of infiltration rate using double ring and digital infiltrometer	CO2	Understand
3	Determination of soil moisture wetting pattern for irrigation scheduling	CO3	Apply
4	Design of Drip irrigation system	CO3	Apply
5	Design of sprinkler irrigation system	CO3	Apply
6	Measurement of flow properties in open irrigated channels (flumes, notches)	CO4	Apply
7	Evaluation of surface irrigation	CO4	Analyze
8	Determination of uniformity coefficient for drip irrigation system	CO4	Analyze
9	Determination of uniformity coefficient for sprinkler system (catch can method)	CO5	Apply
10	To conduct experiment on disc filter for micro irrigation systems	CO5	Apply

**TOTAL: 30 Periods**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1	2		
CO2	3	2	1									1	2		
CO3	3	2	1									1	2		
CO4	3	3	1									1	2		
CO5	3	2	1									1	2		
	3	High				2	Medium				1	Low			

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory				Practical		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10 Marks]	
Remember	10	10	10			30	30
Understand	30	30	30			50	50
Apply	10	10	10			30	30
Analyse							
Evaluate							

Create							
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20AG603	Food and Dairy Engineering	L	T	P	C
		3	0	2	4
Nature of Course		Professional core			
Pre requisites		Basics of Agricultural engineering			

**Course Objectives**

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

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain physical, mechanical, thermal, rheological and electrical properties of food material and appraise their importance in food processing	Understand
CO2	Distinguish various thermal treatment techniques for food products and select suitable thermal processing method for food products based on their properties	Understand
CO3	Compare food drying systems and assess their limitations in applying different food products	Understand
CO4	Explain physical, chemical and thermal properties of milk and compare milk processing Techniques	Understand
CO5	Design various milk processing equipment and evaluate their performance	Understand

**Course Contents:**

**Unit - I Basic Properties of Food Materials**

9

Constituents of food and their energy values - Physical, mechanical, thermal, rheological, electrical and physico-chemical properties of food materials- texture of food materials - definition - Terminologies - viscometry - basic concepts - Concentrations of foods - freeze concentration - membrane concentration.

**Unit - II Thermal Processing of Foods**

9

Thermal processing of foods - product-time-temperature relationships - cooking, blanching pasteurization techniques- UHT Processing - sterilization of solid and liquid foods- interaction of heat energy on food components - Thermal Death Time Curves-loss of nutrient in Newtonian and non-Newtonian liquid foods-batch and continuous sterilization equipment.Preservation by retort processing - principles and applications - microwave and radio frequency heating in food processing- Canning- Aseptic packaging.

**Unit - III Drying and Dehydration**

9

Food spoilage - causes for spoilage -Moisture content - free moisture - bound and unbound moisture - equilibrium moisture content - Water activity -

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sorption behaviour of foods - types of dryers - drum, spray, dryers-advantages and disadvantages - dehydration - methods of dehydration osmotic dehydration.

**Unit - IV Milk Processing****9**

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

**Unit - V Dairy Equipment and Products****9**

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

**Total: 45 Periods****Laboratory component**

S.No	Name of the Experiment	CO Mapping	RBT
1	Estimation of moisture content of given food material	1	Understand
2	Determination of Rehydration ratio of dehydrated food	1	Understand
3	Determination of Oil Content of given food material by using the Oil Expeller	2	Understand
4	Determination of drying rate in tray dryer	2	Understand
5	Experiments on construction and operation of butterchurn and working accessories	3	Understand
6	Study the properties of milk	3	Understand
7	Determination of separation efficiency of cream separator	4	Understand
8	Determination of the acidity of the given sample of milk	4	Understand
9	Visit to dairy industry	5	Understand
10	Visit to food industry (Any one)	5	Understand

**Total: 30 Periods****Text Books:**

1. R. Paul Singh and R. Dennis Heldmen, Introduction to food engineering Third Edition, Acedamic press, London, 2004.
2. H.G. Kessler, Food Engineering and dairy Technology, Freising, Germany, Verlag A Kessler, 1981.
3. R.M. Teledo, Fundamentals of Food Process Engineering, 2<sup>nd</sup> Edition, Van Nostrand Reinhold, New York, 1991.

**Reference Books:**

1. Norman N. Potter and Joseph H. Hotchkiss, Food Science, Fifth Edition, Food Science Text Series, ISBN: 978-1-4613-7263-9 (Print) 978-1-4615-4985-7 (Online), 1995.
2. Gordon L. Robertson, Food Packaging- Principles and Practice Marcel Dekker Inc, USA, 1993.
3. Sukumar De, Outlines of Dairy: Technology, Oxford University Press, 2001.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												
CO2	3	2												
CO3	3	2												
CO4	3	2												
CO5	3	2												
	3	High			2	Medium			1	Low				

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory				Practical		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10]	Model Examination [10]	
Remember	10	10	10			30	30
Understand	30	30	30			50	50
Apply	10	10	10			30	30
Analyse							
Evaluate							
Create							

20AG604	Renewable Energy Resources Technology	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Engineering Thermodynamics for Agriculture Engineering				

**Course Objectives**

The course is intended to

1. Acquire the knowledge of energy conversion and energy storage.
2. Learn the concept of solar energy and applications.
3. Learn the concept of wind energy and types of wind mills.
4. Learn the concept of Geothermal and Tidal power.
5. Introduce the concept of Bio mass energy.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the need of energy conversion and the various methods of energy storage.	Understand
CO2.	Explain the concept and field applications of solar energy.	Understand
CO3.	Identify Winds energy as alternate form of energy and to know how it can be tapped.	Understand
CO4.	Understand the Geothermal & Tidal energy, its mechanism of production and its applications.	Understand
CO5.	Explain bio gas generation and its impact on environment.	Understand

**Course Contents:**

**UNIT - I Energy Conservation and Storage**

9

Energy - Energy Sources & their Availability - Importance of Renewable Energy Resources - Principles of energy conservation - Energy storage- Necessity of energy storage - Energy storage methods - Mechanical Energy storage - Pumped storage - Compressed air storage - Electrical Storage - Lead Acid Battery - Chemical Storage - Energy storage via hydrogen - Electromagnetic energy storage.

**UNIT - II Solar Energy**

9

Solar energy – Introduction - Solar constant - Solar Radiation at the Earth's surface - Solar collectors – Classification - liquid flat plate collector – construction - Concentrating collector - Focusing and non - focusing type. Applications of Solar Energy - Solar water heater - Solar Cooker - Box type - Solar dryer - Solar greenhouse - Summer and winter greenhouse - solar electric power generation - Solar photovoltaic.

**UNIT - III Wind Energy**

9

Introduction - Basic Principles of Wind energy conversion - The nature of wind- The power in the wind (No derivations) - Forces on the Blades (No derivations) - Site Selection considerations - Basic components of a wind energy conversion system (WECS) - Advantages & Limitations of WECS - Wind turbines (Wind mill) - Horizontal Axis wind mill - Vertical Axis wind mill-performance of wind mills - Environmental aspects.

**UNIT - IV Geothermal and Tidal Energy**

9

Geothermal Sources - Hydro thermal Sources - a. Vapor dominated systems b. Liquid dominated systems - Prime movers for geothermal energy conversion -Tidal Energy - Basic Principles of Tidal Power - Components of Tidal Power Plants - Schematic Layout of Tidal Power house - Advantages & Limitations of Tidal power.

**UNIT - V Biomass Energy**

9

Introduction - Biomass conversion techniques - Biogas Generation - Factors affecting biogas Generation - Types of biogas plants - Advantages and disadvantages of biogas plants - urban waste to energy conversion - MSW incineration plant.

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**Laboratory Components**

S.No	List of Experiments	CO Mapping	RBT
1	Testing of Battery	CO1	Apply
1	Testing of solar water heater	CO2	Apply
2	Testing of natural convection solar dryer	CO2	Apply
3	Study on Solar power and I-V Characteristics	CO2	Understand
4	Testing of solar photovoltaic water pumping system	CO2	Apply
5	Automatic weather station – Analysis of wind data and prediction	CO3	Understand
6	Characterization of biomass – proximate analysis	CO4	Analyze
7	Determination of caloric value of fuels – solids and gases	CO5	Apply
8	Design of KVVC / Deenbandhu model biogas plant	CO5	Apply
9	Study of UASB biomethanation plant	CO5	Understand
10	Purification of biogas – CO <sub>2</sub> and H <sub>2</sub> S removal	CO5	Analyze
11	Testing of biogas/producer gas engines	CO5	Apply

**TOTAL: 30 Periods****Text Books:**

1. Rai G.D., "Non-Conventional Energy Sources", Khanna Publishers, 2019.
2. Twidell & Wier., "Renewable Energy Resources", CRC Press (Taylor & Francis), 2021.
3. Nijaguna, B. T., "Biogas Technology" New Age International Pvt. Ltd., New Delhi, 2016.

**Reference Books:**

1. Kothari D.P, Singhal K.C., "Renewable energy sources and emerging technologies", P.H.I, New Delhi, 2022.
2. Bhatia S.C, Gupta R.K., "Text Book of Renewable Energy", Woodhead Publishing India PVT. Limited, 2019.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	2	-	-	2	3	-	-	-	-	2	1	-	-
CO2	2	-	2	-	-	2	3	-	-	-	-	2	1	-	-
CO3	2	2	2	-	-	2	3	-	2	-	2	2	-	-	-
CO4	2	-	2	-	-	2	3	-	-	-	-	2	1	-	-
CO5	2	-	2	-	-	2	3	-	-	-	-	2	1	-	-
	3	High				2	Medium				1	Low			

Summative assessment							
Bloom's Level	Continuous Assessment						Final Examination (Theory) [50 marks]
	Theory				Practical		
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [10 Marks]	Model Examination [10 Mark]	
Remember	10	10	10			20	20
Understand	30	20	20			40	40
Apply	10	20	20			40	40
Analyse							
Evaluate							
Create							

20AG611	Mini Project	L	T	P	C
		0	0	2	1
Nature of Course	Employability Enhancement Courses				
Pre requisites	Design of Basic Machine Elements, CADD Laboratory				

**Course Objective**

The course is intended to

1. To practice the fundamental Agriculture Engineering concepts and principles in addressing a real time situation autonomously or in a team.
2. To develop an ability to solve problem by making a literature review and finding a solution for the same.
3. To Study various types of methodology based on the problem.
4. To create platform to communicate and present the ideas in written and oral form.
5. To create a team work to exhibit the knowledge and skills to contribute to the society.

**Guideline for Review and Evaluation**

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry.

A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department.

At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Use of design principles and develop conceptual and engineering design of any components.	Apply
CO2.	Ability to fabricate any components using different manufacturing tools.	Apply
CO3.	The students will be able to Design engineering solutions to agricultural problems utilising a systems approach and develop projects.	Apply
CO4.	The students will be able to Communicate effectively and to present ideas clearly.	Apply
CO5.	The students will be able to demonstrate the knowledge, skills and work as a team to achieve common goal.	Apply

**Total: 30 Periods**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	3	-	-	3	-	-	-	-	-	-
CO4	3	3	3	3	-	-	3	-	-	3	-	-	-	-	-
CO5	-	-	3	3	-	3	-	3	-	-	-	-	-	-	-
	3	High				2	Medium						1	Low	

	Continuous Assessment [50 Marks]						Final Viva Voce Examination [50 Marks]
	Review I [10]	Review II [10]	Review III [10]	Report [10]	Viva [10]	Total CA [50 Marks]	
<b>Marks</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>2</b>	<b>20</b>	<b>100</b>	<b>50</b>



20AG612	Internship	L	T	P	C
		2 Weeks			1
Nature of Course	Employability Enhancement Courses				
Pre requisites	Fundamental of Agriculture Engineering				

**Course Objective**

1. 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.
2. To gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.
3. To create an opportunity to develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organisational setting.

**Guideline for Review and Evaluation**

The students individually undertake training in reputed engineering companies / Govt organisations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration.

At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Integrate theory and practice.	Apply
CO2.	Learn to appreciate work and its function in the economy.	Apply
CO3.	Acquire employment contacts leading directly to a full-time job following graduation from college.	Apply

**Total: 2 Weeks**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	3	3	-	-	-	-	-	-	2	2	-
CO2	3	3	-	-	3	3	-	-	-	-	-	-	2	2	-
CO3	3	3	-	3	-	3	-	-	3	-	-	-	2	2	-
CO4	3	3	3	3	-	-	3	-	-	3	-	-	2	2	-
	3	High				2	Medium				1	Low			

	Continuous Assessment [100 Marks]			
	Review -1	Review -2	Report / Case Study	Total
Marks	40	40	20	100

## VII SEMESTER

20AG701	Entrepreneurship in Agricultural Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Agricultural Economics				

**Course Objectives:**

The course is intended to

1. To develop and strengthen the entrepreneurial quality and motivation of learners.
2. To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
3. To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
4. To empower the learners to run a Technology driven business efficiently and effectively
5. To develop and understand the various trends in agri business system

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Learn the basics of Entrepreneurship	Understand
CO 2	Understand the Job opportunities in Industries relating to Technopreneurship	Understand
CO 3	Learn the applications and successful technopreneurs	Understand
CO 4	Understand the scope and concepts in agri business systems	Understand
CO 5	Exposed to various trends in agricultural business management	Apply

**Course Contents****UNIT - I Introduction to Entrepreneurship****9**

Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development

**UNIT - II Fundamentals of Technopreneurship****9**

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristic of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

**UNIT - III Applications of Technopreneurship****9**

Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship – Success Stories of Technopreneurs - Case Studies.

**UNIT - IV Concepts of Agricultural Business****9**

Agri-business - scope, characteristics, types. Management - importance, definition, management and administration, management thoughts, Small business - characteristics and stages of growth - Management functions - planning, organizing, leading.

**UNIT - V: Agri Business Organization****9**

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

**TOTAL: 45 Periods**

Passed by Board of Studies meeting

Approved in Academic Council Meeting

*Chauhan*  
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**TEXT BOOKS**

1. S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 2021.
2. Donal F Kuratko Entrepreneurship (11th Edition) Theory, Process, Practice by Published 2019 by Cengage Learning.

**REFERENCE BOOKS**

1. Daniel Mankani. 2003. Technopreneurship: The successful Entrepreneur in the new Economy. Prentice Hall.
2. Edward Elgar. 2007. Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe. Edi: Jan Ulijn, Dominique Drillon, and Frank Lasch. Wiley Pub.
3. Lang, J. 2002, The High Tech Entrepreneur's Handbook, Ft.com.
4. David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution.
5. Harper Business, [https://fanny.staff.uns.ac.id/files/2013/12/Technopreneur – BASE EDUCATION-REVOLUTION.pdf](https://fanny.staff.uns.ac.id/files/2013/12/Technopreneur%20BASE%20EDUCATION-REVOLUTION.pdf).

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1										1	2		
CO2	3	1										1	2		
CO3	3	1										1	2		
CO4	3	1										1	2		
CO5	3	1										1	2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative assessment				
Bloom's Level	Internal Assessment Examinations			Final Examination [60 marks]
	IAE-I [5]	IAE-II [10]	IAE-III [10]	
Remember	20	10	10	20
Understand	20	20	20	40
Apply	10	20	20	40
Analyse				
Evaluate				
Create				

Passed by Board of Studies meeting

*Boeshaing*  
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20AG702	Ground Water and Well Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Prerequisites	Irrigation and Drainage Engineering				

**Course Objectives**

The course is intended to:

CO1: To introduce the concepts of groundwater, its availability, assessment and utilization.

CO2: To understand the well hydraulics so as to locate wells for extraction of groundwater.

CO3: To gain knowledge on design characteristics of wells.

CO4: To understand the theory behind construction and management of wells.

CO5: To know the techniques and importance of groundwater management

**Course Outcomes**

On successful completion of the course the students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Know the technical aspects of groundwater availability, assessment and utilization	Understand
CO2.	Able to locate and effectively utilize the groundwater	Understand
CO3.	Know about the various design characteristics of wells	Remember
CO4.	Familiarize the theory behind construction and management of wells	Understand
CO5.	Able to increase groundwater level and effective utilization	Understand

**Course Contents:**

**UNIT-I Hydrogeologic Parameters**

9

Water Balance – Distribution of subsurface water – Water bearing properties of Rocks – Types of Aquifers–Aquifer properties Estimation–Pumping test:–Permeability, Specific yield, transmissivity and Storage coefficient – Methods of Estimation – Ground water table fluctuation method–GEC Norms– Groundwater development and potential in India–Geophysical Investigation-surface methods, subsurface methods.

**UNIT –II Well Hydraulics**

9

Darcy's law–recuperation test–leak yartesian aquifer–unsteady radial flow–unconfined aquifer – image well theory–partial lypenetrating wells-well losses–step draw down test.

**UNIT –III Well Design**

9

Design characteristics – Design of wells - Well diameter, depth and Well screen design – Materials for well screens – Well casing – Design of collector wells and Infiltration gallery – Dug wells versus tube wells.

**UNIT –IV Well Construction and Maintenance**

9

Types of wells – Well drilling - Boring, Jetting – Rotary drilling, Hammer drilling - Construction – Installation of pipes and screens - Well development, Completion and disinfection – Well maintenance – Well performance test – Well effectiveness – Well loss – Pumping equipment – Rehabilitation of wells and borewells.

**UNIT –V Special Topics**

9

Artificial Recharge Techniques- Seawater Intrusion-Introduction to Ground water modeling Techniques-Groundwater pollution and legislation-Ground water quality-Dose response assessment-Risk analysis.

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**Total:45 Periods**

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**Text Books:**

1. Karanth,K.R.Ground water Assessment, Development and Management.TataMc-GrawHill,2015.
2. Raghunath,H.M.2011.Groundwater, New Age International(P)Ltd.,NewDelhi.

**Reference(s)**

1. MohammadKaramouz, Rastogi,A.K.Ground water Hydrology,Engineering Planning,and Management,CRC Press TaylorandFrancis group,2020.
2. Agarwal,V.C,Ground water Hydrology,Eastern Economy Edition,2012.
3. Giordano,M.andVillholth,K.G.2007.TheAgricultural Groundwater RevolutionVolume3.
4. DavidKeith Todd. Groundwater Hydrology,JohnWiley&Sons, Inc.2007.

Mapping of Course Outcomes(COs) with Programme Outcomes(POs) Programme Specific Outcomes(PSOs)														
Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2			1	2	1				3	2	1
CO2	3	2	3			1	2	1				3	2	1
CO3	3	2	2			1	2	1				3	2	1
CO4	3	2	2			1	2	1				3	2	1
CO5	3	2	2			1	2	1				3	2	1
	3	High			2	Medium			1	Low				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE1 (5)	IAE2 (10)	IAE3 (10)	
Remember	20	20	20	20
Understand	30	20	30	70
Apply		10		10
Analyze				
Evaluate				
Create				

*B. S. Srinivasan*  
**CHAIRMAN - BOARD OF STUDIES**

20AG703	Post Harvest Technology	L	T	P	C
		3	0	2	4
Nature of Course		Professional Core			
Pre requisites		Unit Operations in Agricultural Processing			

### Course Objectives

The course is intended to

1. The students would be exposed to fundamental knowledge in engineering properties of agricultural materials
2. Learn about the different drying process.
3. Understand the different cleaning and grading systems.
4. Gain knowledge on shelling and handling process of post harvested materials.
5. Know about different Post Harvest operations and processing methods of harvested crops and storage of crops.

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the importance of post harvest processing and determine moisture content of products	Understand
CO2	Perform drying of agricultural products and analyze performance of dryers	Understand
CO3	Recognize the working principles of grain cleaning and grading devices and able to select suitable equipment for cereal grains, oilseeds, and pulses	Understand
CO4	Understand the operation of post harvest equipment like shellers, conveyors	Understand
CO5	Know about different Post Harvest operations and processing methods of harvested crops.	Understand

### Course Contents:

#### UNIT - I Fundamentals of Post Harvesting

9

Post harvest technology – introduction – objectives – post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types-principles and operation-moisture content – measurement – direct and indirect methods – moisture meters – equilibrium moisture content.

#### UNIT - II Psychrometry and Drying

9

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

#### UNIT - III Cleaning and Grading

9

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

#### UNIT - IV Shelling and Handling

9

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

#### UNIT - V Crop Processing

9

Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers – types – constructional details – polishing – layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing – millets processing.

**Total: 45 Periods**

*Belushang*  
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**Laboratory Components**

S.No.	List of Experiments	CO Mapping	RBT
1	Determination of moisture content of grains by oven method.	CO1	Understand
2	Determination of porosity of grains.	CO1	Understand
3	Determination of coefficient of friction and angle of repose of grains.	CO2	Understand
4	Testing of groundnut decorticator & maize sheller	CO2	Apply
5	Evaluation of thin layer drier	CO3	Apply
6	Determining the efficiency of bucket elevator and screw conveyor	CO3	Apply
7	Evaluation of shelling efficiency of rubber roll sheller	CO4	Apply
8	Determining the oil content of oil seeds.	CO4	Understand
9	Visit to modern rice mill	CO5	Understand
10	Visit to pulse milling industry	CO5	Understand

**TOTAL: 30 Periods****Text Books**

- Geankoplis, C.J. 2020, Fifth edition, Transport Process and Separation process principles, Pearson india education service Private Limited, UP
- Bijendra Singh, Sudhir Singh, Advances in Postharvest Technologies of Vegetable Crops, Published March 31, 2021 by Apple Academic Press, New Delhi.

**Reference Books:**

- Basharat Nabi Dar, Shabir Ahmad Mir, Emerging Technologies for Shelf-Life Enhancement of Fruits, Volume I to V. Published May 12, 2020 by Apple Academic Press.
- Mohammed Wasim Siddiqui, Asgar Ali. Postharvest Management of Horticultural Crops: Practices for Quality Preservation Published March 31, 2021.
- S. Krishnaprbhu, Post Harvest Technology A Text Book, New Delhi, 2020.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)**

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1										1	
CO2	3	2	1										1	
CO3	3	2	1										1	
CO4	3	2	1										1	
CO5	3	2	1										1	
	<b>3</b>	<b>High</b>			<b>2</b>	<b>Medium</b>			<b>1</b>	<b>Low</b>				

Summative Assessment							
Continuous Assessment							
Bloom's Category	Theory			Attendance [5]	Practical's		Final Examination (50)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)		Rubric based CIA [10Marks]	Model Examination [10 Marks]	
Remember	20	20	20				20
Understand	20	20	20				70
Apply	10	10	10				10
Analyze							
Evaluate							
Create							

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20AG711	Design Project	L	T	P	C
		0	0	2	1
Nature of Course	Employability Enhancement Courses				
Pre requisites	Engineering Grapics, CADD Laboratory				

### Course Objective

#### The course is intended to

1. To design and analysis of Agriculture Engineering machineries.
2. To design of Drip and Sprinkler irrigation system.
3. To design of Agriculture processing equipments.
4. To design of post harvest technology equipments.
5. To design of Green house/Poly House/Net House structures.

### Guideline for Review and Evaluation

1. The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be analysed and desinged may be decided.
2. A design project report to be submitted by the group which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department.
3. At the end of the semester examination the design project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Use of design and analysis of Agriculture Engineering machineries.	Apply
CO2.	Ability to deisgn of Drip and Sprinkler irrigation system.	Apply
CO3.	The students will able to Design of Agriculture processing equipments.	Apply
CO4.	The students will be able to design of post harvest technology equipments.	Apply
CO5.	The students will be able to design of Green house/Poly House/Net House structures.	Apply

Total: 30 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	3	3	-	-	-	-	-	-	2	-	-
CO2	3	3	-	-	3	3	-	-	-	-	-	-	2	-	-
CO3	3	3	-	2	-	3	-	-	3	-	-	-	2	-	-
CO4	3	3	3	3	-	-	3	-	-	3	-	-	1	-	-
CO5	-	-	3	3	-	3	-	2	-	-	-	-	1	-	-
	3	High				2	Medium					1	Low		

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	Continuous Assessment [50 Marks]						Final Viva Voce Examination [50 Marks]
	Review I [10]	Review II [10]	Review III [10]	Report [10]	Viva [10]	Total CA [50 Marks]	
<b>Marks</b>	<b>20</b>	<b>20</b>	<b>20</b>	<b>2</b>	<b>20</b>	<b>100</b>	<b>50</b>

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*Approved in Academic Council Meeting*

20AG712	Study Tour	L	T	P	C
		1 Weeks			0
Nature of Course	Employability Enhancement Courses				
Pre requisites	Internship				

**Course Objective**

1. 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.
2. To gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.
3. To create an opportunity to develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organisational setting.

**Guideline for Review and Evaluation**

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

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Integrate theory and practice.	Apply
CO2.	Learn to appreciate work and its function in the economy.	Apply
CO3.	Acquire employment contacts leading directly to a full-time job following graduation from college.	Apply

**Total: 2 Weeks**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	3	3	-	-	-	-	-	-	2	2	-
CO2	3	3	-	-	3	3	-	-	-	-	-	-	2	2	-
CO3	3	3	-	3	-	3	-	-	3	-	-	-	2	2	-
CO4	3	3	3	3	-	-	3	-	-	3	-	-	2	2	-
	3	High				2	Medium				1	Low			

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20AG811	Major Project	L	T	P	C
		0	0	20	10
Nature of Course	Employability Enhancement Course				
Pre requisites	All Professional Core Subjects				

### Course Objectives

The course is intended

1. To provide an opportunity to students to obtain knowledge in design/formulation of new product development
  2. Develop the ability to solve a specific problem right from its identification.
  3. Review the literature till finding the successful solution.
  4. Train the students in preparing project reports.
  5. Face reviews and viva voce examination.
  6. Understand the application of software package in the project.
- On successful completion of the course, Students will be able to:

CO.No.	Course Outcome	Bloom's Level
CO1	Identify Agriculture Engineering problems by reviewing literature.	Understand
CO2	Identify appropriate techniques to analyse complex Agriculture Engineering problems.	Apply
CO3	Apply Engineering and Management principles through efficient handling of project.	Apply
CO4	Carry out the project in a systematic way.	Apply
CO5	Familiarize on developing models by using software packages.	Apply

**Course Contents : Major Project**

### GUIDELINE FOR REVIEW AND EVALUATION

The student's may be grouped as 1 to 4 and work under a project supervisor. The students may design the procedure for new product development or value addition of existing in consultation with the supervisor and if possible with an industry. A project report is to be submitted by the group which will be reviewed and evaluated for internal assessment by a Committee constituted by the Department Head. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly examined by external and internal examiners.

**Total Hours: 300**

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Mapping of Course Outcomes(COs)with Programme Outcomes(POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	3								3			
CO2	3	3	1	3								3			
CO3	2	2	2	3								3			
CO4	2	1	1	3								3			
CO5	2	1	1	3								3			
	3	High				2	Medium					1	Low		

Continuous Assessment [50 Marks]							Final Viva Voce Examination
Marks	Review I	Review II	Review III	Publication	Report	Total	
	[10]	[10]	[10]	[10]	[10]	[50]	[50 marks]

  
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**PROFESSIONAL ELECTIVE COURSES (PE)  
STREAM-I AGRICULTURAL PROCESS ENGINEERING**

<b>20AGE01</b>	<b>Agricultural by Products and Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Electives				
<b>Prerequisites</b>	Nil				

**Course Objectives**

The course is intended to

1. To impart knowledge to students on various methods of agricultural waste management for eco-friendly energy and manure production.
2. To impart knowledge to students on **Nutritive value and energy production potential of agro wastes.**
3. To impart knowledge to students on **execute potential agro residues and their characteristics for briquetting.**
4. To impart knowledge to students on **estimate the Biochar production.**
5. To impart knowledge **execute the nutrient value and utilization of biogas slurry**

**Course Outcomes**

On successful completion of the course, students will be able to

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Able to determine Various eco-friendly methods for agricultural waste management.	Understand
CO2	Able to estimation Nutritive value and energy production potential of agro wastes.	Understand
CO3	Able to execute potential agro residues and their characteristics for briquetting	Understand
CO4	Able to estimate the Biochar production	Understand
CO5	Able to execute the nutrient value and utilization of biogas slurry	Understand

**Course Contents****UNIT I Introduction****9**

Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics- its recycling and utilization potential- current constraints in collection and handling of agricultural wastes – its environmental impact.

**UNIT II Composting****9**

Definition- Solid waste suitable for composting – Methods of composting - vermicomposting - Mineralization process in composting - Biochemistry of composting – Factors involved – Infrastructure required – maturity parameters – value addition – application methods

**UNIT III Biomass Briquetting****9**

Definition – potential agro residues and their characteristics for briquetting – fundamental aspects and technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant- appliances for biomass briquettes.

**UNIT IV Biochar Production****9**

Definition - characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – fast and slow pyrolysis – characteristics of Biochar – role of Biochar in soil nutrition and carbon sequestration.

**UNIT V Biogas and Bio Ethanol Production****9**

Screening of suitable ligno cellulosic substrate for biogas production -determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value- per cent total carbohydrates, moisture, lignin and cellulosic contents – preparation of feed stocks for anaerobic bio- digestion – types of digesters – factors affecting - nutrient value and utilization of biogas slurry.

**TOTAL: 45 PERIODS****Textbooks:**

1. Raymond C Loehr, “Agricultural Waste Management- problems, processes and approaches”, First edition, Academic press, 1974.
2. Diaz I.F., M. de Bertoldi and W. Bidlingmaier., “Compost science and technology”, Elsevier pub., PP.1-380, 2007.
3. Uta Krogmann, Ina Körne and Luis F. Diaz., “Solid waste technology and management (Vol 1 and2)”, Blackwel Pub Ltd., Wiley Online library, 2010
4. Yong Sik Ok, Sophie M. Uchimiya, Scott X. Chang, Nanthi Bolan.,” “Biochar-production characterization and applications”., CRC press, 2015.

**Reference Books:**

1. P.D. Grover & S.K. Mishra, “Biomass Briquetting: Technology and Practices”. Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996.
2. Magdalena Muradin and Zenon Foltynowicz, “Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland”. Sustainability, 6, 5065-5074, 2014.

<b>Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)</b>															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

<b>Formative assessment</b>			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

<b>Summative Assessment</b>				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	20
Understand	20	20	20	70
Apply	10	10	10	10
Analyze				
Evaluate				

<b>20AGE02</b>	<b>Sustainable Agriculture and Food Security</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Prerequisites</b>	Nil				
Create					

### Course Objectives

The course is intended to

1. To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.
2. Importance of science, food security and ecological balance.
3. To study the natural farming principle for suitable agriculture
4. To study the food supply and demand projections
5. To study the policies for food security

### Course Outcomes

On successful completion of the course, students will be able to

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Able to determine land utilization and cropping pattern in india	Understand
CO2	Able to estimation rainfall, drought and irrigation potential in watershed	Understand
CO3	Able to execute natural farming principle for suitable agriculture	Understand
CO4	Able to estimate the food supply and demand projections	Understand
CO5	Able to execute the policies for food security	Understand

### Course Contents

#### UNIT I Land Resource and Its Sustainability

9

Land Resources of India, Population and land, Land utilization, Net Area Sown, changes in cropping pattern - rainfall, climate, temperature, soil type, technology and socio-economic conditions, land degradation, productivity and sustainability of a land-use system, Sustainable development of land resources.

#### UNIT II Water Resource and Its Sustainability

9

Rainfall forecasting - Adequacy of Rainfall for crop growth – Rainfall, Drought and production instability – Irrigation potential – Available, created and utilized – River basins; Watersheds and Utilizable surface water – Utilizable water in future (Ground water & Surface water)

#### UNIT III Sustainable Agriculture & Organic Farming

9

Agro-ecosystems - Impact of climate change on Agriculture, Effect on crop yield, effect on Soil fertility – Food grain production at State Level – Indicators of Sustainable food availability – Indicators of food production sustenance – Natural farming principles – Sustainability in rainfed farming – organic farming – principles and practices.

#### UNIT IV Food Production and Food Security

9

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

#### UNIT V Polices and Programmes for Sustainable Agriculture and Food Security

9

Food and Crop Production polices – Agricultural credit Policy – Crop insurance –Policies of Natural Resources Use – Policies for sustainable Livelihoods – Virtual water and trade - Sustainable food Security Action Plan.

**Text Books:**

1. B.K.Desai and Pujari, B.T. Sustainable Agriculture: A vision for future, New India Publishing Agency, New Delhi, 2007.
2. Saroja Raman, Agricultural Sustainability – Principles, Processes and Prospects, CRC Press, 2013.

**Reference Books:**

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, Scitech Publications, Chennai, 1999.
3. Gangadhar Banerjee and Srijeet Banerji, Economics of sustainable agriculture and alternate production systems, Ane Books Pvt Ltd., 2017
4. M.S.Swaminathan, Science and sustainable food security, World Scientific Publishing Co., www.padeepz.net Singapore, 2010.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				



20AGE03	Refrigeration and Air Conditioning for Agricultural Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Engineering Thermodynamics for Agriculture Engineering				

### Course Objectives

The course is intended to

1. To understand the principles of operation in different refrigeration system.
2. To learn the different refrigerants, properties and components of refrigeration system.
3. To provide knowledge on basic design aspects of Refrigeration system.
4. To understand the principles of operation in different Air conditioning systems and components.
5. To learn the concept of different unconventional refrigeration cycles and applications in agriculture fields.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the working of different refrigeration systems.	Understand
CO2.	Understand the different refrigerants and their properties.	Understand
CO3.	Provided knowledge on basic design aspects of Refrigeration systems.	Apply
CO4.	Knowledge on the different air conditioning systems.	Understand
CO5.	Understand the different applications of refrigeration system in agriculture sector.	Understand

### Course Contents:

#### UNIT I Refrigeration System 9

Review of thermodynamic principles of refrigeration. Concept of Air refrigeration system - Vapour compression refrigeration cycle – use of P.H charts – multistage and multiple evaporator systems – cascade system – COP comparison.

#### UNIT II Refrigerants & System Components 9

Refrigerants – Properties – Selection of refrigerants, Alternative refrigerants. Compressors – reciprocating & rotary (elementary treatment) – condensers – evaporators cooling towers.

#### UNIT III Psychrometry 9

Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric processes – grand and room sensible heat factors – bypass factors - Cooling load calculations.

#### UNIT IV Air Conditioning Systems 9

Working principles of – Summer and Winter AC, centralized Air conditioning systems, split, ductable split, packaged air conditioning, VAV & VRV systems. Duct design by equal friction method, indoor air quality concepts.

#### UNIT V Unconventional Refrigeration Cycles 9

Vapor absorption systems – Ejector jet, steam jet refrigeration, thermo electric refrigeration. Applications: ice – plant – food storage plants – milk chilling plants.

Total: 45 Periods

**Text Books:**

1. Arora, C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 2015.
2. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., New Delhi, 2017.

**Reference Books:**

1. Jordon and Priester., "Refrigeration and Air Conditioning", Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
2. Stoecker, N.F., and Jones., "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 2015.
3. Dossat, R.J., "Principles of Refrigeration and Air Conditioning", Pearson Education Pvt. Ltd., New Delhi, 2013.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO2	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO3	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO4	3	3	2	2	-	3	3	2	-	-	-	-	2	-	-
CO5	3	3	2	2	-	2	2	1	-	-	-	-	2	2	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20AGE04	Storage and Packaging Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

The course is intended

1. understand about the spoilage and storage process.
2. learn the different storage methods
3. provide knowledge on functions of packaging materials
4. understand the principles of functions of packaging materials testing
5. learn the concept of special packaging techniques

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the working of storage systems.	Understand
CO2.	Understand the different methods of storage	Understand
CO3.	Provided knowledge on functions of packaging materials	Apply
CO4.	Knowledge on the food packaging material testing.	Understand
CO5.	Understand the special packaging techniques	Understand

### Course Contents:

#### Unit I Spoilage and Storage

9

Direct damages, Indirect damages of perishable and durable commodities – control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses..

#### Unit II Storage Methods

9

Improved storage methods for grain-modern storage structures-infestation-temperature and moisture changes in storage structures-CAP storage-CA storage of grains and perishables construction operation and maintenance of CA storage facilities.

#### Unit III Functions of Packaging Materials

9

Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.

#### Unit IV Food Packaging Materials and Testing

9

Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength.

#### Unit V Special Packaging Techniques

9

Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.

**TOTAL : 45 Periods**

**Text Books:**

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

**Reference Books:**

1. Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2. Chakaraverty, A. 2000. 3<sup>rd</sup> edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3		2		3							2		
CO2	3	3		2		3							2		
CO3	3	3		2		3							2		
CO4	3	3		2		3							2		
CO5	3	3		2		2							2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20AGE05	Seed Processing Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Prerequisites	Crop Husbandry Laboratory				

### Course Objectives

The course is intended to

1. Learn the basic seed characters, types and importance of good quality seeds.
2. Gain knowledge about Floral biology and Pollination.
3. Understand the scope and importance of seed certification.
4. Learn about seed processing and processing equipments.
5. Gain knowledge about Seed programmes.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the Seed characters and importance of good quality seeds.	Understand
CO2	Interpret the floral biology and different types of pollination.	Understand
CO3	Summarize the scope and importance of seed certification.	Understand
CO4	Infer about the seed processing techniques and equipments.	Understand
CO5	Explain about seed programmes and seed marketing.	Understand

### Course Contents

#### UNIT I Seed Characters 9

Definition and characteristics of seed- How seed differs from grain- Propagation of crop plants through true seed and vegetative means- Features of good quality seed- Importance of good quality seed in successful crop production- Floral biology- self and cross pollination- Seed propagation- Seed legislations promulgated in India and the purpose of each of these legislation.

#### UNIT II Seed Production and Certification 9

Seed multiplication- systems of seed multiplication- multiplication ratio- field selection and planting ratio- isolation needs and rouging- classes of seed- Harvest and extraction of seed- Methods of hybrid seed production- Seed certification process.

#### UNIT III Seed Processing and Testing 9

Components of seed processing -Steps involved in seed processing- preliminary cleaning, basic cleaning and grading- Equipment used in each of the steps- Seed treatment- Seed drying- Seed sampling- Seed testing details of specific tests conducted for different purposes- Standards prescribed for different crops.

#### UNIT IV Seed Programmes and Marketing 9

Types of organizations involved in seed production- Steps involved in planning and developing a seed programme- Seed marketing activities- Costing and pricing strategies- Economics of production of different crop seed- Seed packaging- Visit to seed organizations- Export procedures and formalities- Seed/plant quarantine methods.

#### UNIT V Seed Production in Specific Crops 9

Principles and special techniques used for seed production- Seed production of crops by selecting representatives of Cereals- Millet- Pulses- Vegetables- fruits- flowers- spices- Plantation crops.

**Total: 45 Periods**

**Text Books:**

1. Singh, S.P., Commercial Vegetable Seed Production, Kalyani Publishers, Chennai, 2001.
2. Agarwal, R.L., Seed Technology, Oxford IBH Publishing Co., New Delhi, 1995.

**References Books:**

1. Subir Sen and Ghosh, N., Seed Science, Kalyani Publishers, Chennai, 2017.
2. Dahiya, B.S., and Rai, K.N., Seed Technology, Kalyani Publishers, Chennai, 2015.
3. George, Raymond, A.T., Vegetable Seed Production, Longman Orient Press, London and New York, 2005.

**Web Source:**

1. [https://agritech.tnau.ac.in/seed\\_certification/seed%20processing-importance.html](https://agritech.tnau.ac.in/seed_certification/seed%20processing-importance.html)
2. <http://www.agrilearner.com/seed-processing-techniques/>

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE06	Process Engineering of Fruits and Vegetables	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

1. The course is intended to impart knowledge on Structure composition and ripening of fruits and vegetables
2. To learn the basic principles of cleaning, grading and on-farm processing
3. To learn the basic knowledge about the preservation of horticultural crops
4. To know about the drying and dehydration of fruits and vegetables
5. To study the fundamental concepts of storage and selecting suitable storage conditions.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Able to analyse the structure, composition and ripening of fruits and vegetables.	Understand
CO2.	To gain knowledge on pretreatments of fruits and vegetables	Understand
CO3.	To gain insight on preservation of horticultural crops	Understand
CO4.	Analyze and select the suitable dryer for drying fruits and vegetables	Understand
CO5.	Understanding the fundamental concepts of storage and selecting suitable storage conditions.	Understand

### Course Contents:

#### UNIT I Structure, Composition and Ripening

9

Importance of post-harvest technology of horticultural crops -structure, cellular components, composition and nutritive value of horticultural crops-fruit ripening - Post-harvest physiological and biochemical changes in fruits and vegetables; maturity Indices and standards for selected fruits and vegetables.

#### UNIT II Cleaning, Grading and On-Farm Processing

9

Harvesting and washing of fruits, vegetables, spices and plantation crops cleaning and grading - peeling equipments - construction and working pre-cooling - importance methods Commodity pretreatments - chemicals, wax coating, prepackaging.

#### UNIT III Preservation of Horticultural Crops

9

Thermal and non-thermal techniques for preservation of fruits and vegetables-minimal processing - quick freezing-canning -processing and concentration of juice membrane separation process and application - hurdle technology. Preparation of processed products - Jam jelly, squash, sauce preserve and pickle.

#### UNIT IV Drying and Dehydration

9

Dehydration of horticultural crops- types of dryers, construction and working methods - fluidized bed dryer, scouted bed diver osmotic dehydration and foam mat crying-principles construction and operation Valuable products from fruits and vegetaries waste.

#### UNIT V Storage

9

Storage of horticultural commodities - storage under ambient conditions, low temperature storage, evaporative cooling-cold storage of horticultural commodities - estimation of cooling load - controlled atmosphere storage-modified atmosphere packaging.

**Total: 45 Periods**

**Text Books:**

1. Srivastava R.P. and Sanjeev Kumar., "Fruit and vegetable preservation"., International Book Distributing Co... Lucknow, 1998.
2. Sudheer K. P. and V. Indra., "Post - Harvest Technology of Horticultural Crops", New India Publishing Company. New Delhi, 2007.

**Reference Books:**

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

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				



20AGE07	Fundamentals of Nano Science	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

The course is intended

1. Learn the basic and fundamentals of nano sciences
2. Gain knowledge general methods o Nano Sciences
3. Understand the scope and importance of Nano materials
4. Learn about Nano cherecterizatioin techniiues
5. Gain knowledge on applications o Nano Sciences.

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Able to analyse the Nano structures	Understand
CO2.	To gain knowledge on methods of Nano materials preparation	Understand
CO3.	To gain knowledge on Nano mAterials	Understand
CO4.	Analyze and select the characterization techniques in Nano sciences	Understand
CO5.	Understanding the applications of Nano Sciences	Understand

### Course Contents:

#### Unit I Introduction 9

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

#### Unit II General Methods of Preparation 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE..

#### Unit III Nanomaterials 9

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

#### Unit IV Characterization Techniques 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

#### Unit V Applications 9

NanoInfoTech: Information

storage- nanocomputer,

molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 Periods**

**Text Books:**

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**Reference Books:**

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom’s Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE08	Agricultural Structures and Environmental Control	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Strength of Materials for <b>Agriculture Engineering</b>				

### Course Objectives

#### The course is intended to

1. Acquire the knowledge of Planning and production in environmental.
2. Learn the concept of Design and Structures.
3. Learn the concept of Cost and Maintenance.
4. Learn the concept of Management in wastes.
5. Introduce Treatment method of food waste.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the Planning and production in environmental	Understand
CO2.	Explain the concept of Design and Structures	Understand
CO3.	Identify the Cost and Maintenance	Understand
CO4.	Understand the Management in wastes	Understand
CO5.	Explain Treatment method of food waste.	Understand

### Course Contents:

**UNIT I Planning and production** 9  
 Planning and layout of farmstead. Physiological reactions of livestock to solar radiation and other environmental factors, livestock production facilities.

**UNIT II Design and Structures** 9  
 BIS. Standards for dairy, piggery, poultry and other farm structures. Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc.

**UNIT III Cost and Maintenance** 9  
 Engineering for rural living and development, rural roads, farm fencing, their construction cost and repair and maintenance.

**UNIT IV Management** 9  
 Design of septic tank for small family. Solid waste management system.

**UNIT V Treatment of food waste** 9  
 BOD and COD of food plant waste, primary and secondary treatment of food plant waste.

**TOTAL: 45 PERIODS**

**Text books:**

1. Albright, L. D., "Environmental control for Animals and Plants". ASAE, Michigan, USA, 1996.
2. Clark, J.A., "Environmental Aspects of Housing for Animal Production", Butterworths, London, 1980.
3. Goel, J. K., "Energy and Environment of Buildings & Farms" Saroj Prakashan, Alahabad, 2002.

**Reference Books:**

1. Maton, Aetal., "Housing of Animals-Developments in Agrl.Engg", ElsevierScience Publishing Co. Inc. 1986.
2. Michael and Ohja., "Principles of Agricultural Engineering (Vol. 1)", Jain Brothers, New Delhi, 2002.

**Website Reference :**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)																
COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1							3							2		
CO2			3											2		
CO3											2			2		
CO4							2							2		
CO5							3							2		
	3	High				2	Medium				1	Low				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE09	Food Plant Design and Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. Acquire the knowledge of by-products and its utilization ideas.
2. Learn the concept of Waste management.
3. Learn the concept of Direct combustion of solid waste.
4. Learn the concept of Thermo-chemical conversion of solid waste.
5. Introduce Bio-chemical conversion.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the byproducts and its utilization ideas	Understand
CO2.	Explain the concept of Design and Structures	Understand
CO3.	Identify the Direct combustion of solid waste	Understand
CO4.	Understand the Thermo-chemical conversion of solid waste	Understand
CO5.	Explain Treatment method Bio-chemical conversion.	Understand

### Unit I: Plant Location and Layouts

9

Introduction to food plant design - special features of food and agricultural process industry - plant location - location factors, site selection, location theory and models - layout - objectives, classical and practical layout – preparation of process chart and machinery layout – product layout and process layout - plant layout fruit, vegetables and meat processing, size reduction machinery, bakery products, milk and milk products, solid – liquid and liquid – liquid separation plant-, evaporation plant, drying plant, bake ovens and frying plant, heat exchanger plant, refrigeration and air conditioning plant, boiler, packaging plant.

### Unit II: Plant Construction and Materials

9

Construction materials – sand, brick, cement, steel and wood – manufacture of bricks and types of kilns - refractory bricks - cement – properties, types and uses - testing and storage of cement - foundations – bearing capacity of soils, testing the bearing capacity - brick masonry - types of bonds - stone masonry – mortars - functions, types and their uses, functions of sand and surkhi in mortars and preparation of mortars - concretes – characteristics, types, uses and reinforced cement concrete - roofs – classification of roofs – steel and wooden sloping roofs – lean to roof - types of flat roofs and types of floorings.

### Unit III: Electrical and Water Supply

9

Estimation of services - peak and critical load – preparation of electrical layout – selection of fittings and accessories for electrical and water supply – provision of water supply – design of water storage system - selection of pipe, valves and safety devices - drainage – systems, pipeline, traps, safety devices - illumination and ventilation – materials, mounting, operation and maintenance - layout for effluent treatment plant – safe disposal of effluent.

### Unit IV: Production Planning and Control

9

Production planning and control – continuous and intermittent production – scheduling - routing and dispatching - activity chart and Gantt chart - net work planning methods – PERT and CPM - applications - method study – work study – methods – man-machine

chart - time study – standard time of a job - inventory control – economic ordering quantity – inventory models.

**Unit V: Repair and Maintenance of Equipment**

9

Repair and maintenance of equipment – preventive maintenance and breakdown maintenance – replacement of equipment – alternative methods and analysis – method of annual equivalence, present worth method and internal rate of returns.

**TOTAL: 45 PERIODS**

**Text books:**

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

**Reference Books:**

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

**Website Reference :**

1. [www.fsis.usda.gov/OA/topics/SecurityGuide.pdf](http://www.fsis.usda.gov/OA/topics/SecurityGuide.pdf)
2. [www.ceoadvice.com/pdf/Plant\\_Layout-Material\\_Handling.pdf](http://www.ceoadvice.com/pdf/Plant_Layout-Material_Handling.pdf) -
3. [www.foodengineeringmag.com](http://www.foodengineeringmag.com)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							3						2		
CO2			3										2		
CO3											2		2		
CO4							2						2		
CO5							3						2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				

Create				
--------	--	--	--	--

20AGE10	Waste and By-products Utilization	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. Acquire the knowledge of by-products and its utilization ideas.
2. Learn the concept of Waste management.
3. Learn the concept of Direct combustion of solid waste.
4. Learn the concept of Thermo-chemical conversion of solid waste.
5. Introduce Bio-chemical conversion.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the byproducts and its utilization ideas	Understand
CO2.	Explain the concept of Design and Structures	Understand
CO3.	Identify the Direct combustion of solid waste	Understand
CO4.	Understand the Thermo-chemical conversion of solid waste	Understand
CO5.	Explain Treatment method Bio-chemical conversion.	Understand

### Course Contents:

#### UNIT I Introduction 9

By-products/waste, types of food by-product and waste, magnitude of by-products and waste in food production, magnitude of by-products and wastes in food processing.

#### UNIT – II Waste management concepts 9

Waste characteristics, waste management and effluent treatment.

#### UNIT – III Direct combustion of solid waste 9

Proximate and ultimate analysis of biomass, theory of combustion, direct combustion of biomass as fuel in furnaces, operating conditions affecting design of furnace.

#### UNIT – IV Thermo-chemical conversion of solid waste 9

Biomass gasification, gasification process mechanism, types of gasifier reactors, utilization of producer gas.

#### UNIT – V Bio-chemical conversion 9

Selection of proper size of biogas plant, utilization of biogas for cooking purpose. Utilization of biogas for lighting purposes and engine operation.

**Total: 45 Periods**

### Text Books:

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

Delhi, 1996.

**Reference Books:**

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

**Website Reference:**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							3						2		
CO2			3										2		
CO3													2		
CO4							3				2		2		
CO5							2						2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				



20AGE11	Processing of Fats and Oils	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Prerequisites	Nil				

### Course Objectives

The course is intended to

1. To understand the physical and chemical properties of fats and oils.
2. To study the extraction and refining processes of various oils and fats.
3. To learn the packaging, quality standards of fats and oils.
4. To learn the quality attributes of oils and fats.
5. To study the packaging materials and Invent methods for industrial applications of oils and fats.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Enumerate the importance of fats and oils.	Understand
CO2	The manufacturing process of oils and fats.	Understand
CO3	Apply knowledge on manufacture of designer fats.	Understand
CO4	Appraise the quality attributes of oils and fats.	Understand
CO5	Design suitable packaging materials and Invent methods for industrial applications of oils and fats.	Understand

### Course Contents

#### UNIT I Physical And Chemical Properties

9

Fats and oils – formation – functions of oil in human body - fatty acids – double bonds and their position in oil – Geneva type classification - sources of vegetable oils – production status-oil content – coconut , palm, peanut , rice bran, sesame, mustard and sunflower seeds oil – physical and chemical properties of fats and oils - chemical reactions of oil – hydrolysis – hydrogenation, oxidation and polymerization.

#### UNIT II Extraction Methods

9

Oil extraction methods –mechanical expression – ghani , power ghani, rotary, hydraulic press, screw press, expellers, filter press - principle of operation and maintenance-solvent extraction process – steps involved, batch and continuous-continuous solvent extraction process for rice bran, soy bean and sunflower-oil extraction process for groundnut and cotton seed-production of special oils – palm oil, virgin coconut oil – extraction process

#### UNIT III Refining of Oils

9

Refining of oils – objectives – characterization - degumming – Zeneath process – deacidification process – continuous acid refining-bleaching of oil –decolourising agents-deodorization and winterization processes- Hydrogenation of Fats – Vanaspati and Margarine – Ghee and butter

#### UNIT IV Packaging of Edible Oils

9

Packaging of edible oils – requirements – types – tinfoil, semi rigid, glass, Polyethylene Terephthalate, Poly Vinyl Chloride, flexible pouches – packaging for Vanaspati and ghee changes during storage of oil –rancidity – causes – atmospheric oxidation and enzyme action – free fatty acid – colour-non edible oils – castor oil, linseed oil, vegetable waxes – production and processing..

UNIT V Industrial Standards

Applications and Quality  
9

Industrial applications of fats and oils – quality regulations - manufacture of soap, candle, paints and varnishes - ISI and AGMARK standards – site selection for oil extraction plant- safety aspects- HACCP standards in oil industries.

**Total: 45 Periods**

**Text Books:**

1. Harry Lawson, "Food oils and Fats - Technology, Utilization and Nutrition", CBS Publishers and Distributors, New Delhi, 1997.
2. Gunstone F.D., "Oils and Fats in Food Industry", Blackwell Publishing, United Kingdom, ISBN – 13: 9781405181212, 2008.

**REFERENCE BOOKS:**

1. Gunstone F.D., "Vegetable Oils in Food Technology: Composition, Properties and Uses", 2<sup>nd</sup> Edition, Wiley - Blackwell Publishing Ltd., ISBN 9781444332681, 2011.
2. Frazier W.C. and D.C. Westhoff, "Food Microbiology", 4th Ed., McGraw-Hill Book Co., New York, ISBN\_9780070667181,2008.
3. Gunstone F.D., "Oils and Fats in Food Industry", Blackwell Publishing, United Kingdom, ISBN – 13: 9781405171212, 2008.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE12	Fish Production and Processing	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. To know the history and different types of aquaculture.
2. To know the fishery management principles and life cycle
3. To learn about the fish nutrients and methods of feed formulation.
4. To learn about the fish genetics and Breeding.
5. To know the fish processing methods and value addition methods.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Explain about the history and different types of aquaculture.	Understand
CO2.	Illustrate the fishery management principles and life cycle.	Understand
CO3.	Summarize the fish nutrients and methods of feed formulation.	Understand
CO4.	Explain about the fish genetics and Breeding.	Understand
CO5.	Infer about the fish processing methods and value addition methods.	Understand

### Course Contents:

#### UNIT I Principles of Aquaculture

9

Definition, basics, scope and history of aquaculture- Present global and national scenario- Systems of aquaculture- Different types of aquaculture- Pre-stocking and post-stocking pond management- Criteria for selection of species for aquaculture- Integrated culture systems- Water and soil quality in relation to fish production- O<sub>2</sub> & CO<sub>2</sub> accumulation in aquaculture systems.

#### UNIT II Fundamentals of Fish Production

9

Fish taxonomy- Anatomy and Biology of fish- Fishing crafts and gears- Life cycle of fishes- Diseases and health management - Fishery Management- Natural fish seed resources- Spawn rearing and transportation- Hatchery management.

#### UNIT III Fish Nutrition and Feed Technology

9

Principal nutrients and nutritional requirements of cultivable fishes- Methods of feed formulation and manufacturing- Forms of feeds- Food additives- Feed storage- Feed evaluation- Feeding devices and methods- Non-nutrient dietary components- Nutritional deficiency diseases.

#### UNIT IV Fish Genetics and Breeding

9

Principles of genetics and breeding- monohybrid and dihybrid ratios- Gene interaction- Population genetics- Quantitative genetics- Hybridization- Selective breeding- Inbreeding and its consequences- Certification and Quarantine procedures

#### UNIT V Fish Processing

and Value Additions

9

Principle of fish preservation and processing- Processing of fish by traditional methods- Hurdle technology- Canning and Preparatory treatments- Packing, Thermal processing and Storage- Fermented fish products- Value added fish products- Diversified products- HACCP in safe products production,

**Total: 45 Periods**

**TEXTBOOK:**

1. Ayyappan, S., "Handbook of Fisheries and Aquaculture, ICAR Publications", New Delhi, 2011.
2. Lovell, R.T., "Nutrition and feeding of fishes", Chapman & Hall, New York, 1998.

**REFERENCE BOOKS:**

1. Rath, R.K., "Fresh water Aquaculture", Scientific publications, 2011.
2. Ramanathan, N. and Francis, T., "Manual on breeding and larval rearing of cultivable fishes", Fisheries College and Research Institute, Tuticorin, 1996.
3. Sen, D.P., "Advantages in Fish Processing Technology", Allied publishers Pvt. Ltd. Mumbai, 2005.

**WEB SOURCE:**

1. <https://www.fao.org/3/w0495e/w0495E03.htm>
2. <https://www.fao.org/flw-in-fish-value-chains/value-chain/processing-storage/en/>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				

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20AGE13	Food Safety Regulations and Standards	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

**Course Objectives**

1. The course is intended to know the basic knowledge about the food safety
2. To know the basic principles about food quality and standards
3. To learn the basic knowledge about food quality assurance and standards
4. To study the various regulations for food business operator
5. To learn the principles of food quality management systems in food industries

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To identify the suitable food safety for foods	Understand
CO2.	Able to identify suitable food quality standards	Understand
CO3.	To apply principles of quality assurance and quality management systems in food industries	Understand
CO4.	Able to appraise various regulations for food business operator	Understand
CO5.	To apply principles of food quality management systems in food industries	Understand

**Course Contents:**

**UNIT I Food Safety**

9

Principles and need for quality control and safety, strategy and criteria for food safety. Consumer lifestyle and demand, issues in food safety, food traceability and recall, case studies in food safety.

**UNIT II Food Quality and Standards**

9

Quality of foods, Quality Standards – Mandatory and optional standards, Food safety Systems – ISO 9000, ISO 14000, ISO 22000, Mechanism of developing and fixing food standards, Good Manufacturing Practice, HACCP, Standard Operating procedure

**UNIT III Quality Assurance in Food Industry**

9

Objectives, importance and functions of quality control, concept of quality assurance and quality control, quality control procedures, quality assurance procedures, international organizations: ISO, CAC, WTO, USFDA, Codex, EIC. National organizations: BIS, CCFS, Agmark, MMPO and APEDA, Good Laboratory Practices.

**UNIT IV Regulations for Food Business Operator**

9

Food adulteration and food safety, Food laws – Food Safety and Standards Act (FSSAI), Prevention of Food Adulteration Act, Packaged Commodities Rules, Functions of Food Business Operator, QA Adult, IPR and Patents, Issues affecting consumers and industry – Genetically Modified Foods, Fortification,

Pesticide Residues, Organic Foods, Food Additives.

**UNIT V Food Quality Management System**

**9**

FSSAI functions, duties and responsibilities of food safety regulations, food safety and standards for food products, implementation. Validation, verification and improvement of food safety management systems. Good hygienic Practices (GHP), FSSC 22000, Food Safety Adult.

**Total: 45 Periods**

**Text Books:**

1. Inteaz Alli-Food Quality Assurance: Principles and Practices, 2nd Edition Taylor and Francis UK, 2014
2. Andres Vasconcellos J-Quality Assurance for the Food Industry: A Practical Approach CRC Press, New York, 2004

**Reference Books:**

1. Da-Wen Sun, "Handbook of Food Safety Engineering", John Wiley & Sons, New Jersey, 2012
2. Singh, SP, Food Safety, Quality Assurances, and Global Trade Concerns and Strategies|| International Book Distributing Company, Lucknow, 2009
3. Yasmine Motarjemi and Huub Lelieveld., "Food Safety Management – A practical Guide for The Food Industry", Elsevier, New York, 2014.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				

Analyze				
Evaluate				
Create				

**STREAM-II SOIL AND WATER CONSERVATION ENGINEERING**

20AGE21	Watershed Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Nil				

**Course Objectives****The course is intended to**

1. Introduce the basics of watershed management.
2. Learn the concept of watershed planning.
3. Learn the concept of watershed management.
4. Learn the concept of water conservation practices.
5. Learn the concept of watershed development programme.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the basic concept of watershed management	Understand
CO2.	Understand the planning method of watershed	Understand
CO3.	Understand the Management skills of watershed	Understand
CO4.	Understand the conservation practice	Understand
CO5.	Understand the watershed development programme	Understand

**Course Contents:****UNIT I Introduction****9**

Watershed – Definition - concept - Objectives – Land capability classification - priority watersheds - land resource regions in India.

**UNIT II Watershed Planning****9**

Planning principles – collection of data – present land use - Preparation of watershed development plan - Estimation of costs and benefits - Financial plan – selection of implementation agency - Monitoring and evaluation system

**UNIT III Watershed Management****9**

Participatory watershed Management - run off management - Factors affecting runoff – Temporary & Permanent gully control measures - Water conservation practices in irrigated lands - Soil and moisture conservation practices in dry lands.

**UNIT IV Water Conservation Practices****9**

In-situ & Ex-situ moisture conservation principle and practices - Afforestation principle – Micro catchment water harvesting - Ground water recharge – percolation ponds -Water harvesting - Farm pond -

Supplemental irrigation - Evaporation suppression - Seepage reduction.

**UNIT V Watershed Development Programme**

9

River Valley Project (RVP) - Hill Area Development Programme (HADP) - National Watershed Development Programme for Rainfed Agriculture (NWDPR) - Other similar projects operated in India – Govt. of India guidelines on watershed development programme - Watershed based rural development – infrastructure development - Use of Aerial photography and Remote sensing in watershed management - Role of NGOs in watershed development.

**Total: 45 Periods**

**Text Books:**

1. Suresh, R., “Soil and Water Conservation Engineering”, Standard Publishers & Distributors, New Delhi, 2005.
2. Ghanashyam Das, “Hydrology and Soil Conservation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.
3. Tideman, E.M., “Watershed Management”, Omega Scientific Publishers, New Delhi, 1996.

**Reference Books:**

1. Gurmel Singh et al. 2004. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
2. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.

**Website References:**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2		2	3						3		
CO2				2		2	3						3		
CO3				2		2	2						3		
CO4				2		2	3						3		
CO5				2		2	3						3		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom’s Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				



Analyze				
Evaluate				
Create				

<b>20AGE22</b>	<b>Micro Irrigation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Electives				
<b>Pre requisites</b>	Basics of Agricultural Engineering				

**Course Objectives**

The course is intended to

1. expose the students to the fundamental knowledge on water lifts and pumps
2. learn about pump valves
3. understand the micro irrigation concept and applications
4. Learn the drip irrigation system.
5. Develop the sprinkler irrigation design.

**Course Outcomes**

On successful completion of the course, students will be able to

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Explain water lifts and pumps	Remember
CO2	Identify the pump valves	Understand
CO3	Develop the micro irrigation concept and applications	Understand
CO4	Design the drip irrigation system.	Understand
CO5	Summarize the sprinkler irrigation design.	Apply

**Course Content:**

**UNIT I Water Lifts and Pumps**

**9**

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 Valves**

**9**

Types of valves- Pressure relief valve- Gate valve-Isolated valve- Non return valve- Butterfly valve- Solenoid valves-Automated control valve- selection, repair and maintenance.

**UNIT III Micro Irrigation Concept and Applications**

**9**

Micro irrigation- comparison between traditional and micro irrigation methods -Merits and demerits of micro- irrigation system, Types and components of micro irrigation system- Scope and potential problem of micro irrigation - Low cost Micro irrigation Technologies- Gravity fed micro irrigation - Care and maintenance of micro-irrigation System.

**UNIT IV Drip Irrigation Design**

**9**

Drip irrigation - Components- Dripper- types and equations governing flow through drippers-Wetting pattern- Chemigation application- Pump capacity- Installation- Operation and maintenance of Drip irrigation system. - Design of surface and sub-surface drip

irrigation.

### UNIT V Sprinkler Irrigation Design

9

Sprinkler irrigation- Components and accessories - Hydraulic design - Sprinkler selection and spacing- Capacity of sprinkler system - types - Sprinkler performance- Sprinkler discharge- Raingun and POP irrigation. Water distribution pattern- Droplet size, filtering unit, fertigation - System maintenance.

**Total: 45 Periods**

#### Text Books:

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

#### Reference Books:

1. Modi, P.N., and Seth, S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 1991.
2. Jack Keller and Rond Belisher., "Sprinkler and Trickle Irrigation", Vannistr and Reinhold New York, 1990.
3. Sivanappan R.K., "Sprinkler Irrigation", Oxford and IBH Publishing Co., New Delhi, 1987.

#### Website References:

1. <https://www.agriculturejournals.cz/web/rae/>
2. <https://sciendo.com/journal/AGRICENG>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1	2		
CO2	3	2	1									1	2		
CO3	3	2	1									1	2		
CO4	3	3	1									1	2		
CO5	3	2	1									1	2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE23	On Farm Water Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. Acquire the knowledge of design of irrigation channels.
2. Learn the concept of command area.
3. Learn the conjunctive use of surface and groundwater.
4. Learn the concept of water balance.
5. Introduce the special topics involves in water management.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the need of design in irrigation channels	Understand
CO2.	Explain the concept of command area	Understand
CO3.	Identify conjunctive use of surface and groundwater	Understand
CO4.	Understand the concept of water balance	Understand
CO5.	Learn the special topics involves in water management	Understand

### Course Contents:

#### UNIT I Design of Irrigation Channels

9

Design of Erodible and Non-Erodible, Alluvial channels- Kennedy" s and Lacey" s Theories - Materials for Lining watercourses and field channel - Water control and Diversion structure - Design - Land grading - Land Leveling methods.

#### UNIT II Command Area

9

Command area - Concept – CADA Programmes in Tamil Nadu - Duty of water - expression - relationship between duty and delta - Warabandhi - water distribution and Rotational Irrigation System – case studies.

#### UNIT III Conjunctive Use of Surface and Groundwater

9

Availability of water - Rainfall, groundwater – Irrigation and utilization - Prediction of

canal supply and demand – water requirement over and under utilization of

water – Dependable rainfall – Rainfall analysis by Markov chain method – Probability matrix.

**UNIT IV Water Balance**

**9**

Groundwater balance model – Weekly water balance - Performance indicators – Adequacy, Dependability, Equity and efficiency – conjunctive use plan by optimization – Agricultural productivity indicators – Water use efficiency.

**UNIT V Special Topics**

**9**

National water policy - Institutional aspects - Socio-economic perspective- Reclamation of salt affected soils- Seepage loss in command area- Irrigation conflicts- Water productivity – Water pricing.

**Total: 45 Periods**

**Text Books:**

1. Keller, .J. and Bliesner D.Ron, Sprinkler and Trickle irrigation, An ari book, Published by Van No strand Rein hold New York, 2001.
2. Israelson, Irrigation principles and practices, John Wiley & sons, New York, 2002.
3. Modi, P.N., Irrigation and water resources and water power engineering, Standard Book House, New Delhi, 2002.

**Reference Books:**

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.

**Website References:**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3										3		
CO2							3						3		
CO3							2						3		
CO4							2						2		
CO5							2						2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				

*B. S. Chaudhary*  
**CHAIRMAN - BOARD OF STUDIES**

Evaluate				
Create				

20AGE24	Automation in Irrigation	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

**Course Objectives**

The course is intended to

1. expose the students to the fundamental concept of irrigation automation
2. learn about the system automation
3. understand the IoT in irrigation
4. learn the use of surface and micro irrigation automation
5. develop the assessment parameters of irrigation

**Course Outcomes**

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain fundamental concept of irrigation automation	Remember
CO2	Identify the system automation	Understand
CO3	Develop the IoT in irrigation	Understand
CO4	Summarize the surface and micro irrigation automation	Understand
CO5	Design of assessment parameters of irrigation	Apply

**Course Content:**

**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 Automation System** **9**

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

**UNIT III IoT in Irrigation** **9**

IoT based Automated Irrigation System – IoT based Smart Irrigation – Sensor based Automation – 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 – Systems of Automation and its components – Design – Cost – Operation and maintenance.

**UNIT V Assessment of Parameters in Irrigation**

9

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

**Total: 45 Periods****Text Books:**

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. Rajesh Singh, "Internet of Things (IoT) Enabled Automation in Agriculture, New India, Publishing Agency, Nipa. 2018

**Reference Books:**

1. Brian Wahlin and Darell Zimbelman, Canal Automation for Irrigation Systems, America Society of Civil Engineers, 2014.
2. Darell D.Zimbelman, Planning, Operation, Rehabilitation and Automation of Irrigation water delivery system, American Society of Agricultural Engineers.

**Website References:**

1. <https://www.agriculturejournals.cz/web/rae/>
2. <https://sciendo.com/journal/AGRICENG>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3			2											
CO2	3			2											
CO3	3			2											
CO4	3			2											
CO5	3			2											
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				

Evaluate				
Create				

20AGE25	Agricultural Waste Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. Enhance the basic concepts of Agricultural Waste management.
2. Gain knowledge on utilization of agricultural wastes
3. Understand the fundamental aspects of biomass briquetting
4. Learn about the basics of Biochar production
5. Gain knowledge about the biogas and bio ethanol production

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the basic concepts of Agricultural waste management	Understand
CO2	Illustrate the different types of agriculture wastes and its utilization	Understand
CO3	knowledge on the Biomass briquetting techniques	Understand
CO4	Explain the Biochar production methods	Understand
CO5	Summarize the basic concept of biogas and bio ethanol production	Understand

### Course Contents:

#### UNIT I Introduction

9

Definitions- Availability of different types of agriculture wastes - its overall characteristics – classification of agro wastes based on their characteristics- Recycling- utilization potential- current constraints in collection and handling of agricultural wastes – environmental impact- Importance of collecting and Recycling.

#### UNIT II Composting

9

Definition and Importance- Solid waste suitable for composting – Methods of composting - vermicomposting - Biochemistry of composting – Factors involved – Infrastructure required and maturity parameters – value addition – application methods.

**UNIT III Biomass Briquetting**

**9**

Definition – Scope and Importance- Potential agro residues and their characteristics for briquetting – Fundamental aspects- Steps involved in briquetting- Technologies involved in briquetting – economic analysis of briquetting – setting up of briquetting plant- appliances for biomass briquettes.

**UNIT IV Biochar Production**

**9**

Definition - scope and importance of biochar- Characteristics of agro wastes suitable for Biochar production – Methods of Biochar production – Steps involved in biochar production- Pyrolysis – Methods of Pyrolysis- characteristics of Biochar – Role of Biochar in soil nutrition and carbon sequestration.

**UNIT V Biogas and Bio Ethanol Production**

**9**

Screening of suitable lingo cellulosic substrate for biogas production- Preparation of feed stocks for anaerobic bio- digestion – Types of digesters – Factors affecting - Nutrient value and utilization of biogas slurry- Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol – pre treatment-fermentation and distillation.

**Total: 45 Periods**

**Text Books:**

1. Uta Krogmann, Ina Körne and Luis F. Diaz.2010. Solid waste technology and management (Vol 1 and2). Blackwel Pub Ltd., Wiley Online library.
2. Yong Sik Ok, Sophie M. Uchimiya, Scott X. Chang, Nanthi Bolan.,” Biochar-production characterization and applications”. 2015. CRC press.

**Reference Books:**

1. Magdalena Muradin and Zenon Foltynowicz, “Potential for Producing Biogas from Agricultural Waste in Rural Plants in Poland”. Sustainability, 2014, 6, 5065-5074.
2. Biochar production from agricultural wastes via low-temperature microwave carbonization.
3. Qian Kang, Lise Appels, Tianwei Tan and Raf Dewil, “Bioethanol from Lignocellulosic Biomass: Current Findings Determine Research Priorities” The Scientific World Journal, 2014, Article ID 298153, 13 pages.

**Website References:**

1. [https://agritech.tnau.ac.in/org\\_farm/orgfarm\\_composting.html](https://agritech.tnau.ac.in/org_farm/orgfarm_composting.html)
2. <https://www.businesswaste.co.uk/agricultural-waste-management/>

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												
CO2	3	2												
CO3	3	2												
CO4	3	2												
CO5	3	2												
	<b>3</b>	<b>High</b>			<b>2</b>	<b>Medium</b>			<b>1</b>	<b>Low</b>				

Formative assessment			
Bloom’s Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	



Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE26	Climate Change and Adaptation	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. To know the basics and importance of atmosphere.
2. To know the basics of ozone layer and green house effect.
3. To learn about the global warming.
4. To learn about the climate change.
5. To know the mitigation measures against climate change.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Explain about the characters and composition of atmosphere.	Understand
CO2.	Illustrate the ozone layer and its depletion.	Understand
CO3.	Summarize the global warming causes and its impact.	Understand
CO4.	Explain about the climate change and its impact on various sectors.	Understand
CO5.	Infer about the mitigation technologies and practices against the climate change	Understand

### Course Contents:

#### UNIT I 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- Atmospheric pressure- Humidity- Cloud types and their classification.

#### UNIT II Earth's Climate

System  
9

Climate and Weather -Different agricultural seasons of India and Tamil Nadu and climatic characteristics of India- Role of ozone in environment- ozone layer - ozone depleting gases - Green House Effect- Hydrological Cycle – Carbon Cycle- Lapse rates.

**UNIT III Global Warming 9**

Global warming- Causes of global warming- Green House gases- Carbon dioxide- Methane- Nitrous oxide and Ozone- Radiative effects of Greenhouse Gases - impacts of global warming- Mitigation measures.

**UNIT IV Climate Change and Its Causes 9**

Climate change- Major Causes of climate change - Melting of ice Pole-sea level rise- Impacts of Climate Change on various sectors: Agriculture, Forestry and Ecosystem –Water Resources and Human Health- ,Industry and Social- Projected Impacts for Different Regions– Risk of Irreversible Changes- Climate Sensitivity and Feedback.

**UNIT V Climate Change and Mitigation Measures 9**

Carbon credits and Carbon Trading- Clean development mechanism- Kyoto Protocol and Montreal Protocol- UNFCCC and IPCC- Future Clean Technology– Eco- Friendly Plastic - Alternate energy – Carbon sequestration, Carbon capture and storage (CCS)- Mitigation Technologies, Practices and Efforts in India.

**Total: 45 Periods**

**Text Books:**

1. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007.
2. Mavi, H.S., 2010. Introduction to Agro- meteorology, oxford and IBH Publishing Co., New Delhi.

**Reference Books:**

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.

**Website References:**

1. <https://climate.nasa.gov/resources/global-warming-vs-climate-change/>
2. <https://www.wwf.org.uk/climate-change-and-global-warming>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)																
Cos	Pos												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2		-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2		-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3		-	-	-	-	-	-	-	-	-	-	-	-	-
	3	High				2	Medium				1	Low				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE27	Disaster Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Environmental Science				

### Course Objectives

#### The course is intended to

1. To provide students an exposure to disasters, their significance and types.
2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes in the country and
5. To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Identify the different types of disasters, causes	Understand
CO2.	Learn the impact on environment and society	Understand
CO3.	Abel to Assess vulnerability and various methods of risk reduction measures as well as mitigation.	Understand
CO4.	Abel to Draw the hazard and vulnerability profile of India, scenarios in the Indian context,	Understand
CO5.	Understand Disaster damage assessment and management.	Understand

### Course Contents:

#### UNIT I Introduction to Disasters

Definition: Disaster, Hazard,  
Risks – Disasters: Types of

Vulnerability, Resilience,  
disasters Earthquake,

Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters.

**UNIT II Approaches to Disaster Risk Reduction (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs).

**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 etc.- 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**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation.

**UNIT V Disaster Management: Applications, Case Studies and Field Works 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire.

**Total: 45 periods**

**Text Books:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361].
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011.

**Reference Books:**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi
2. Government of India, National Disaster Management Policy,2009.

**Website References:**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							3						2		
CO2							3						2		
CO3							3						2		
CO4							3						2		
CO5							3						2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks

Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE28	Water Harvesting and Soil Conservation Structures	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basics of Agricultural Engineering				

**Course Objectives**

The course is intended to

1. Gain knowledge on soil erosion principles
2. Understand about the estimation of soil erosion
3. Learn about the erosion control measures
4. Exposer on water conservation measures
5. Know about the agriculture sedimentation

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the soil erosion principles	Remember
CO2	Interpretation of method of estimation of soil erosion	Understand
CO3	Apply the knowledge on erosion control measures	Apply
CO4	Illustrate the water conservation measures	Understand
CO5	Know about the agriculture sedimentation	Understand

**Course Content:**

**UNIT I Soil Erosion Principle**

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

9

Prerequisites for soil and water conservation measures.

**UNIT II Estimation of Soil Erosion** **9**

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

**UNIT III Erosion Control Measures** **9**

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

**UNIT IV Water Conservation Measures** **9**

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

**UNIT V Sedimentation** **9**

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

**Total: 45 periods**

**Text Books:**

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

**Reference Books:**

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.

**Website References:**

1. [www.fao.org/docrep/w7314e/w7314e0q.htm](http://www.fao.org/docrep/w7314e/w7314e0q.htm)
2. <https://sciencdo.com/journal/AGRICENG>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1	2		
CO2	3	2	1									1	2		
CO3	3	2	1									1	2		
CO4	3	3	1									1	2		
CO5	3	2	1									1	2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

<b>20AGE29</b>	<b>Landscape Irrigation Design and Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Nil				

### Course Objectives

The course is intended to

1. Expose the students to the fundamental knowledge on introduction of landscape irrigation.
2. Learn about landscape irrigation.
3. Understand the modern methods of landscape irrigation.
4. Learn the design of landscape irrigation.
5. Develop the system of landscape irrigation.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain Introduction of landscape irrigation	Remember
CO2	Identify the landscape irrigation	Understand
CO3	develop the modern methods of landscape irrigation	Understand
CO4	Design of landscape irrigation	Understand
CO5	Summarize the system of landscape irrigation	Apply

### Course Content:

#### UNIT I Introduction of Landscape

9

Introduction to landscaping - Definition of landscape, Historical importance of Indian gardens and history of gardening in gardens of India and study of systems.

different eras, Famous their methods of irrigation

**Unit II Landscape Irrigation****9**

Conventional method of landscape irrigation- hose irrigation system, quick release coupling system and portable sprinkler with hose pipes.

**Unit-III Modern Methods of Landscape Irrigation****9**

Modern methods of landscape irrigation - pop-up sprinklers, spray pop-up sprinkler, shrub adopter, drip irrigation and bubblers; Merits and demerits of conventional and modern irrigation systems

**UNIT IV Design of Landscape Irrigation****9**

Types of landscapes and suitability of different irrigation methods, water requirement for different landscapes, Segments of landscape irrigation systems, Main components of modern landscape irrigation systems and their selection criteria; Types of pipes, pressure ratings, sizing and selection criteria.

**UNIT V Systems of Landscape Irrigation**

Automation system for landscape irrigation- main components, types of controllers and their application, Design of modern landscape irrigation systems, operation and maintenance of landscape irrigation systems. Use of softwares in irrigation design.

**Total: 45 Periods****Text Books:**

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

**Reference Books:**

1. Majumdar D. P., "Irrigation Water Management Principles and Practices", Prentice Hall of India, New Delhi, 2004.
2. Michael A. M., "Irrigation Theory and Practice", Vikas Publishing House, New Delhi, 2009.
3. "Irrigation and Drainage", Paper 24. "Crop Water Requirement". FAO, Rome, 1992 Reprint.
4. "Irrigation and Drainage" paper 56. "Crop Evapotranspiration: guidelines for computing crop water requirements", FAO, Rome 1998.
5. Sharma R.K and Sharma T.K., "Irrigation Engineering", S.Chand, New Delhi, 2008.

**Website References:**

1. <https://www.agriculturejournals.cz/web/rae/>
2. <https://sciendo.com/journal/AGRICENG>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1	2		
CO2	3	2	1									1	2		
CO3	3	2	1									1	2		
CO4	3	3	1									1	2		
CO5	3	2	1									1	2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	



Attendance	5
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Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE30	Remote Sensing and GIS Applications	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Surveying and Levelling				

### Course Objectives

#### The course is intended to

1. To introduce the principles and basic concepts of Remote Sensing and GIS
2. To introduce the remote sensing systems, data products and analysis
3. To introduce the concepts of remote sensing in Agriculture.
4. To introduce the spatial data models, analysis and presentation techniques
5. To study the applications of Remote Sensing and GIS in agriculture, soil and water resources

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To learn the principles and basic concepts of Remote Sensing and GIS	Understand
CO2.	Learn the remote sensing systems, data products and analysis	Understand
CO3.	Identify the concepts of remote sensing in Agriculture	Understand
CO4.	Understand the Data Input and models in GIS.	Understand
CO5.	Study the applications of Remote Sensing and GIS in agriculture, soil and water resources.	Understand

**Course Contents:**

**UNIT I Concepts of Remote Sensing and Satellites 9**

Definition- Historical background - Components of remote sensing – Energy source, electromagnetic spectrum, radiation principle, platforms and sensors - Active and passive remote sensing interference - Atmospheric effects on remote sensing – Energy interaction with earth surface feature - Data acquisition - Reflectance, spectral signatures for water, soil and vegetation.- Satellites - Types – Sun synchronous.

**UNIT II Data Products and Image Analysis 9**

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

**UNIT III Concepts of GIS 9**

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

**UNIT IV Data Input and Analysis 9**

Data – Spatial, Non-Spatial – Database models – Hierarchical network, Relational and Object-Oriented Data Models – Raster and Vector – Methods of Data input – Data Editing – Files and formats – Data structure – Data compression. Introduction to analysis – Measurements – Queries – Reclassification – Simple spatial analysis – Buffering – Neighboring functions – Map overlay.

**UNIT V Application of RS and GIS 9**

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

**Total: 45 Periods**

**Text Books:**

1. Anji Reddy. M, Remote Sensing and Geographical Information Systems, BS Publications, Hyderabad, 2001.
2. Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.
3. Patel A.N & Surendra Singh, “Remote sensing principles & applications”, Scientific Publishers , Jodhpur 1992.

**Reference Books:**

1. Bettinger, P., and Michael, G.W., “Geographical Information System: Applications in Forestry and Natural Resources Management,” Tata McGraw–Hill Higher Education, New Delhi, 2003
2. Ian Heywood., “An Introduction to GIS”, Pearson Education, New Delhi, 2001.

**Website References:**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					3								2		
CO2					3								2		

*B. S. S. S.*

**CHAIRMAN - BOARD OF STUDIES**

CO3				2								2		
CO4				2								2		
CO5				3								2		
	3	High			2	Medium			1	Low				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE31	Command Area Development	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

**Course Objectives**

The course is intended to

1. Expose the students to the fundamental knowledge on irrigation requirement
2. Learn about method of irrigation
3. Understand the diversion structures
4. Learn the command area development
5. Develop the design of agricultural drainage system

**Course Outcomes**

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain irrigation requirement	Remember
CO2	Identify the method of irrigation	Understand
CO3	develop the diversion structures	Understand
CO4	Design the canal & command area development	Understand
CO5	Summarize the drainage system	Apply

**Course Content:**

UNIT I Irrigation  
9

Requirement

Introduction--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 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 Command Area Development** **9**

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators – Cross drainage works – Canal Outlet, Escapes –Lining and maintenance of canals - Excess irrigation and waterlogging problem - Command area - Concept, Components of CADP - its role for water distribution and system operation - rotational irrigation system.

**UNIT V Design of Agricultural Drainage System** **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: 45 Periods**

**Text Books:**

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

**Reference Books:**

1. Modi, P.N., and Seth, S.M., “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi, 1991.
2. Jack Keller and Rond Belisher., “Sprinkler and Trickle Irrigation”, Vannistr and Reinhold, New York, 1990.
3. Sivanappan R.K., “Sprinkler Irrigation”, Oxford and IBH Publishing Co., New Delhi, 1987.

**Website References:**

1. <https://www.agriculturejournals.cz/web/rae/>
2. <https://sciendo.com/journal/AGRICENG>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1	2		
CO2	3	2	1									1	2		
CO3	3	2	1									1	2		
CO4	3	3	1									1	2		

*B. S. Srinivasan*

**CHAIRMAN - BOARD OF STUDIES**

CO5	3	2	1							1	2		
	3	High			2	Medium			1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE32	Land Reclamation Techniques	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. Acquire the knowledge of Land Reclamation.
2. Learn the concept of Command Area Development.
3. Learn the concept of Land Grading & Land Levelling.
4. Learn the concept of Flood Control.
5. Introduce Treatment method of Grassed Waterways.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the Land Reclamation concepts.	Understand
CO2.	Explain the concept of Command Area Development	Understand
CO3.	Identify the concept of Land Grading & Land Levelling	Understand
CO4.	Understand the Management in Flood Control	Understand

CO5.	Explain Treatment method of Grassed Waterways.	Understand
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**Course Contents:****UNIT I Land Reclamation** **9**

Classification of usar soils, salt resistant crops, reclamation of usar soils. Reclamation of waste lands forest lands and sandy soils, sand dunes stabilization.

**UNIT – II Ravine Reclamation Command Area Development** **9**

Classifications of ravines - various measures for ravine reclamation - Advantage and disadvantages - Command area development - Component of C.A.D.A. - Various C.A.D.A. programmes in India.

**UNIT – III Land Grading & Land Levelling:** **9**

Water harvesting – Scope - need types - long term - short-term water harvesting techniques - design of ponds.

**UNIT – IV Flood Control** **9**

Types of floods - damages caused by floods - elementary idea of head water flood control methods.

**UNIT – V Grassed Waterways** **9**

Use - design of waterways - grasses for waterways - construction of water ways - establishment of grasses on waterways - maintenance of waterways.

**Total: 45 Periods****Text Books:**

1. Michael, A.M. and Ojha, T.P. 2002. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.
2. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi. Press India Pvt. Ltd, 2007.
3. Jagadish Prasad. (1996). Principles and Practices of Dairy Farm Management. Kalyani Publishers, New Delhi.

**Reference Books:**

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

**Website References:**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							2								
CO2							2								
CO3							2								
CO4							2								
CO5							2								
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE33	Advanced Drainage Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basics of Agricultural Engineering				

### Course Objectives

The course is intended to

1. To expose the students concept of irrigation development.
2. To introduce the concepts of Soil-water-plant relationship from the context of irrigation water management.
3. Learn about the crop water requirement.
4. To train the students to evaluate the efficiency of surface irrigation systems, Productivity of irrigation systems and their performance.
5. To train the students to design different micro irrigation systems and select suitable methods.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain fundamental concept of irrigation development	Remember
CO2	Identify the system of soil water and plant relationship	Understand
CO3	Learn about the crop water requirement	Understand
CO4	Summarize the surface and efficiency of irrigation	Understand
CO5	Design of assessment of drip and sprinkler irrigation	Apply

**Course Content:****UNIT I Development of Irrigation****9**

Water Resources of India - Irrigation- Need, Advantages and Disadvantages, History of Irrigation development in India- National Water Policy- Inadequacy of Irrigation Management- Criteria for good Irrigation management.

**UNIT II Soil Water Plant Relationship****9**

Soil physical properties influencing Soil-water relationship-Forms and occurrence of Soil Water Classification of Soil Water- Soil Water Constants- Energy concept of Soil Water-Forces acting on Soil Water- Soil Water Potential concept- Soil Water retention- Soil Moisture Measurement.

**UNIT III Crop Water Requirement****9**

Water requirement of crops- Evapotranspiration and Consumptive use- Methods of estimating Evapotranspiration- Effective Rainfall- Irrigation Requirement-Duty of Water- Irrigation Efficiencies Irrigation Scheduling- Irrigation measurement.

**UNIT IV Surface Irrigation Methods****9**

Canal network and canal design- Surface irrigation methods- Types- Border irrigation, Furrow irrigation and Strip irrigation- Specifications, Hydraulics and Design.

**UNIT V Drip and Sprinkler Irrigation Method****9**

Sprinkler and Drip- History and development, Types, Components, Design and Layout, Performance Evaluation, Operation and Maintenance.

**Total : 45 Periods****Text Books:**

1. H.R.Haise, E.G.Kruse. et al., 1981. "Automation of Surface Irrigation: 15 years of USDAResearch and Development at Fort Collins, Colorado"
2. Michael, A.M., "Irrigation Theory and Practice", Vikas Publishers, New Delhi, 2002.

**Reference Books:**

1. Brian Wahlin and Darell Zimbelman, Canal Automation for Irrigation Systems, American Society of Civil Engineers, 2014
2. Darell D.Zimbelman, Planning, Operation, Rehabilitation and Automation of Irrigation water delivery system, American Society of Agricultural Engineers.

**Reference Books:**

1. <https://www.agriculturejournals.cz/web/rae/>
2. <https://sciendocom/journal/AGRICENG>



Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

### STREAM-III : FARM MACHINERY AND POWER

20AGE41	Agricultural Economics and Farm Management	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

#### Course Objectives:

The course is intended to

1. Understand the scope, importance and concept of farm management and farm layout.
2. Learn about the basic laws of Economics
3. Gain knowledge about cost curves and cost of cultivation for different types of crop.
4. Gain knowledge about the basic farm resources and its management techniques.
5. Learn about the farm financial, planning and budgeting techniques.

#### Course Outcomes

On successful completion  
able to

of the course, students will be

CO. No.	Course Outcome	Bloom's Level
CO 1	Explain the basic concept of farm management and farm layout.	Understand
CO 2	Constructing the basic laws of economics and cost concept.	Understand
CO 3	Illustrate about cost curves and its types, cost of cultivation.	Understand
CO 4	Infer about the different farm resources and its management.	Understand
CO 5	Summarize the farm financial studies	Understand

## Course Contents

### UNIT I Farm Management 9

Agricultural Economics – definition and scope – Farm Management – definition and scope- Classification of farms – Basic concepts of farm management - Relationship between farm management and other basic sciences - Farm layout – Farm records and accounts.

### UNIT II Laws of Economics 9

Basic laws of economics – demand and supply concepts – law of increasing, diminishing and constant returns- Product relationship – Production function definition and types- Optimum level of input use – Economics of scale external and internal economies and dis-economies - Cost concepts and its types - Factor relationship concepts.

### UNIT III Cost Curves 9

Principle of substitution – isoquant, isocline, expansion path- Product-product relationship – Production possibility curve – Cost curves – Factor-factor relationship – Least cost combination of inputs – Estimation of cost of cultivation of annual and perennial crops – Preparation of interview schedule and farm visit for data collection.

### UNIT IV Management of Resources 9

Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process – Management of resources – types of resources and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis and Discounting techniques.

### UNIT V Financial Analysis of Farm 9

Farm financial analysis – Balance sheet and Income statement – Cash flow analysis – Farm investment analysis – Time comparison principles – Farm planning and its types- Farm level management system – Farm budgeting and its type- examples of farm planning and budgeting.

**Total: 45 Periods**

#### Text books:

1. Johl, S.S., and Kapur, T.R., "Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007.
2. Devi, I., "Agricultural Economics" Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

#### Reference Books:

1. Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
2. Subba Reddy, S., and Raghu Ram, P. „ "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
3. Sankhayan, P.L. „ "Introduction to Farm Management", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001

#### Web source:

1. <https://www.britannica.com/topic/farm-management>

2. <http://www.aau.ac.in/colleges/departments/college-of-agriculture/agricultural-economics-and-farm-management/about/1/2>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1												
CO2	3	1													
CO3	2	2	1												
CO4	3	3	1												
CO5	2	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE42	Mechanics of Tillage and Traction	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Farm Tractors				

**Course Objectives**

The course is intended to

1. To impart the fundamental knowledge of mechanics in various tillage implements.
2. To impart the fundamental knowledge of dynamics in various tillage implements.
3. To familiarize the students about traction and mobility concept.
4. To study the tyres and testing methods.
5. To understand the statistics and GIS

applications of geo system.

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**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To understand the mechanics of tillage.	Understand
CO2.	To carry out a dynamics of tillage.	Understand
CO3.	To understand the traction and mobility concept.	Understand
CO4.	To identify the tyres geometry and tyre testing.	Understand
CO5.	To identify various agencies, support institutions and government organizations involved in safety training and promotion	Understand

**Course Contents:****UNIT I Mechanics of Tillage** **9**

Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship.

**UNIT II Dynamics of Tillage** **9**

Design of tillage tools principles of soil cutting, design equation, force analysis, application of dimensional analysis in soil dynamics performance of tillage tools.

**UNITIII Traction** **9**

Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction.

**UNIT IV Tyres** **9**

Tyre size, tyre lug geometry and their effects, tyre testing.

**UNIT V Applications** **9**

Soil compaction and plant growth, variability and geo statistics, application of GIS in soil dynamics.

**Total: 45 Periods****Text Books:**

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.

**Reference Books:**

1. Ralph Alcock.1986. Tractor Implements System. AVI Publ.
2. S. C. Jain, Farm Machinery- An Approach

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-

CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE43	Special Farm Equipment	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Farm Tractors				

**Course Objectives**

The course is intended to

1. To understand the movers and wedding equipments.
2. To enable the students to learn about the sprayers and dusters.
3. To enable students to understand the working of harvesters.

understand the

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**CHAIRMAN - BOARD OF STUDIES**

4. To have knowledge about air seeders and plough.
5. To familiarize the students with specialized farm equipments.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To understand the weeding equipments working principle.	Understand
CO2.	To carry out a different types of psrayers and dusters.	Understand
CO3.	To prepare and identify the energy expenses.	Understand
CO4.	Infer the Anthropometry and applications.	Understand
CO5.	To identify the human engineering in tractor design.	Understand

**Course Contents:**

**UNIT I Mowers and Weeding Equipment**

**9**

Weeding and intercultural equipment. Junior hoe - guntaka - blade harrow - rotary weeders for upland and low land - selection, constructional features and adjustments - Spading machine – coir pith applicators - Mower mechanism – lawn mowers.

**UNIT II Sprayers and Dusters**

**9**

Sprayers – Sprayer operation – boom sprayer - precaution - coverage - factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) - Electrostatic sprayers - Areal spraying – Air assist sprayers - orchard sprayers - Dusters - types - mist blower cum duster - other plant protection devices, care and maintenance.

**UNIT III Threshers and Harvesters**

**9**

Construction and adjustments - registration and alignment. Windrowers, reapers, reaper binders and forage harvesters. Diggers for potato, groundnut and other tubers. Sugarcane harvesters - cotton pickers - corn harvesters - fruit crop harvesters – vegetable harvesters.

**UNIT IV Threshers and Other Machineries**

**9**

Thresher – construction and working of multi crop thresher. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter- flail mowers - lawn mowers – tree pruners

**UNIT V Specialized Farm Equipment**

**9**

Pneumatic planters – air seeders – improved ploughs – reversible ploughs – suction traps – seed and fertilizer broadcasting devices, manure spreaders, sweep weeders – direct paddy seeders, direct paddy cum daincha seeder, coconut tree climbing devices, tractor operated hoist, tractor operated rhizome planter - Transplanters and Balers.

**Total: 45 Periods**

**Text Books:**

1. Jagdishwar Sahay. 2010. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi.
2. Michael and Ojha. 2005. Principles of Agricultural Engineering. Jain brothers, New Delhi.

**Reference Books:**

1. Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributors, Delhi.
2. Harris Pearson Smith machinery and et al. 1996. Farm equipments. Tata

McGraw-Hill pub., New Delhi.

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

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE44	Ergonomics and Safety In Agricultural Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

**Course Objectives**

The course is intended to

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1. To understand the roles of ergonomics in Agriculture.
2. To enable the students to learn about Physiological stress and physical activity.
3. To enable students to understand the energy expenses.
4. To have knowledge about sources anthropometry.
5. To familiarize the students with human engineering in tractor design.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To understand the human metabolism.	Understand
CO2.	To carry out a physiological functions.	Understand
CO3.	To prepare and identify the energy expenses.	Understand
CO4.	Infer the Anthropometry and applications.	Understand
CO5.	To identify the human engineering in tractor design.	Understand

**Course Contents:**

**UNIT I Ergonomics**

9

Ergonomics- introduction- Role of ergonomics in Agriculture - Human metabolism- energy liberation in human body- Types of human metabolism- energy requirements at work - acceptable work load.

**UNIT II Physiological Functions**

9

Human Skeletal system – muscle, structure and function - Physiological stress - Efficiency of work - Physical functions - Age and individual differences in physical functions- Physiological and operational criteria of physical activity.

**UNIT III Energy Expenditure**

9

Energy expenditure of activities-keeping energy expenditure within bounds- Energy expenditure of Spraying-Weeding operations - Movements of body members- Strength and endurance of movements - Movement of body members related to Agricultural activities - Speed and accuracy of movements - Time and distance of movements - Reaction time.

**UNIT IV Anthropometry**

9

Anthropometry – introduction- Types of data- Principles of applied anthropometry - concept of percentile – Normal distribution – Estimating the range – Minimum and Maximum dimensions- Cost benefit analysis - applications of anthropometric data. Anthropometric consideration in tool / equipment design.

**UNIT V Human Engineering in Tractor Design**

9

The operator – Machine Interface – Operator exposure to environmental factors – Thermal comfort for tractor operator – Spatial, Visual and Control requirement of the operator – Occupational health hazards - Noise – Dust- Vibration in Tractor.

**Total: 45 Periods**

**Text Books:**

1. Bridger, R.S. Introduction to ergonomics, McGraw Hill, INC, New York. 1995.
2. Sharma, D.N and Mukesh, S. Design of Agricultural Tractor- Principles and Problems, Jain Brothers, New Delhi. 2012.
3. Hand Book of Engineering, Indian Research, New Delhi.

Agricultural Council of Agricultural 2013. (ISBN : 978-81-



20AGE45	Energy Auditing and Management	L	T	P	C
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7164-134-5)

**Reference Books:**

1. Wesley E.Woodson. Human Factors design Hand Book. McGraw Hill Book Co., New York. 1981.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

		3	0	0	3
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Nil				

**Course Objectives**

The course is intended to

1. To understand the current energy scenario and importance of energy conservation.
2. To get familiarization with the measuring instruments used for the energy auditing
3. To emphasize the need for energy audit on various electrical systems.
4. To determine the methods of energy audit for the various industrial systems.
5. To illustrate the concepts of different energy efficient devices.

**Course Outcomes**

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Develop the ability to learn about the need for energy auditing process and usage of energy audit equipment.	Understand
CO2	Students will learn about the basic concepts of economic analysis and understand the energy management techniques	Understand
CO3	Learn the fundamental concepts and energy saving potentials for various electrical equipment	Understand
CO4	Develop the skills to learn and understand the energy efficient tools for industrial systems	Understand
CO5	Students will be able to learn about the concepts of energy efficiency in electrical utilities	Understand

**Course Contents****Unit - I General Aspects of Energy Audit****9**

Commercial and Non-commercial energy - energy needs of growing economy - energy pricing – energy sector reforms - energy conservation and its importance - Re-structuring of the energy supply sector - Energy Conservation Act-2001 and its features - electricity tariff – Demand Side Management – Energy Audit - Need for Energy Audit –Energy audit Methodology – understanding energy costs.

**Unit - II Instruments for Energy Auditing****9**

Energy Audit Instruments – classification – basic precautions – Need for instruments- Types - ultrasonic non-contact type flow meters for liquids – Clamp-on type power/energy meters – Anemometers/Pitot tube for measuring velocity of gas – Digital Manometer – Tachometer – Digital Thermometers for liquid/surface temperature – Pyrometer – Thermal Imagers – Lux Meter – Combustion Gas Analyzer – Pressure Gauges – Digital Hydro-temperature meter for temperature and RH measurement.

**Unit - III Energy Efficiency in Electrical Systems****9**

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors – case study.

**Unit - IV Energy Efficiency in Industrial Systems****9**

Compressed Air System: Types of air compressors –compressor efficiency, efficient compressor operation, compressed air system components –Factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, Performance Evaluation, energy conservation opportunities, Pumps and Pumping System: Types, Performance Evaluation, energy conservation opportunities – case study.

**Unit - V Energy Efficient Systems****Technologies in Electrical**  
**9**

<b>20AGE46</b>	<b>Bio-Energy Systems: Design and Applications</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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Maximum demand controller - automatic power factor controllers –Energy Efficient transformer – Energy Efficient motors - soft starters with energy saver - Variable Speed Drives –Energy Efficient Lighting System: Light source, choice of lighting, luminance requirements – Electronic ballast - occupancy sensors – Energy saving potential of each technology

**Total: 45 Periods**

**Text Books:**

1. MoncefKradi, Energy Audit of Building Systems : An Engineering Approach, Second Edition, CRC Press, 2016
2. Sonal Desai, Handbook of Energy Audit, McGraw Hill Education (India) Private Limited, 2015
3. Michael P.Deru, Jim Kelsey, Procedures for Commercial Building Energy Audits, American Society of Heating, Refrigerating and Air conditioning Engineers, 2011

**Reference Books:**

1. Thomas D.Eastop, Energy Efficiency: For Engineers and Technologists, Longman Scientific & Technical, 1990
2. Albert Thumann, Terry Niehus and William J. Younger, “Handbook of Energy Audits”, 9th Edition, The Fairmont Press, 2012

<b>Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)</b>															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

<b>Formative assessment</b>			
Bloom’s Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

<b>Summative Assessment</b>				
Bloom’s Category	Internal Assessment			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

		3	0	0	3
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Nil				

**Course Objectives**

The course is intended to

1. Analyze the technologies available for conversion of biomass to energy in terms of its technical.
2. To detail on the types of biomass, its surplus availability and characteristics. competence and economic implications.
3. To apply the knowledge on combustion process.
4. To study the applications of gasification, pyrolysis and carbonisation.
5. To detail on the Invent methods for liquified biofuels production system.

**Course Outcomes**

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Enumerate the importance of bioenergy.	Understand
CO2	The manufacturing process of biomethanation.	Understand
CO3	Apply knowledge on combustion process.	Understand
CO4	Appraise the applications of gasification, pyrolysis and carbonisation.	Understand
CO5	Invent methods for liquified biofuels production system.	Understand

**Course Contents****UNIT I Introduction****9**

Biomass: types – advantages and drawbacks – Indian scenario – characteristics – carbon neutrality – conversion mechanisms – fuel assessment studies – densification technologies – Comparison with coal – Proximate & Ultimate Analysis - Thermo Gravimetric Analysis – Differential Thermal Analysis – Differential Scanning Calorimetry.

**UNIT II Biomethanation****9**

Microbial systems – phases in biogas production – parameters affecting gas production – effect of additives on biogas yield – possible feed stocks. Biogas plants – types – design – constructional details and comparison – biogas appliances – burner, luminaries and power generation – effect on engine performance

**UNIT III Combustion****9**

Perfect, complete and incomplete combustion - stoichiometric air requirement for biofuels - equivalence ratio – fixed Bed and fluid Bed combustion – fuel and ash handling systems – steam cost comparison with conventional fuels

**UNIT IV Gasification, Pyrolysis and Carbonisation****9**

Chemistry of gasification - types – comparison – application – performance evaluation – economics – dual fuelling in IC engines – 100 % Gas Engines – engine characteristics on gas mode – gas cooling and cleaning systems - Pyrolysis - Classification - process governing parameters – Typical yield rates. Carbonization Techniques – merits of carbonized fuels

**UNIT V Liquified Biofuels****9**

History of usage of Straight Vegetable Oil (SVO) as fuel - Biodiesel production from oil seeds, waste oils and algae - Process and chemistry - Biodiesel health effects / emissions / performance. Production of alcoholic fuels (methanol and ethanol) from biomass – engine modifications

**Total: 45 Periods****Text Books:**

1. Bio Gas

Technology, B.T. Nijaguna.

New Age International- New Delhi.2001-02

2. Energy Technology, S. Rao & B. B. Parulekar – Khanna Publishers, Delhi-1999.

3. Non-Conventional Energy Sources, G. D. Rai – Khanna Publishers. Delhi.

**Reference Books:**

1. Greenhouse Technology for Controlled Environment, G.N. Tiwari, Alpha Science International Ltd., Pangbourne.England.

2. Renewable Energy Resources, John.W.Twidell, Anthony. D. Weir, EC BG-2001.

3. BioMass, Deglisc. X and P. Magne, Millennium Enterprise, New Delhi.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE47	Tractor Design and Testing	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Farm Tractors				

### Course Objectives

#### The course is intended to

1. To learn the design procedure for agriculture tractor.
2. To understand the parameters for design of tractor stability.
3. To design the mechanical power transmission in tractors.
4. To understand the design of steering system.
5. To get the knowledge on testing of Tractor engine.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Develop the design procedure for Tractors.	Apply
CO2.	Illustrate the parameters for design of tractor stability.	Apply
CO3.	Create the design of mechanical power transmission.	Apply
CO4.	Create the design of steering system.	Apply
CO5.	Develop the testing procedure for Tractors engine.	Apply

### Course Contents:

#### Unit I Design Procedure for Agricultural Tractor

9

Procedure for design and development of agricultural tractor, classification, selection.

#### Unit II Parameters for Design of Tractor Stability

9

Study of parameters for balanced design of tractor for stability & weight distribution, traction theory, hydraulic lift and hitch system design.

#### Unit III Design of Power Transmission System

9

Complete drive train, transmission. Design of mechanical power transmission in agricultural tractors: single disc, multi disc and cone clutches.

#### Unit IV Design of Steering System

9

Design of Ackerman Steering and tractor hydraulic steering. Rolling friction and anti-friction bearings.

#### Unit V Design of Tractor Engine and Testing

9

Study of special design features of tractor engines and their selection viz. cylinder, piston, piston pin, crankshaft, etc Design of seat and controls of an agricultural tractor, Tractor Testing.

**Total: 45 Periods**

### Text Books:

1. C., Tiwari, P. S., Suresh Narang and Mehta, C. R. 2004. Data Book for Agricultural Machine Design Varshney, Central Institute of Agricultural Engineering, NabiBagh, Berasia Road, Bhopal.
2. Adinath, M. and Gupta, A. B. 2012. Manufacturing Technology. New Heights Publishers, KarolBagh. New Delhi.

**Reference Books:**

1. Sharma, P. C. and Aggarwal, D. K. 2013. Machine Design, Kataria, S.K. and Sons Publisher. New Delhi.
2. Banga, T. R. and Sharma, S. C. 2009. Industrial Organization and Engineering Economics. Romesh Chander Khanna, Khanna Publishers. New Delhi.
3. Richey, C. B. 1961. Agricultural Engineer's Handbook. McGraw-Hill Publisher. New York.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3	2	-	-	-	1	2	-	-	-	-	-	-	-	
CO2	3	2	2	2	-	1	2	-	-	-	-	1	-	-	
CO3	3	2	2	2	-	1	2	-	-	-	-	1	-	-	
CO4	3	2	2	2	-	1	2	-	-	-	1	1	-	-	
CO5	3	2	2	-	-	1	2	-	-	-	-	-	-	-	
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20AGE48	Thermal Power Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Engineering Thermodynamics for Agriculture Engineering				

### Course Objectives

#### The course is intended to

1. To learn the types of fuels and working of external combustion engines.
2. To understand the working of working and different system of IC engines.
3. To calculate the performance parameters of IC engine.
4. To understand the working of different types of boilers.
5. To get the knowledge on concept of cogeneration and CHP.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Determine the calorific values of fuels.	Apply
CO2.	Illustrate the working of an IC engines.	Understand
CO3.	Identify the performance of an engine & Conduct the different tests.	Apply
CO4.	Explain the working of different types of boilers.	Understand
CO5.	Illustrate the concept of Cogeneration and CHP.	Understand

### Course Contents:

#### UNIT I Fuels and External Combustion Engines 9

Fuels – types and properties – higher and lower heating values, their determination- study of thermodynamic cycles - Rankine - Brayton - External combustion engine - steam, sterling engines.

#### UNIT II IC Engines 9

IC Engines - Types – Components – two stroke & four stroke cycle engines – valve timing diagrams – petrol and diesel engines – Rating of SI and CI engine fuels – Ignition system for petrol engines – Fuel injection system for CI engines – cooling systems for IC engines – Lubrication systems for IC engines.

#### UNIT III Performance of IC engines 9

Performance Parameters IMEP, IHP, BHP - rope brake, prony brake, hydraulic and electrical dynamometers. Mechanical efficiency – Brake Thermal Efficiency – Volumetric efficiency - Testing of IC engines: Morse test and Heat balance test for IC engines.

#### UNIT IV Steam Boilers 9

Boilers-components – classification – Cochran, Scotch marine, Lancashire, Cornish, Locomotive, Babcock and Wilcox, La-Mont, Loeffler and Benson boilers – boilers mountings and accessories. Performance of steam boilers. Water treatment – methods of water treatment for boilers - Boiler safety and maintenance.

#### UNIT V Cogeneration and Combined Heat and Power

Cogeneration & Trigeneration - Gas and steam turbines – principle - waste heat recovery boiler losses. Cooling towers. CHP Systems - biogas Cogeneration CHP Plant Equipment - performance. Measurement of pressure, fluid flow, and temperature - calibration.

**Total: 45 Periods**

#### Text Books:

1. Khurmi R.S & Gupta J K., "A Text book of thermal Engg", S.Chand & Co. Ltd., 2020.

2.. Nag P.K.,  
thermodynamics", Tata-

"Engineering  
McGraw Hill Publishing Co,



New Delhi, 2017.

- Jain P.C. and Monika Jain., "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2015.

**Reference Books:**

- Ganesan V., "IC Engines", TATA McGraw-Hill Publishers, New Delhi, 2017.
- Kothandaraman. C.P., Domkundwar.S, and Domkundwar. A.V., "A Course in Thermal Engineering", Dhanpat Rai & Sons, 2016.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	1	2	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	1	2	-	-	-	-	1	-	-	-
CO3	3	2	2	2	-	1	2	-	-	-	-	1	-	-	-
CO4	3	2	2	2	-	1	2	-	-	-	1	1	-	-	-
CO5	3	2	2	-	-	1	2	-	-	-	-	-	-	-	-
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	20	10	20	20
Apply	20	30	20	60
Analyze				
Evaluate				
Create				

20AGE49	Human Engineering and Safety	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. To understand the principles of safety management.
2. To enable the students to learn about various functions and activities in organization.
3. To enable students to conduct safety audit and write audit reports effectively in auditing situations.
4. To have knowledge about sources of information for safety promotion and training.
5. To familiarize students with evaluation of safety performance.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To understand the functions and activities of safety engineering department.	Understand
CO2.	To carry out a safety audit and prepare a report for the audit.	Understand
CO3.	To prepare an accident investigation report.	Apply
CO4.	To estimate the accident cost using supervisors report and data.	Apply
CO5.	To identify various agencies, support institutions and government organizations involved in safety training and promotion	Understand

### Course Contents:

#### UNIT I Introduction and Needs of Safety

9

Introduction- Safety- Goals of safety engineering. Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation.

#### UNIT II Safety Organization

9

Safety organization - objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer responsibilities, authority. Safety committee- needs, types, advantages. Accident prevention Methods- Engineering, Education and Enforcement

#### UNIT III Safety Education and Training

9

Safety Education & Training-Importance, Various training methods, Effectiveness of training, Behaviour oriented training. Communication - purpose, barrier to communication. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5s of housekeeping. Work permit system - objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

#### UNIT IV Safety Performance Monitoring

9

Personal protection in the work environment, Types of PPEs, Personal protective equipment respiratory and non respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Cost of accidents - Computation of Costs - Utility of Cost data. Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis (JSA), Safety surveys, and Safety audits. Safety Inventory Technique.

**UNIT V Accident Investigation and Reporting****9**

Accident investigation - Why? When? Where? Who? and How? Basics - Man- Environment and Systems. Process of Investigation - Tools-Data Collection - Handling witnesses - Case study. Accident analysis - Analytical Techniques - System Safety-Change Analysis – MORT - Multi Events Sequencing -TOR.

**Total: 45 Periods****Text Books:**

1. Heinrich H.W., "Industrial Accident Prevention" McGraw-Hill Company, New York., 4<sup>th</sup> edition, 2013.
2. Krishnan N.V., "Safety Management in Industry" Jaico Publishing House, Bombay, 2010.

**Reference Books:**

1. John V. Grimaldi and Rollin H.Simonds., "Safety management", All India Traveller Book Seller, Delhi.
2. Ronald P, Blake., "Industrial safety", Prentice Hall, New Delhi.
3. Akhil Kumar Das., "Principles of Fire Safety Management", Eastern Economy Edition, 2020.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20AGE50	Farm Machinery Design and Production	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Farm Tractors				

### Course Objectives

#### The course is intended to

1. To learn the design procedure for agriculture machines.
2. To understand the parameters for design of power transmission components.
3. To identify the different materials for agricultural machinery.
4. To understand the advanced manufacturing techniques.
5. To familiarize the knowledge about design requirements..

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Develop the design procedure for agricultural machines.	Apply
CO2.	Illustrate the parameters for design of power transmission components.	Apply
CO3.	Understand the different materials for agricultural machinery.	Understand
CO4.	Infer the advanced manufacturing techniques.	Understand
CO5.	Illustrate the design requirements	Understand

### Course Contents:

#### Unit I Design parameters of agricultural machines 9

Introduction to design parameters of agricultural machines & design procedure. Characteristics of farm machinery design. Research and development aspects of farm machinery.

#### Unit II Design of power transmission components 9

Design of standard power transmission components used in agricultural machines: mechanical and hydraulic units. Introduction to safety in power transmission.

#### Unit III Material for agricultural machinery 9

Application of design principles to the systems of selected farm machines. Critical appraisal in production of Agricultural Machinery. Advances in material used for agricultural machinery. Cutting tools including CNC tools and finishing tools.

#### Unit IV Advanced manufacturing techniques 9

Advanced manufacturing techniques including powder metallurgy, EDM (Electro-Discharge Machining). Heat Treatment of steels including pack carburizing, shot peening process, etc.

#### Unit V Design requirements 9

Limits, Fits and Tolerances, Jigs and Fixtures. Industrial lay-out planning, Quality production management. Reliability. Economics of process selection. Familiarization with Project report.

**Total: 45 Periods**

#### Text Books:

1. Liljedahl J. B., Carleton W. M., Turnquist P. K. and Smith D. W. 1984. Tractors and their Power Units. AVI Publishing Co. Inc., Westport, Connecticut.
2. Mehta M. L., Verma, S. R., Mishra, S. K., Sharma, V. K. 2005. Testing and Evaluation of Agricultural Machinery, Daya Publishing House, New Delhi.

**Reference Books:**

1. Raymond N, Yong E. A. and Nicolas S. 1984. Vehicle Traction Mechanics, Elsevier Scientific Publications, USA.
2. Maleev V. L., 1964. Internal Combustion Engines, Tata McGraw-Hill, USA.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	1	2	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	1	2	-	-	-	-	1	-	-	-
CO3	3	2	2	2	-	1	2	-	-	-	-	1	-	-	-
CO4	3	2	2	2	-	1	2	-	-	-	1	1	-	-	-
CO5	3	2	2	-	-	1	2	-	-	-	-	-	-	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20AGE51	Testing of Farm Machineries	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Farm Tractors				

**Course Objectives****The course is intended to**

1. To learn the different constraints involved in machinery.
2. To understand the testing and evaluation of tractor.
3. To identify the testing and evaluation of power tiller
4. To understand the testing and evaluation of tillage and sowing equipment.
5. To familiarize the testing and evaluation of plant protection and harvesting machinery.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	To understand the different constraints involved in field machinery system.	Understand
CO2.	To gain knowledge on testing and evaluation of tractor.	Apply
CO3.	To gain knowledge on testing and evaluation of power tiller	Apply
CO4.	To understand the testing and evaluation of tillage and sowing equipment	Apply
CO5.	To understand the testing and evaluation of plant protection and harvesting machinery	Apply

**Course Contents:****UNIT I Management of Machinery****9**

Field machinery system – operational constraints – power constraints – working day – operation specific machinery management problems. Cost – Value of money – operational cost machinery for operator comfort and safety

**UNIT II Tractor****9**

Testing and evaluation systems in India – General Guide lines on the use of test codes. Testing and Evaluation of agricultural tractors – Indian standards. Performance of agricultural tractors – analysis of results – Nebraska tractor test and test reports.

**UNIT III Power Tiller****9**

Testing and evaluation of power tiller and power tiller attached implements.

**UNIT IV Tillage and Sowing Equipment****9**

Testing and evaluation of Tillage machinery - seed cum fertilizer drill – weeders - Rice transplanter

**UNIT V Plant Protection and Harvesting Machinery****9**

Testing and evaluation of manually operated sprayer and duster - Combine harvester - thresher.

**Total: 45 Periods****Text Books:**

1. Metha M.L., SR.Verma, K Mishra and V.K. Sharma, "Testing and Evaluation of Agricultural Machinery", National Agricultural Technology Information Centre, Ludhiana-141001, 1995.
2. RNAM test codes and procedure for farm machinery, 1983.
3. Donnell Hunt. "Farm power and machinery

management”, Scientific International Pvt. Ltd. New Delhi, 2013.

**Reference Books:**

1. Liljedahl, J.B., P.K. Turnquist, D.W.Smith and M.Hoki. 2004. Fourth Edition. Tractors and their power units. CBS Publishers and Distributers, Delhi.
2. Kepner, R.A., R.Bainer, E.L. Barger. 2005. Third Edition. Principles of farm machinery. CBS Publishers and Distributers, Delhi.
3. Claude Culpin (198) Profitable farm mechanization Crosby Lockwood & Sons Ltd., 26, Old Brompton Road, SW.7

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	1	2	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	1	2	-	-	-	-	1	-	-	-
CO3	3	2	2	2	-	1	2	-	-	-	-	1	-	-	-
CO4	3	2	2	2	-	1	2	-	-	-	1	1	-	-	-
CO5	3	2	2	-	-	1	2	-	-	-	-	-	-	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20AGE52	Blue Print of Machines	L	T	P	C
		3	0	0	3
Nature of Course	Professional Electives				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. To understand the basic machine blueprints.
2. To enable the students to learn about use of basic drafting tools.
3. To enable students to learn the basic drafting principles.
4. To have knowledge about geometric dimensions and blueprint notes.
5. To familiarize students with sheet metal, mechanical blueprints used in industry.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Interpret basic machine blueprints used for engineering and manufacturing.	Understand
CO2.	Demonstrate the use of basic drafting and measuring tools.	Understand
CO3.	Describe basic drafting principles and practices.	Understand
CO4.	Interpret blueprint notes, geometric dimensions, change orders.	Understand
CO5.	Interpret sheet metal, mechanical, electrical and welding blueprints used in industry.	Understand

### Course Contents:

#### UNIT I Basic Machine Blueprints

9

Manufacturing processes and materials – Thread and fastening systems – Section line symbols – Cam, gear and bearing terminology – Prints of cam, gear and bearing.

#### UNIT II Drafting and Measuring Tools

9

Drawing scales - Read and identify – Sketching of lines, shapes, multiview and isometric objects - Use of scales, calipers, micrometers, dial calipers and dial indicators – Metric and inch measuring systems.

#### UNIT III Drafting Principles and Practices

9

Drafting industry – Documentation processes – American National Standards Institute (ANSI) – Multiview, sectional and auxiliary view of drawings – Dimensioning and tolerancing systems – Types of pictorial drawings.

#### UNIT IV Geometric Dimensions

9

Calculation of specified tolerances – Geometric dimensioning - ANSI Symbols – Prints of cam, gear and bearing specifications – parts lists.

#### UNIT V Industry Applications of Blueprints

9

Welding symbols – single and multiple component - sheet metal prints – seams and hems – ANSI symbols for electrical drafting - basic electrical diagrams.

**Total: 45 Periods**

### Text Books:

1. Jack Rudman.,  
Operator”, National

“Blueprint Machine  
Learning Corporation,



1989.  
 2. Robert Stark., "Blueprint for a Time Machine" outskirts Press, Inc., 2021.

**Reference Books:**

1. Pintozzi J.A., "The Apprentice Guide to Blueprint Reading", Independently Published, 2017.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)																
Cos	Pos												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-	
CO2	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-	
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-	
CO5	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-	
	3	High				2	Medium				1	Low				

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGE53	Modern Applications of Sensors	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	IoT in Agriculture Systems				

### Course Objectives

The course is intended to

1. To expose the students concept of fundamentals and characteristics
2. To introduce the concepts of optical sources and detectors
3. Learn about the intensity polarization and infer metric sensor
4. To train the students to evaluate the strain force ,torque and pressure sensors
5. To train the students to design of positions, directions and displacement level of sensors

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain fundamental concept of fundamentals of irrigation	Remember
CO2	Identify the system concept of optical sources and detectors	Understand
CO3	Learn about the intensity polarization and infer metric sensor	Understand
CO4	Summarize the surface and efficiency of irrigation	Understand
CO5	Design of assessment of drip and sprinkler irrigation	Apply

### Course Content:

#### UNIT I Sensor fundamentals and characteristics 9

Fundamentals of sensor - Sensor Classification - sensor characteristics - Performance and Types - Error Analysis characteristics.

#### UNIT II Optical Sources and Detectors 9

Electronic and Optical properties of semiconductor as sensors, LED, Semiconductor lasers, Fiber optic sensors, Thermal detectors, Photo multipliers, photoconductive detectors, Photo diodes, Avalanche photodiodes, CCDs.

#### UNIT III Intensity Polarization and Interferometric Sensor 9

Intensity sensor, Microbending concept, Interferometers, Mach Zehnder, Michelson, FabryPerot and Sagnac, Phase sensor: Phase detection, Polarization maintaining fibers.

#### UNIT IV Strain, Force, Torque and Pressure sensors 9

Canal network and canal design- Surface irrigation methods- Types- Border irrigation, Furrow irrigation and Strip irrigation- Specifications, Hydraulics and Design.

#### UNIT V Position, Direction, Displacement and Level sensors 9

Potentiometric and capacitive sensors, Inductive and magnetic sensor, LVDT, RVDT, eddy current, transverse inductive, Hall effect, magneto resistive, magnetostrictive sensors. Fiber optic liquid level sensing, Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor. Signal condition circuits for reactive and self generating sensors.

**Total:45 Periods**

### Text Books:

1. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Applications", 3<sup>rd</sup> edition, Springer, New York, 2015.
2. Jon. S. Wilson, "Sensor Technology Hand Book", 1st edition, Elsevier, Netherland, 2011.

**Reference Boks:**

1. GerdKeiser, "Optical Fiber Communications", 5th edition, McGraw-Hill Science, Delhi, 2017.
2. John G Webster, "Measurement, Instrumentation and sensor Handbook", 2nd edition, CRC Press, Florida, 2017.
3. Eric Udd and W.B. Spillman, "Fiber optic sensors: An introduction for engineers and scientists", 2nd edition, Wiley, New Jersey, 2013.

**Website References:**

1. <https://www.ECEjournals.cz/web/rae/>
2. [https://sciendo.com/journal/ECE\\_CENG](https://sciendo.com/journal/ECE_CENG)

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and PSOs															
COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

## OPEN ELECTIVE COURSES (For Other Branches)

20AG001	Air Pollution and Control Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Environmental Science				

**Course Objectives****The course is intended to**

1. To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous
2. To understand the fundamentals knowledge on meteorology.
3. To Gain control of particulate contaminants.
4. Learn the different control of **gaseous contaminants**
5. **Gain knowledge about air quality management.**

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	The students completing the course will have an understanding of the nature and characteristics of air pollutants, noise pollution.	Understand
CO2.	Ability to identify, formulate and solve air and noise pollution problems	Understand
CO3.	basic concepts of air quality management	Remember
CO4.	ability to design stacks and particulate air pollution control devices to meet applicable	Understand
CO5.	Identify the air quality management.	Understand

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

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards – Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

**UNIT II METEOROLOGY****9**

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

**UNIT III CONTROL OF PARTICULATE CONTAMINANTS****9**

Factors affecting Selection of Control Equipment – Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations.

**UNIT IV CONTROL OF GASEOUS CONTAMINANTS****9**

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations.

**UNIT V INDOOR AIR QUALITY MANAGEMENT****9**

Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control- Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures.

**Total: 45 Periods**

TEXTBOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak „Air Pollution“, Lweis Publishers, 2000.
2. Arthur C.Stern, „Air Pollution (Vol.I – Vol.VIII)“, Academic Press, 2006.
3. Wayne T.Davis, „Air Pollution Engineering Manual“, John Wiley & Sons, Inc.,2000.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO2	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO3	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO4	3	3	2	2	-	3	3	2	-	-	-	-	2	-	-
CO5	3	3	2	2	-	2	2	1	-	-	-	-	2	2	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGO02	Principles of Food Preservation	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective courses				
Prerequisites	Basics of Agricultural Engineering				

### Course Objectives

The course is intended to

1. To expose the students to the principles and different methods of food processing and Preservation.
2. Understand the principles of food processing and their impact on the shelf life and quality of food materials and products.
3. Introduce novel food processing techniques.
4. To understand the operations and features of different non-thermal processing techniques and applying to improve the shelf life of product.
5. Introduce the principle of advanced novel techniques in food processing industries.

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Apply different methods of high and low temperature processing techniques over raw foods and analyze the process time of that food properties of food.	Understand
CO2	Understand and apply the suitable dryers to different food to increase the shelf life and analyse the working of extrusion process and their features.	Understand
CO3	Analyze the shelf life of foods processed and preserved by natural and chemical agents.	Understand
CO4	Understand the operations and features of different non-thermal processing techniques and applying to improve the shelf life of product.	Understand
CO5	Apply the principle of advanced novel techniques in food processing industries.	Understand

### Course Contents

#### Unit - I Food preservation and its importance

9

Introduction to food preservation, Wastage of processed foods; shelf life of food products; types of food based on its perishability, Traditional methods of preservation

#### Unit - II Methods of Food Handling and Storage

9

Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods. retort pouch packing, Aseptic packaging.

#### Unit - III Thermal Methods

9

Newer methods of thermal processing; batch and continuous; In container sterilization- canning; application of infra-red microwaves; ohmic heating; control of water activity; preservation by concentration and dehydration; osmotic methods

#### Unit - IV Drying process for typical foods

9

Rate of drying for food products; design parameters of different type of dryers; properties of air-water mixture, Psychrometric chart, freezing and cold storage, freeze concentration, dehydro- freezing, freeze drying, IQF;

calculation of refrigeration load, design of freezers and cold storages

### Unit - V Non-Thermal Methods

9

Super Critical Technology for Preservation – Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology,

**Total: 45 Periods**

#### TextBooks

1. Karnal, Marcus and D.B. Lund Physical Principles of Food Preservation. Rutledge, 2003.
2. VanGarde, S.J. and Woodburn. M Food Preservation and Safety Principles and Practice. Surbhi Publications, 2001.
3. Sivasankar, B. Food Processing and Preservation, Prentice Hall of India, 2002.

#### Reference Books

1. Rahman, M. Shafiur. Handbook of Food Preservation. Marcel and Dekker, 2006.
2. Zeuthen, Peter and Bogh-Sorensen, Leif. Food Preservation Techniques. CRC / Wood Head Publishing, 2003.
3. Ranganna, S. Handbook of Canning and Aseptic Packaging. Tata McGraw-Hill, 2000.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGO03	Introduction to Bio Energy and Bio Fuels	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective courses				
Prerequisites	Nil				

### Course Objectives

The course is intended to

1. This course will be focused on achievement, acquisition of knowledge and enhancement of comprehension of information regarding bioenergy and biofuel technologies and their sustainable applications.
2. To study in detail on the types of biomass, its surplus availability and characteristics.
3. To study the technologies available Technologies for conversion of biomass to energy in terms of its technical competence and economic implications.
4. To study the analysis effect of constraints on the performance of biofuel energy systems
5. To study the Environmental, bioenergy Sustainability and perform Energy-Economic Analysis for a typical applications

### Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	The students will be able to analyze the appropriate kinds of energy for future development	Understand
CO2	Student will be able do to Simulation and Modelling of typical energy system	Understand
CO3	A practical understanding on the various biomass energy conversion technologies and its relevance towards solving the present energy crisis.	Understand
CO4	Able to analysis effect of constraints on the performance of biofuel energy systems	Understand
CO5	Has a potential to do Environmental, bioenergy Sustainability and perform Energy-Economic Analysis for a typical applications	Understand

### Course Contents

#### Unit - I CONCEPTS

9

Biopower, Bioheat, Biofuels, advanced liquid fuels, drop-in fuels, biobased products

#### Unit – II FEEDSTOCKS

9

Harvested Feedstocks: First generation biofuels, Second generation biofuels, third generation biofuels. Residue Feedstocks: Agricultural wastes, forestry wastes, farm waste, organic components of residential, commercial, institutional and industrial waste.

#### Unit - III CONVERSION TECHNOLOGIES

9

Biorefinery concept – biorefineries and end products, Biochemical conversion – hydrolysis, enzyme and acid hydrolysis, fermentation, anaerobic digestion and trans-esterification, Thermochemical conversion – Combustion, Gasification, Pyrolysis, other thermochemical conversion technologies. Scaling up of emerging technologies.

#### Unit - IV BIOFUELS

9

Pros and cons of Biofuels, Algal biofuels, Cyanobacteria and producers of biofuels, Jatropha as biodiesel producer, Bioethanol, Biomethane, biohydrogen, biobutanol, metabolic engineering of fuel molecules,



Engineering aspects of biofuels, Economics of biofuels

### Unit - V SUSTAINABILITY & RESILIENCE

9

Environmental Sustainability, bioenergy sustainability, emissions of biomass to power generation applications, emissions from biofuels. ILUC issues, Carbon footprint, Advanced low carbon fuels

**Total: 45 Periods**

#### TextBooks

1. Biorenewable Resources – Engineering new products. Robert C Brown. Blackwell Publishing Professional, 2003.
2. Biofuels. Wim Soetaert and Erik Vandamme (Editors) Wiley. 2009.
3. Biomass for Renewable Energy, Fuels and Chemicals. Donald Klass. Academic press. 1998

#### Reference Books

1. Introduction to Bioenergy. Vaughn C. Nelson and Kenneth L. Starcher.
2. Bioenergy: Biomass to Biofuels by Anju Dahiya

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes(PSO)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	2													
CO3	3	2													
CO4	3	2													
CO5	3	2													
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AG004	Energy Technology	L	T	P	C
		3	0	0	3
Nature of Course	Open Electives				
Pre requisites	Engineering Thermodynamics for Agriculture Engineering				

### Course Objectives

#### The course is intended to

1. To learn the energy scenario in India and energy alternatives.
2. To understand the working principle of different types of conventional energy system.
3. To understand the working principle of different types of non - conventional energy system.
4. To introduce the concept of Bio mass energy.
5. To get the knowledge on energy act and energy audit.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Identify the energy sources availability in India.	Understand
CO2.	Classify the different conventional energy sources.	Understand
CO3.	Understand the non - conventional energy sources.	Understand
CO4.	Explain bio gas generation and its impact on environment.	Understand
CO5.	Illustrate the energy act, audit and energy management methods.	Understand

### Course Contents:

#### UNIT I Energy

9

Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives.

#### UNIT II Conventional Energy

9

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

#### UNIT III Non-Conventional Energy

9

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation. Wind energy, types of windmills, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy..

#### UNIT IV Biomass Energy

9

Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.

#### UNIT V Energy Conservation

9

Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit – Types methodology, reports, instruments. Benchmarking and energy performance, material and energy balance, thermal energy management.

**Total: 45 Periods**

**Text Books:**

1. Rao, S. and Parulekar, B.B., "Energy Technology", Khanna Publishers, 2005.
2. Rai, G.D., "Non-conventional Energy Sources", Khanna Publishers, New Delhi, 2014.

**Reference Books:**

1. Nejat Veziroglu, "Alternate Energy Sources", IT, McGraw Hill, New York.
2. El. Wakil., "Power Plant Technology", Tata McGraw Hill, New York, 2102.
3. Sukhatme. S.P., "Solar Energy - Thermal Collection and Storage", Tata McGraw hill, New Delhi, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	-	1	1	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	-	1	1	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGO05	Green Building Design	L	T	P	C
		3	0	0	3
Nature of Course	Open Electives				
Pre requisites	-				

### Course Objectives

#### The course is intended to

1. Acquire the knowledge of environmental implications of buildings.
2. Learn the concept of building technologies.
3. learn the concept of comforts in building.
4. learn the concept of utility of solar energy in buildings.
5. Introduce green composites for buildings.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the environmental implications of buildings	Understand
CO2.	Explain the concept of building technologies	Understand
CO3.	Identify the comforts in building	Understand
CO4.	Understand the utility of solar energy in buildings	Understand
CO5.	Explain green composites for buildings.	Understand

### Course Contents:

#### UNIT I ENVIRONMENTAL IMPLICATIONS OF BUILDINGS

9

Energy use - carbon emissions, water use, waste disposal - Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials - Transportation Energy for Building Materials; Maintenance Energy for Buildings.

#### UNIT II Implications of Building Technologies Embodied Energy of Buildings

9

Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

#### UNIT III COMFORTS IN BUILDING

9

Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

#### UNIT IV UTILITY OF SOLAR ENERGY IN BUILDINGS

9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

#### UNIT V GREEN COMPOSITES FOR BUILDINGS

9

Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
2. Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

**REFERENCE BOOKS:**

1. Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
2. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.

**WEBSITE REFERENCE :**

1. [https://www.icar.org.in/content/agricultural\\_engineering\\_division](https://www.icar.org.in/content/agricultural_engineering_division)
2. <https://www.agroengineering.org/index.php/jae>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							2						2		
CO2			2										2		
CO3			2										2		
CO4			1										1		
CO5			1										2		
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AG006	Low Cost Automation	L	T	P	C
		3	0	0	3
Nature of Course	Open Electives				
Pre requisites	IoT in Agriculture Systems				

### Course Objectives

#### The course is intended to

1. To learn the basic knowledge about automation.
2. To understand the basic hydraulic system for automation.
3. To understand the basic pneumatic system for automation.
4. To introduce the concept of electronic systems for automation.
5. To get the knowledge on assembly and workstations in automation.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Identify the concept of automation in industry.	Understand
CO2.	Classify the different hydraulic systems for automation.	Understand
CO3.	Understand the pneumatic system for automation.	Understand
CO4.	Explain the concept of electronic systems for automation.	Understand
CO5.	Illustrate the workstations in automation.	Understand

### Course Contents:

#### UNIT I Automation of Assembly Lines 9

Concept of automation - mechanization and automation - Concept of automation in industry - mechanization and automation - classification, balancing of assembly line using available algorithms - Transfer line-monitoring system (TLMS) using Line Status - Line efficiency - Buffer stock Simulation in assembly line.

#### UNIT II Automation Using Hydraulic Systems 9

Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, intensifiers etc. - Selection of hydraulic fluid, practical case studied on hydraulic circuit design and performance analysis - Servo valves, electro hydraulic valves, proportional valves and their applications.

#### UNIT III Automation Using Pneumatic Systems 9

Pneumatic fundamentals - control elements, position and pressure sensing -logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods – step counter method - compound circuit design - combination circuit design. Pneumatic equipments - selection of components – design calculations -application - fault finding – hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

#### UNIT IV Automation Using Electronic Systems 9

Introduction - various sensors – transducers - signal processing - servo systems - programming of microprocessors using 8085 instruction - programmable logic controllers.

#### UNIT V Assembly Automation 9

Types and configurations - Parts delivery at workstations - Various vibratory and non-vibratory devices for feeding - hopper feeders, rotary disc feeder, centrifugal and orientation - Product design for automated

assembly.

**Total: 45 Periods**

**Text Books:**

1. Anthony Esposito, "Fluid Power with applications", Prentice Hall international, 2009. •
2. Mikell P Groover, "Automation, Production System and Computer Integrated Manufacturing", Prentice Hall Publications, 2007.
3. Kuo. B.C, "Automatic control systems", Prentice Hall India, New Delhi, 2007.

**Reference Books:**

1. Peter Rohner, "Industrial hydraulic control", Wiley Edition, 1995.
2. Mujumdar.S.R, "Pneumatic System", Tata McGraw Hill 2006.

**Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)**

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	-	1	1	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	-	1	1	-
	3	High				2	Medium				1	Low			

**Formative assessment**

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

**Summative Assessment**

Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AGO07	Process Modelling and Simulation	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Computer Aided Design and Drafting Laboratory				

### Course Objectives

#### The course is intended to

1. To give an overview of various methods of process modeling, different computational techniques for simulation.
2. Learn the solution of linear and non-linear algebraic equations.
3. To develop the unsteady state lumped systems.
4. Understand the various types of **steady state distributed system**.
5. **Analyze the various unsteady state system and modeling.**

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understood the development of process models.	Understand
CO2.	Able to solve the computational techniques to solve the process models.	Understand
CO3.	Able to analysis of various liquid level tank	Remember
CO4.	Able to solve the boundary value problems.	Understand
CO5.	Able to design the modeling systems	Apply

### Course Contents:

#### UNIT I INTRODUCTION 9

Introduction to modeling and simulation, classification of mathematical models, conservation equations and auxiliary relations.

#### UNIT II STEADY STATE LUMPED SYSTEMS 9

Degree of freedom analysis, single and network of process units, systems yielding linear and non-linear algebraic equations, flow sheeting – sequential modular and equation oriented approach, tearing, partitioning and precedence ordering, solution of linear and non-linear algebraic equations.

#### UNIT III UNSTEADY STATE LUMPED SYSTEMS 9

Analysis of liquid level tank, gravity flow tank, jacketed stirred tank heater, reactors, flash and distillation column, solution of ODE initial value problems, matrix differential equations, simulation of closed loop systems.

#### UNIT IV STEADY STATE DISTRIBUTED SYSTEM 9

Analysis of compressible flow, heat exchanger, packed columns, plug flow reactor, solution of ODE boundary value problems.

#### UNIT V Unsteady State Distributed System & other Modelling Approaches 9

Analysis laminar flow in pipe, sedimentation, boundary layer flow, conduction, heat exchanger, heat transfer in packed bed, diffusion, packed bed adsorption, plug flow reactor, hierarchy in model development, classification and solution of partial differential equations. Empirical modeling, parameter estimation, population balance and stochastic modeling.

**TOTAL : 45 PERIODS**



**TEXT BOOKS:**

1. Ramirez, W.; "Computational Methods in Process Simulation", 2nd Edn., Butterworths Publishers, New York, 2000.
2. Luyben, W.L., "Process Modelling Simulation and Control", 2nd Edn, McGraw-Hill Book Co., 1990.

**REFERENCES:**

1. Felder, R. M. and Rousseau, R. W., "Elementary Principles of Chemical Processes", John Wiley, 2000.
2. Franks, R. G. E., "Mathematical Modeling in Chemical Engineering", John Wiley, 1967.
3. Amiya K. Jana, "Process Simulation and Control Using ASPEN", 2nd Edn, PHI Learning Ltd (2012).

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO2	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO3	3	3	2	2	-	3	3	-	-	-	-	-	2	-	-
CO4	3	3	2	2	-	3	3	2	-	-	-	-	2	-	-
CO5	3	3	2	2	-	2	2	1	-	-	-	-	2	2	-
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AG008	Supply Chain Management	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. To learn the importance and strategies of Supply chain management.
2. To enable the students to learn about the design of supply chain network.
3. To implement the supply chain management tools in transportation system.
4. To assess the supply chain management system coordination.
5. To integrate the IT concepts in supply chain management.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the scope and importance of supply chain management.	Understand
CO2.	Construct the supply chain network.	Apply
CO3.	Illustrate the design of supply chain network in transportation system.	Understand
CO4.	Understand the coordination of supply chain management.	Understand
CO5.	Identify the role of IT in supply chain management.	Understand

### Course Contents:

#### UNIT I Introduction 9

Role of Logistics and Supply chain Management: Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

#### UNIT II Supply Chain Network Design 9

Role of Distribution in Supply Chain – Factors influencing Distribution network design – Design options for Distribution Network Distribution Network in Practice - Role of network Design in Supply Chain – Framework for network Decisions.

#### UNIT III Logistics in Supply 9

Role of transportation in supply chain – factors affecting transportation decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation.

#### UNIT IV Sourcing and Coordination in Supply Chain 9

Role of sourcing supply chain supplier selection assessment and contracts - Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect - Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

#### UNIT V Supply Chain and Information Technology 9

The role IT in supply chain- The supply chain IT framework Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

**Total: 45 Periods**

**Text Books:**

1. Sunil Chopra, Peter Meindl and Kalra., "Supply Chain Management, Strategy, Planning, and Operation", Pearson Education, 2010.
2. James B.Ayers., "Handbook of Supply Chain Management", St.Lucle press, 2008.

**Reference Books:**

1. Jeremy F.Shapiro., "Modeling the Supply Chain", Thomson Duxbury, 2012.
2. Srinivasan G.S., "Quantitative models in Operations and Supply Chain Management, PHI, 2010.
3. David J.Bloomberg, Stephen Lemay and Joe B.Hanna., "Logistics", PHI 2013.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO2	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	1	1	-
CO5	3	2	2	-	-	1	1	-	-	-	1	1	1	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

20AG009	Systems Engineering	L	T	P	C
		3	0	0	3
Nature of Course	Open Electives				
Pre requisites	Nil				

### Course Objectives

#### The course is intended to

1. To learn the concept and steps involved in system engineering.
2. To understand the sequence processes of System engineering.
3. To understand the analysis of alternatives like NPV, ROI, IRR, Time series and Regression models.
4. To get the knowledge about decision assessment.
5. To understand the engineering principles.

### Course Outcomes

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Identify the systems engineering knowledge and life cycles.	Understand
CO2.	Classify the different systems engineering processes.	Understand
CO3.	Understand the different analysis of alternatives.	Understand
CO4.	Understand the different analysis of alternative models.	Understand
CO5.	Apply systems engineering principles to make decision for optimization.	Apply

### Course Contents:

#### UNIT I Introduction 9

Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life - cycle phases, logical steps of systems engineering, Frame works for systems engineering.

#### UNIT II Systems Engineering Processes 9

Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

#### UNIT III Analysis of Alternatives - I 9

Cross - impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure.

#### UNIT IV Analysis of Alternatives – II 9

Reliability, Availability, Maintainability, and Supportability models; stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models.

#### UNIT V Decision Assessment 9

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management.

**Total: 45 Periods**

**Text Books:**

1. Andrew P. Sage, James E. Armstrong Jr., "Introduction to Systems Engineering", John Wiley and Sons, Inc, 2015.
2. Krishna Kumar Dwivedi, Mukesh Pandey., "Fundamentals of Systems Engineering", Wiley, 2017.

**Reference Books:**

1. William N.Sweet, Samuel J.Seymour, Steven M.Biemer., "Systems Engineering Principles and Practice", Wiley – Interscience, 2011.
2. Ali K Kamrani., "Systems Engineering Tools and Methods For Engineers", T and F CRC, 2011.
3. Ali K. Kamrani, Maryam Azimi., "Systems Engineering Tools and Methods", Taylor & Francis Inc, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	1	1	1	-	-	1	-	-	-	-
CO2	3	2	2	-	-	1	1	-	-	-	1	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	1	1	1	-	-	1	-	-	-	-
CO5	3	2	2	-	-	1	1	-	-	-	1	-	-	-	-
	3	High				2	Medium				1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations			Final Examination (60)
	IAE 1 (5)	IAE 2 (10)	IAE 3 (10)	
Remember	20	20	20	40
Understand	30	30	30	60
Apply				
Analyze				
Evaluate				
Create				

## ONE CREDIT COURSE

20MEA03	Plastics - Processing Tooling Assembly and Testing	L	T	P	C
		1	0	0	1
Nature of course	Employability Enhancement Course				
Pre requisites	Fundamentals of Agricultural Engineering				

**Course Objectives**

The course is intended to

1. To know the various plastic materials used in Automotive, home appliance and Medical fields
2. To understand the basic and advanced methods of plastic processing and the tooling and equipment used for it.
3. To learn various post processing requirements such as painting, foiling and pad painting.
4. To learn the various plastic joining processes
5. To learn about various plastic testing methods.

**Course Outcomes**

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Understand the types of plastics, processing methods and tooling.	Understand
CO 2	Understand plastic assembly and testing methods	Understand

**Course Contents****Unit I – Plastics - Processing and Tooling****8**

Introduction on plastics, Types of plastics - Thermo plastics, Thermo setting plastics, Applications in Automobiles, Home appliances etc. Basic concepts on plastics design, Mould flow analysis, Plastic processing - Preheating, Molding, Molding types - Injection molding, compression molding, Rot molding, 2K molding, Tooling - Core, cavity, inserts, Heating and cooling circuits, Tool materials, Molding machines - Types, tonnage and other specifications.

  
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## Unit II – Molding Defects Assembly and Testing

7

Molding defects – War page, Catching, Weld line, burning, Sink marks etc., Method of avoiding defects, Post molding process - Annealing, Texturing, color foiling, pad painting, Painting, etc., Assembly of plastics - Ultrasonic welding, Heat sinking, Vibration welding. Testing of plastics - UV Testing, Scratch resistance, Flammability, resistance against chemicals, impact test.

Total: 15 Hours

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3				3							1	2	
CO2	3				3							1	2	
CO3	3				3							1	2	
CO4	3				3							1	2	
CO5	3				3							1	2	
	3	High				2	Medium					1	Low	

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	20	20
Apply	20	20
Analyze		
Evaluate		
Create		

  
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20AGA02	Honey Bee Keeping Techniques	L	T	P	C
		0	0	2	1
Nature of Course	Employability Enhancement Course				
Pre requisites	Nil				

### Course Objectives

The course is intended to

1. Gain knowledge on basics of honey bee keeping
2. Acquire knowledge on equipment for bee keeping
3. Aware on comb and colony preparation
4. Understand the harvesting and preservation of honey
5. Learn the cost estimations in bee keeping

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain of general classification and types of honey bees	Understand
CO2	Illustrate the equipments in bee keeping	Understand
CO3	Create comb and colony for honey production	Apply
CO4	Develop the harvesting, preservation and processing of honey	Apply
CO5	Estimation and cost analysis for bee keeping	Analyze

### List of Experiments

1. Bee Keeping – Present Scenario & Prospects, Commercial Bee Keeping
2. Honey Bees and Honey –Types and classification
3. Prepare month wise calendar of operations in bee keeping
4. Select suitable species and races of bees for Bee keeping
5. Identification of Flora and location of sites
6. Use of Bee Boxes and other Tools and its maintenance
7. Building of Comb and colony
8. Raw production at different life stages of bees
9. Manage insects and diseases and nuisance in bee hives
10. Colony management during honey flow and dearth period

  
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11. Harvesting, and Preservation of Honey
12. Processing of honey- Packaging, labeling, branding and Marketing
13. Work out the economics of Bee Keeping
14. Field Visit & Interaction with Bee Keepers
15. Industrial visit to honey processing industry

**Total : 30 Periods**

**Text Books:**

1. Atwal, AS 2000. Essentials of Bee Keeping and pollination Kalyani publishers, Ludhiana 394 p.
2. Abrol D.P, 2011 Beekeeping A comprehensive guide to bees and beekeeping scientific publishers Jodhpur, 896 pages.

**Reference Books:**

1. Tina Ranjan Das 2006. Beekeeping with Apis cerana indica(in Tamil) Megens Jensens, Denmark, 130 p, Wedmore E B 1988. A manual of beekeeping BBNO, Somerset, 389 p
2. Ted Hooper, 1991 Guide to Bees and Honey (Third Edition), BAS printers Ltd. over Wallop, Hampshire 271 p.
3. Roger A Morse, 1994 The new complete guide to beekeeping. The countryman Press. Woodstock Vermont 207p

**Web Resource:**

1. [http://agritech.tnau.ac.in/farm-enterprises/fe-apiculture\\_home.html](http://agritech.tnau.ac.in/farm-enterprises/fe-apiculture_home.html)
2. <http://www.aragriculture.org/insects/beekeeping.html>

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3				3							1	2	
CO2	3				3							1	2	
CO3	3				3							1	2	
CO4	3				3							1	2	
CO5	3				3							1	2	
	3	High				2	Medium				1	Low		

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	20	20
Apply	20	20
Analyze		

  
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Evaluate		
Create		

20AGA03	Web Design and Internet Applications	L	T	P	C
		0	0	2	1
Nature of Course	Employability Enhancement Courses				
Pre requisites	Nil				

**Course Objectives****The course is intended to**

1. Acquire the knowledge of Design using Staad Pro..
2. Introduce Design and model using Staad.
3. Learn the concept of Load structure
4. Learn the concept of frame Design
5. Acquire the design idea of structure.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the Planning and Design	Understand
CO2.	Apply the Design and models	Apply
CO3.	Understand the Concept of Load structure	Understand
CO4.	Apply the design of frame design	Apply
CO5.	Analyze the Design of Structure	Analyze

**Unit I Introduction to web designing principles****9**

Basic principles in web designing - Communication, typefaces, colours, images, navigations, grid based layouts, „F“ pattern design, load time - Planning process - Five golden rules of web designing

**Unit II Web designing concepts****9**

Basics in web design and design concepts - Designing navigation bars – HTML/CSS Navigation bars - Page design steps and home page layout in HTML/CSS

**Unit III Introduction to internet and WWW****9**

Internet and World Wide Web (WWW) history and applications – World Wide Web Consortium (W3C) – history and overview, fundamental technologies of WWW - HTML, URL, HTTP

**Unit IV Website designing and its tools****9**

Creation of a web site – How the website works – Types of websites: static and dynamic - Plan your content, Wireframe your design, Create web pages, Publishing your website – Web standards - Audience requirement

**Unit V introduction to Java script and database connectivity****9**

Java script – Client side scripting - Variables & functions - Working with alert, confirm and prompt - Connectivity of web pages with databases – Project

  
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TOTAL HOURS : 30

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3												
CO2			3												
CO3			3												
CO4			3												
CO5			3												
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	20	20
Apply	20	20
Analyze		
Evaluate		
Create		

  
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20AGA04	Staad Pro. software course	L	T	P	C
		0	0	2	1
<b>Nature of Course</b>		Employability Enhancement Courses			
<b>Pre requisites</b>		Computer Aided Design and Drafting Laboratory			

**Course Objectives****The course is intended to**

1. Acquire the knowledge of Design using Staad Pro..
2. Introduce Design and model using Staad.
3. Learn the concept of Load structure
4. Learn the concept of frame Design
5. Acquire the design idea of structure.

**Course Outcomes**

On successful completion of the course the students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the Planning and Design	Understand
CO2.	Apply the Design and models	Apply
CO3.	Understand the Concept of Load structure	Understand
CO4.	Apply the design of frame design	Apply
CO5.	Analyze the Design of Structure	Analyze

**Course Contents:**

1. Creating Models, Structures, Graphical Interface,
2. Steel Designing
3. How to Specify Member Properties
4. How to Specify Material Constants
5. How to Specify Supports
6. How to Specify Loads
7. How to Specify Analysis Type
8. Annotating the Displacements
9. Creating Models of a Reinforced
10. Concrete Framed Structure
11. Modelling and Analysis of a Slab
12. Interoperability Feature
13. Interactive Design Information
14. Creating Models Using Graphical Interface
15. Performing Analysis and Designing
16. Viewing Results Using the Output File
17. Viewing Post Post -Processing
18. Stress Contours
19. Specifying Post-Analysis Print Commands
20. Producing on Onscreen Report
21. Viewing Supports

Reactions

  
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TOTAL: 30 PERIODS

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3												
CO2			3												
CO3			3												
CO4			3												
CO5			3												
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	20	20
Apply	20	20
Analyze		
Evaluate		
Create		

  
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<b>20AGA05</b>	<b>Solidworks Software Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Nature of Course</b>	Employability Enhancement Courses				
<b>Pre requisites</b>	Computer Aided Design and Drafting Laboratory				

**Course Objectives**

**The course is intended to**

1. Solidworks is used to develop mechatronics systems from beginning to end.
2. At the initial stage, the software is used for planning, visual ideation, modeling, feasibility assessment, prototyping, and project management.
3. The software is then used for design and building of mechanical, electrical, and software elements.

**Course Outcomes**

On successful completion of the course the students will be able to

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1.	Able to demonstrate competency with multiple drawing and modification commands in SoLID WORKS..	Understand
CO2.	Able to create own ideas.	Understand
CO3.	Create three-dimensional assemblies incorporating multiple solid models.	Apply
CO4.	Able to analyze the various components.	Understand
CO5.	Apply industry standards in the preparation of technical mechanical drawings	Apply

**Course Contents:**

**UNIT I INTRODUCTION**

**6**

SolidWorks Graphical User Interface - Sketch Entities - Sketch Tools – Relations – Dimensioning.

**UNIT II COMMANDS**

**6**

Part Modeling Tools - Creating Extrude features - Creating Revolve features - Creating Swept features- Creating curves - Creating Fillet features - Inserting Hole types- Creating Shell & Rib

**UNIT III ASSEMBLY**

**6**

Creating Pattern Introduction to Assembly Modeling & Approaches- Assembly Modeling - Tools Applying Standard Mates - Creating Explode Views - Surface Modeling tools - Application of tools

  
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**UNIT IV SURFACE MODELING**

6

Sheet Metal Design- Base Flange - Sheet Metal Tab Break Corner - Closed Corners - Rip - Introduction to GD&T- Generating Drawing Views.

**UNIT V ANGLE OF PROJECTION**

6

Introduction to Angle of Projection - Creating Dimensions- Inserting Annotations.

**Total: 30 Periods**

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3												
CO2			3												
CO3			3												
CO4			3												
CO5			3												
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	20	20
Apply	20	20
Analyze		
Evaluate		
Create		

  
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20MEA06	ANSYS Software Course	L	T	P	C
		0	0	2	1
Nature of course	Employability Enhancement Course				
Pre requisites	Engineering Mechanics and Strength of Materials for Agriculture Engineering				

### Course Objectives

The course is intended to

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

### Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Analyze the force and stresses of link elements, beams and plates.	Analyze
CO 2	Analyze the thermal stresses of plates and shells.	Analyze

### List of Experiments

#### Force and Stress Analysis (Simple Treatment only)

- Study about the basic procedure to perform the analysis in ANSYS.
- Stress analysis of beams (Cantilever, Simply supported & Fixed ends)
- Stress analysis of a plate with a circular hole.
- Stress analysis of an axi-symmetric component.
- Mode frequency analysis of beams (Cantilever, Simply Supported, Fixedends)

#### Thermal Stress Analysis (Simple treatment only)

- Thermal stress analysis of a 2D component.
- Conductive heat transfer analysis of a 2D component.
- Convective heat transfer analysis of a 2D component.

  
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Total: 30 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			3												
CO2			3												
CO3			3												
CO4			3												
CO5			3												
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	20	20
Apply	20	20
Analyze		
Evaluate		
Create		

  
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<b>20MEA07</b>	<b>Research Methodology</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>
<b>Nature of course</b>	Employability Enhancement Course				
<b>Pre requisites</b>	-				

**Course Contents:**

1. Meaning of research, dissertation, thesis, Term paper, journal paper, concept notes.
2. Research hypo thesis, need & justification, Novelty of Research.
3. Characteristics and components of Research, Need based /specific problem solving (state / national)
4. Topics identification, learning, formulating and analyzing the problem with existing problem/project/extension work of respective department / division / interdepartmental efforts.
5. Search Procedures for statement and formulation of research problem. Literature survey, web search, textual reading, search engine application, online data search , use of internet, personal communication, bound journal/paid journal/ E-journals, institution repository, gateway, cross-ref, Scopus, Science Direct, Advanced search tools. Institution Library consultation/ borrow
6. Application of proposed research / Fundamental Research/ Experiment base Numerical/ Computation.
7. Computation work, language, programming, software tools, to be used. Spread sheet, features and functions, data storage, generating charts, graphs tables- use of latest's software tools, features of statistical tools/ features.
8. Application of theoretical and system modeling for respective area of problems.
9. Statistical tools with data mining. Probability and sampling distribution, ANOVA test, SSPS Package, correlations, Test of Hypothesis, Student test, error analysis, mean square error , Box analysis, normalization of data series, Linear programming, Dynamic Programming , Fuzzy logic problem.
10. Optimization analysis:- Use of Factors, ANN, ANOVA (BOTH WAYS), SIGNAL TO NOISE RATIO, Orthogonal arrays, replication, Data validation with predicted values,
11. Aims & objective of research. Area of Research- Formulation of research objectives based on Literature survey, critical review, Gaps exist in present knowledge domains in the field of research. Scope analysis
12. Research Methodology: - Study population, parameters estimation and consideration, sampling- field /industrial real life, monitoring, Experimental investigation, Literature /Proceedings/ journal search, etc. Plan for data

  
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- collection, and analyzing , Plan For data processing and recording , Ethical presentation
13. Experimental Work: - Analytical methods/ Protocols, Standard methods national and international codes, flowchart for Experimental procedures, Fabrication details of experimental devices and instruments to be used, experimental Set up, pilot plant if any to be required. Replications, Quality control, Quality Assurance procedures, Standardization of instruments to be used.
14. Work plan: - Major components and outline of the different phases of research investigation, use of flow chart, time frame summary of proposal.
- 15, Use of mathematical tools: - Numerical analysis, Finite element and difference , differential equation solving tools, use of tensor and vector calculus, etc., design of experiment.
16. Presentation tools: - Power point tool, creating and customizing presentation.
17. Thesis writings: - Draft thesis, paper communication and publications, conference attendance presentation proceedings, Plagiarism checking ( use of Urkund, Biblio, Tertitin) and citation. Major contribution, outcome of the research, patent possibilities.

**Total: 30 Periods**

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)</b>															
<b>COs</b>	<b>POs</b>												<b>PSOs</b>		
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>1</b>	<b>2</b>	<b>3</b>
CO1			3												
CO2			3												
CO3			3												
CO4			3												
CO5			3												
	3	High				2	Medium				1	Low			

<b>Bloom's Level</b>	<b>Summative Assessment (Internal Mode)</b>	
	<b>Assessment 1 (50 Marks)</b>	<b>Assessment 2 (50 Marks)</b>
Remember	10	10
Understand	20	20
Apply	20	20
Analyze		
Evaluate		
Create		

  
**CHAIRMAN - BOARD OF STUDIES**

*Passed by Board of Studies meeting*

*Approved in Academic Council Meeting*

  
**CHAIRMAN - BOARD OF STUDIES**

*Passed by Board of Studies meeting*

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