AI16301 PRINCIPLES AND PRACTICES OF CROP PRODUCTION 3 0 0 3

COURSE OBJECTIVES

- To impart knowledge in the basics of agriculture principles and practices.
- To acquire knowledge in seasonal selection of crops its establishments.
- To introduce about the management of crops in all aspects.
- To study the cultivation practices of major field crops.
- To get an idea about the production practices of cash crops.

UNIT I AGRICULTURE AND CROP PRODUCTION 9

Introduction to agriculture - terms and definitions - development, scope and importance - Branches. Field crops - Classification - Factors affecting crop growth and production - genetic (internal) and environmental (external) factors; Edaphic and Biotic; Major crops in India and Tamilnadu - Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices

UNIT II CROP SELECTION AND ESTABLISHMENT 9

Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants; Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover, including selection and treatment of seed and nursery growing.

UNIT III CROP MANAGEMENT 9

Crop water Management; Crop nutrition management - need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling; Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and methods of harvest.

UNIT IV PRODUCTION PRACTICES OF AGRICULTURAL CROPS - I 9

Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: cereal crops, grain legumes, Special purpose crops such as those grown for green manure and fodder.

UNIT V PRODUCTION PRACTICES OF AGRICULTURAL CROPS - II 9

Generalized management and cultivation practices of Oil seed crops, sugarcane, and fiber crops

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire knowledge in factors affecting growth and production of crops
- analyse the choice of crops to be selected for different regions and seasons
- understand the crop management practices of agricultural field crops.
- identify the best cultivation practices to be followed for higher yield of field crops.
- gain an idea about the cultivation of cash crops.

TEXTBOOKS

1. Reddy T. Sankara G.H. YellamandaReddi, Principles of Agronomy, Kalyani Publishers, New Delhi, 1995.
2. Rajendra Prasad, Text Book of Field Crop Production. Directorate of Information and Publication, KrishiAnusandhanBhavan, Pusa, New Delhi, 2005.

3. Handbook of Agriculture. ICAR Publications, New Delhi.

REFERENCES

1. Balasubramaniyan, P and SP. Palaniappan. 2002. Principles and practices of Agronomy. Agrobios (India), Jodhpur.
2. Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2005
3. Chatterjee, B.N. and K.K.Bhattacharyya.1986. Principles and Practices of Grain legume production. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Chatterjee, B.N. and P.K.Das.1989. Forage crop production - Principles and Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

CO/PO Mapping

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	-	-	-	-	-	-	3	3	2
CO3	2	3	-	-	-	2	-	-	-	-	-	-	3	2
CO4	-	3	2	-	-	2	-	-	-	-	-	3	3	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	2

AI16302 PRINCIPLES OF AGRICULTURAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To study the basic theory and practice for various areas of agricultural engineering, application of engineering to the problems of agricultural production.
- To impart knowledge in farm structures
- To introduce students the harvesting and mowing equipments
- To give outline in the cold storage and packaging of agricultural produce
- To define the concepts of energy requirement in agricultural operations

UNIT I INTRODUCTION, SOIL AND WATER CONSERVATION AND IRRIGATION ENGINEERING 10

Agricultural Engineering - Introduction - Branches - Importance in national and global scenario - Institutes and organizations - Soil and water - Land development, Soil irrigability classification - Soil erosion and control, Soil conservation methods, Watershed management - Agro meteorology - Soil Water Plant relationship - Sources of water - Tanks - Wells and Reservoirs - Canal Network - Irrigation Scheduling - Irrigation methods - Micro irrigation - Participatory management of Irrigation Systems.

UNIT II FARM STRUCTURES 8

Farm stead, Farm Roads, Cattle sheds, Stanchion barn, Poultry shed, Hog housing, Machinery and implement shed, Storage structures for food grain, feed and forage - Structures for Plant environment - Green houses, Poly houses - Shade net.

UNIT III FARM MACHINERY AND EQUIPMENT 8

Tractor and Power Tiller - Tillage equipment - Sowing, Planting, Fertilizer application, Fertigation equipment - Spraying, Weeding and interculture - Harvesting and Mowing Equipment, Pumps.

UNIT IV AGRICULTURAL PROCESS ENGINEERING 10

Post harvest of crops, Unit operations in agricultural processing, Ripening chamber and Cold Storage - Packing of agricultural produces - Material handling equipments - Milk processing and dairy products.

UNIT V AGRO ENERGY 9

Energy requirement in agricultural operations - Solar (Thermal and Photovoltaic), Wind mills, Biogas energy and their utilization in agriculture - Gasification of biomass for IC Engines - Energy efficient cooking stoves and alternative cooking fuels - agricultural waste and their utilization.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire knowledge in soil water conservation, irrigation engineering and farm structures
- utilize the agricultural waste effectively
- understand the post harvest technology of agricultural crops
- know the energy efficient cooking stoves and alternative cooking fuels
- understand the milk processing and dairy products

TEXTBOOKS

1. Michael, A.M. &Ojha, T.P. “Principles of Agricultural Engineering Vol. I & II”, Seventh Edition, Jain Brothers, New Delhi, 2011.
2. JagdishwarSahay. “Elements of Agricultural Engineering”, Standard Publishers Distributors, 2010.
3. Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology - A problem solving approach, Springer Science, NY, USA, 2007.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	3	1	-	-	3	2	2	3	3	2
CO2	3	3	-	-	3	1	-	-	3	2	2	3	3	2
CO3	2	1	-	-	1	1	1	-	1	2	-	1	2	1
CO4	2	2	-	-	-	-	-	-	1	-	-	-	-	3
CO5	2	3	2	-	3	-	2	-	3	-	-	3	2	1

AI16303 **STRENGTH OF MATERIALS** **3 2 0 4**

COURSE OBJECTIVES

- To impart knowledge in the fundamental concepts of stress and strain in mechanics of solids and structures.
- To estimate the thermal stresses developed in bars and relationship between elastic constants.
- To understand the concept of centre of gravity and moment of inertia of mechanical elements.
- To analyse the behaviour of beams under the action of various forces.
- To study the methods used for determination of deflection in beams, shells, springs and torsion of shafts

UNIT I STRESSES AND STRAINS **15**

Simple stresses and strains – elasticity and plasticity – force deformation curve for various materials – Hooke's Law – Principle of superposition – Stresses in bars of different sections – stresses in bars of uniformly tapering sections and in composite bars – stresses in inclined planes – principal stresses and planes

UNITII THERMAL STRESS AND ELASTIC CONSTANTS **15**

Thermal stresses and strains in simple bars and composite bars – lateral and linear strain –Poisson's ratio – volumetric strain of a rectangular body subjected to an axial force – relation between elastic constants and their derivation.

UNITIII CENTRE OF GRAVITY AND MOMENT OF INERTIA **15**

Centroid – plane figures, symmetrical, unsymmetrical sections, solid bodies and cut out holes –moment of inertia – rectangular section, perpendicular axis theorem – circular section, parallel axis theorem – unsymmetrical section.

UNIT IV SHEAR FORCE AND BENDING MOMENT **15**

Types of loads acting on the beams – different types of beams – shear force – bending moment – sign conventions – relation between shear force and bending moment – bending stresses in beams – shearing stresses in beams

UNIT V DEFLECTION OF BEAMS, SHELLS AND SPRINGS **15**

Deflection of beams – double order differential equation method – Macaulay's method. Deformation of thin cylindrical and spherical shell – torsion of circular shafts – deflection of helical spring.

TOTAL PERIODS 75

COURSE OUTCOMES

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

- understand the fundamental concepts of stress and strain in mechanics of solids and structures.
- understand the effect of thermal stresses in bars
- determine the centre of gravity and moment of inertia of any sections.
- analyse and determine shear force, bending moment and stresses in beams.
- gain sufficient knowledge in deflection of beams, shells, springs and design of shafts.

TEXTBOOKS

1. Bansal, R.K., “Strength of Materials”, Laxmi Publications (P) Ltd., 2007
2. Rajput, R.K., “Strength of Materials”, by S Chand & Co Ltd., 2007
3. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES

1. Egor. P.Popov “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series,2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing ,,co. Ltd., New Delhi, 2005

CO/PO Mapping

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	3	1	-	-	-	-	-	-	-	1	1
CO2	2	3	2	3	1	-	-	-	-	-	-	-	1	1
CO3	2	3	2	3	1	-	-	-	-	-	-	-	3	3
CO4	2	3	2	3	1	-	-	-	-	-	-	-	2	2
CO5	2	3	2	3	1	-	-	-	-	-	-	-	3	3

AI16304 SURVEYING AND LEVELLING 3 0 0 3

COURSE OBJECTIVES

- To introduce students the principle of surveying
- To provide exposure in various methods and applications of surveying to agricultural engineering projects.
- To understand the advanced level of surveying equipments
- To demonstrate methodologies involved in levelling
- To study the applications of levelling

UNIT I FUNDAMENTALS AND CHAIN SURVEYING 9

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

UNIT II COMPASS AND PLANE TABLE SURVEYING 9

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

UNIT III LEVELLING 9

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

UNIT IV LEVELLING APPLICATIONS 9

Longitudinal and Cross-section-Plotting - Contouring - Methods - Characteristics and uses of contours-Plotting - Methods of interpolating contours - computation of cross sectional area and volumes Earthwork calculations - Capacity of reservoirs - Mass haul diagrams

UNIT V THEODOLITE AND MODERN SURVEYING 9

Theodolite - Types - Description - Horizontal and vertical angles - Temporary and Permanent adjustments - Heights and distances- Tangential and Stadia Tacheometry - Subtense methods - Stadia constants - Anallactic lens - Traversing - Gale's table - Total Station - Global Positioning System (GPS).

TOTAL PERIODS 45

COURSE OUTCOMES

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

- use all surveying equipments.
- gain knowledge in the principles and classification of chain surveying and ranging.
- understand the different types of bearing and traversing.

- demonstrate the theodolite, total station and global position system.
- prepare LS and CS, contour maps and carryout surveying works related to land and civil engineering projects.

TEXT BOOKS

1. Dr. B. C. Punmia, Surveying , Volume I &II,Laxmi Publications (P) Ltd., 2005
2. N.N. Basak ,Surveying and Levelling, Tata McGraw-Hill Education Pvt. Ltd., 2004
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001.
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.

REFERENCES

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

CO/PO Mapping

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	1	-	-	-	-	3	-	-	-	-	3	2
CO2	-	3	2	3	3	-	-	2	3	-	-	2	-	1
CO3	-	-	-	-	3	1	-	-	-	-	-	-	1	3
CO4	3	-	3	-	1	2	-	-	-	-	-	-	-	2
CO5	2	1	2	-	3	-	-	1	-	-	-	1	2	2

ME16307 **THEORY OF MACHINES** **3 0 0 3**

COURSE OBJECTIVES

- To introduce the students the theory of machines pertaining to agricultural engineering
- To study various terminologies used in machines
- To understand concept of sliding and rolling friction
- To impart knowledge in gears
- To delineate the concepts of flywheel and balancing

UNITI 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.

UNITII 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 cycloid 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 epi- cyclic gear trains.

UNIT V FLYWHEEL AND BALANCING **9**

Inertia - turning moment - flywheel - fluctuation of speed and energy. Balancing of rotating masses.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain inputs in the terminologies pertaining to agricultural machineries.
- acquire basic knowledge in the friction applications, gear and gear trains.
- apply practical utility in sliding and rolling friction.
- know the motion of cam and follower.
- implement ideas of rotating masses and reciprocating masses

TEXT BOOKS

1. Rattan, S.S, Theory of Machines, 3rd Edition, Tata McGraw-Hill, 2009
2. Khurmi, R.S. and Gupta, J.K, Theory of machines, Eurasia Publication House,1994

REFERENCES

1. Thomas Beven,Theory of Machines, CBS Publishers and Distributors, New Delhi,1984
2. Ballaney, P.L, Theory of machines, Khanna Publishers, New Delhi,1994
3. A text book of theory of machines, Dr.R.K.Bansal, Laxmi publications (p) Ltd, New Delhi, 1st Edition 2000.

4. Theory of machines and mechanisms, J.E. Shigley, J.J. Uicker, Theory of Machines and Mechanisms, Mc-Graw Hill, 2nd Edition, 1995.
5. Design of machinery : An introduction to the synthesis and analysis of mechanisms and machines, Robert L Norton, New York : McGraw-Hill, 2012

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	-	-	-	-	-	-	3	3	2
CO3	2	3	-	-	-	2	-	-	-	-	-	-	3	2
CO4	-	3	2	-	-	2	-	-	-	-	-	3	3	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	2

AI16305 CROP HUSBANDRY LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To know the basic principles in field preparation practices of crop cultivation.
- To introduce the basic concept of seed selection and its treatment.
- To gain sufficient knowledge in crop cultivation practices like sowing, intercultural operations and harvest.
- To introduce the different crop production practices in wet land, dry land and irrigated upland through hands on experience and demonstrations.
- To get an idea about weed management, pest management and post harvesting.

LIST OF EXPERIMENTS

1. Field preparation studies
2. Seed selection and seed treatment procedures
3. Seed bed and nursery preparation
4. Sowing / Transplanting
5. Biometric observation for crops
6. Nutrient management studies
7. Water management and irrigation scheduling
8. Weed management studies
9. Integrated Pest Management studies
10. Harvesting and Post harvesting

TOTAL PERIODS 30

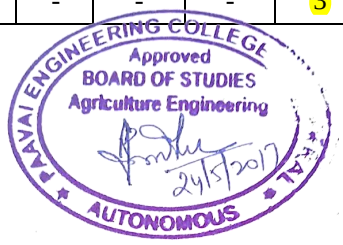
COURSE OUTCOMES

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

- acquire hands on experience in various crop production practices.
- identify the choice of seeds to be selected for cultivation.
- get exposure on crop cultivation practices like sowing, intercultural operations and harvest.
- gain practical experience in crop production practices in wetland, irrigated upland and dry land.
- gain experience on pest application and weed control in crop cultivation.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	-	-	-	2	-	-	-	-	-	-	3	3	-
CO4	3	-	-	-	2	-	-	-	-	-	-	3	3	3
CO5	3	-	-	-	-	-	2	2	-	-	-	3	3	-



AI16306 AGRICULTURAL ENGINEERING PRACTICES LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To learn agro - meteorological measurements influencing crop production.
- To identify and estimate biometric parameters of different food crops
- To study the soil and water parameter measurements.
- To demonstrate farm machinery and implements.
- To practice on agro - energy equipments.

LIST OF EXPERIMENTS

AGROMETEOROLOGY **12**

1. Meteorology – Precipitation – Rain gauges – recording and non-recording rain gauges -
2. Measurement of humidity, wind direction and speed
3. Measurement of sunshine and solar radiation
4. Measurement of evaporation using evaporimeter and Automatic Weather Station (AWS)

SEEDS AND CROPS **9**

1. Identification of food grains and crops
2. Estimation of germination rate for cereals, pulses and oilseeds by conventional method and using Seed Growth germinator
3. Estimation of biometric parameters of different food crops

SOIL AND WATER PARAMETERS **3**

1. PH and EC measurement using electrode device

AGRICULTURAL MACHINERY **6**

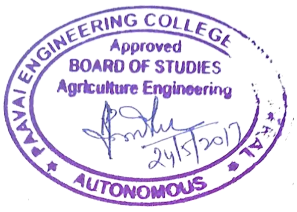
2. Demonstration of Agricultural machineries and equipment
3. Demonstration of Agro-energy equipment

TOTAL PERIODS 30

COURSE OUTCOMES

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

- learn agro-meteorological measurements influencing crop production.
- identify and estimate biometric parameters of different food crops.
- measure the soil and water parameters.
- gain knowledge in operation of farm machinery and implements.
- understand the use and working principle of agro-energy equipments.



*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	3	-
CO3	3	2	-	-	2	2	-	-	-	-	-	3	3	3
CO4	3	-	-	-	2	-	-	-	-	-	-	3	3	-
CO5	3	-	-	-	2	-	-	-	-	-	-	2	3	-

AI16307 **SURVEYING LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

- To provide exposure in various methods and applications of surveying to agricultural engineering projects.
- To train the student to acquire skill in operating various surveying instruments
- To develop skill to operate levelling instruments
- To train the student, how to demonstrate the total station and GPS
- To study the applications of levelling

LIST OF EXPERIMENTS

1. CHAIN SURVEYING

a. Ranging, Chaining and Pacing
b. Chain traversing

2. COMPASS SURVEYING

a. Triangulation Problem
b. Compass traversing

3. PLANE TABLE SURVEYING

a. Radiation
b. Intersection - Triangulation problem
c. Plane table traversing

4. LEVELLING

a. Fly levelling using Dumpy level
b. Fly levelling using Tilting level
c. Check levelling
d. Block Levelling
e. Radial Contouring

5. THEODOLITE SURVEYING

a. Tangential and Stadia Tacheometry

6. DEMONSTRATION OF TOTAL STATION AND GPS

TOTAL PERIODS 60

COURSE OUTCOMES

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

- use all surveying equipments
- gain knowledge in the principles and classification of chain surveying and ranging
- demonstrate the theodolite, total station and global position system
- understand the different types of bearing and traversing
- prepare LS and CS, contour maps and carryout surveying works related to land and civil engineering projects

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	3	1	-	-	3	2	2	3	3	2
CO2	3	3	-	-	3	1	-	-	3	2	2	3	3	2
CO3	2	1	-	-	1	1	1	-	1	2	-	1	2	1
CO4	2	2	-	-	-	-	-	-	1	-	-	-	-	3
CO5	2	3	2	-	3	-	2	-	3	-	-	3	2	1

SEMESTER IV

MA16403	**PROBABILITY AND STATISTICS**	**3**	**2**	**0**	**4**

(COMMON TO AGRI & CHEMICAL)

COURSE OBJECTIVES

- To acquire knowledge of the random variable and manipulate.
- To analyse the relationship between the two random variables.
- To determine the concepts of hypotheses testing, its need and applications.
- To equip with statistical techniques for designing experiments, analyzing, interpreting and presenting research data.
- To apply the statistical tools in engineering problems..

UNIT I RANDOM VARIABLES **15**

Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES **15**

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and Linear regression - Transformation of random variables - Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS **15**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS **15**

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

UNIT V STATISTICAL QUALITY CONTROL **15**

Control charts for measurements (X and R charts) - Control charts for attributes (P, C and NP charts) - Tolerance limits - Acceptance sampling.

TOTAL PERIODS 75

COURSE OUTCOMES

At the end of course, students will be able to

- understand the fundamental concepts of probability.
- acquire the knowledge on standard distributions for real life phenomenon.
- learn the sampling distributions and statistical techniques for engineering and management problems.
- realize the principles to be adopted for designing the experiments.
- gain knowledge on the quality control charts and sampling.

TEXTBOOKS

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

2. Johnson. R.A. and Gupta. C.B., Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes" McGraw Hill Education India , 4th Edition, New Delhi , 2010.

REFERENCES

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum"s Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	2	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3

AI16401 UNIT OPERATIONS IN AGRICULTURAL PROCESSING 3 0 0 3

COURSE OBJECTIVES

- To introduce the scope, importance and key concepts of the agro processing
- To expose the fundamentals of various unit operations in agricultural processing
- To gain fundamental knowledge in evaporation, filtration, sedimentation, processing, crystallization and distillation in processing of agricultural produce.
- To impart knowledge in the concepts of size reduction
- To understand the factors influencing various unit operations in agriculture processing

UNIT I EVAPORATION AND CONCENTRATION 9

Unit operations in food processing - conservation of mass and energy - overall view of an engineering process - dimensions and units - dimensional and unit consistency - dimensionless ratios-evaporation - definition - liquid characteristics - single and multiple effect evaporation - performance of evaporators and boiling point elevation - capacity - economy and heat balance - types of evaporators - once through and circulation evaporators - short tube evaporators and long tube evaporators - agitated film evaporator

UNIT II FILTRATION AND SEDIMENTATION 9

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

UNIT III SIZE REDUCTION 9

Size reduction - grinding and cutting - principles of comminuting - characteristics of comminuted products - particle size distribution in comminuted products - energy and power requirements in comminuting - crushing efficiency - Rittinger's, Bond's and Kick's laws for crushing - size reduction equipments - crushers - jaw crusher, gyratory crusher - crushing rolls - grinders - hammer mills - rolling compression mills - attrition, rod, ball and tube mills - construction and operation.

UNIT IV PROCESSING 9

Contact equilibrium separation processes - concentrations - gas-liquid and solid-liquid equilibrium - equilibrium concentration relationships - operating conditions - calculation of separation in contact - equilibrium processes - gas absorption - rate of gas absorption - stage - equilibrium gas - absorption equipment. Properties of tower packing - types - construction - flow through packed towers. Extraction - rate of extraction - stage equilibrium extraction-equipment for leaching coarse solids - intermediate solids - basket extractor -extraction of fine material - Dorr agitator - continuous leaching - decantation systems - extraction towers - washing - equipments

UNIT V CRYSTALLISATION AND DISTILLATION 9

Crystallization - Equilibrium - Rate of crystal growth stage - Equilibrium crystallization -Crystallizers - Equipment - Classification - Construction and operation - Crystallizers - Tank - Agitated batch - Swenson - Walker and Vacuum crystallizers - Distillation - Binary mixtures - Flash and differential distillation - Steam distillation - Theory - Continuous distillation with rectification - Vacuum distillation - Batch distillation - Operation and process -Advantages and limitation - Distillation equipments - Construction and operation - Factors influencing the operation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand scope, importance and key concepts of the agro processing
- know the fundamentals of various unit operations of agricultural processing
- use the processing methods of agricultural produce
- apply the concepts of size reduction
- have the knowledge of crystallisation and distillation.

TEXTBOOKS

1. Earle, R.L., "Unit operations in Food Processing", Pergamon Press, Oxford, U.K, 1985.
2. Sahay. K.M. and Singh, K.K., "Unit Operations of Agricultural Processing", Vikas Publishing House Pvt.Ltd., New Delhi, 2008.
3. McCabe, W.L., and Smith, J.C., "Unit Operations of Chemical Engineering", Mc-Graw-Hill Inc., Kosaido Printing Ltd., Tokyo, 1990.

REFERENCE

1. Coulson, J.M., and Richardson, J.F., "Chemical Engineering", Vol. 1, ThePergamonress New York, 1977.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	-	3	2	-	-	2	3	-	-	-	-	3	3	2
CO4	-	3	2	-	-	-	2	-	-	-	-	3	3	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	2

AI16402 HYDROLOGY AND WATER RESOURCES ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To introduce the student the concept of hydrological aspects of water availability and requirements
- To give idea in the factors affecting runoff
- To study the properties of aquifers
- To impart knowledge to quantify, control and regulate the water resources
- To develop skill to conduct spatial analysis of rainfall data and design of water storage reservoirs

UNIT I PRECIPITATION AND ABSTRACTIONS 10

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 - Horton's equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - 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 8

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

UNIT V GROUNDWATER AND MANAGEMENT 10

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the key drivers on water resources, hydrological processes and their integrated behaviour in catchments
- gain knowledge in properties of aquifers
- to construct and apply a range of hydrological models to surface water and groundwater problems including hydrograph, flood/drought management, artificial recharge
- o conduct Spatial analysis of rainfall data
- o design water storage reservoirs

TEXTBOOKS

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998

REFERENCES

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. VenTe Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

CO/PO Mapping :

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	1	3	2	-	2	-	2	2	1	-	3	2
CO2	2	3	3	2	2	1	2	1	2	3	2	2	2	3
CO3	2	2	3	2	3	1	3	1	3	3	2	2	2	3
CO4	3	2	3	3	2	2	3	1	2	2	3	1	2	2
CO5	2	2	2	3	3	2	2	-	2	2	3	1	2	3

AI16403 **PRINCIPLES AND PRACTICES OF HORTICULTURAL CROP PRODUCTION** **3 0 0 3**

COURSE OBJECTIVES

- To impart basic knowledge of horticulture crop production.
- To study the production practices of horticulture crops.
- To understand the cultivation practices of fruits and plantation crops.
- To acquire knowledge in production practices of vegetable crops.
- To introduce the production practices of flowers and medicinal plants.

UNIT I INTRODUCTION AND PROPAGATION OF HORTICULTURAL CROPS 9

Scope and importance of Horticulture and Horticultural crops - area and production - exports and imports - classification - climatic zones of India and Tamil Nadu in relation to Horticultural crops - factors limiting Horticultural crop production. Propagation structures and Plant growth structures. Propagation seed/vegetative method - their advantages and disadvantages - techniques of seed propagation - vegetative propagation - principles and methods - stock/scion relationship - propagation by specialized plant parts - propagation tools

UNIT II PRCATICES IN HORTICULTURAL CROPS 8

Establishment of orchards - multitier cropping - cover crops – intercrops - mulching - bearing habits - training and pruning - flowering, pollination and fruit set - fruitfulness and unfruitfulness - causative factors - fruit drop - causes and prevention - role of plant growth regulators in Horticulture. Maturity indices - Harvesting - post harvest handling - losses.

UNIT III PRODUCTION PRACTICES OF FUITS, SPICES AND PLANTATION CROPS 11

Generalized management and cultivation practices for important - Fruits crops : Mango, Banana, Grapes, Acid lime, Papaya, Sapota, Guava; - Spice crops : Pepper, Cardamom, Turmeric, Ginger, Coriander, Fenugreek; Plantation crops : Coffee, Tea, Coconut, Areca nut

UNIT IV PRODUCTION PRACTICES OF VEGETABLES 9

Generalized management and cultivation practices for important vegetable Crops: Tomato, chillies, capsicum, brinjal, bhendi, onion, gourds, cassava, carrot, radish, beetroot, cabbage, cauliflower, amaranthus, moringa.

UNIT V PRODUCTION PRACTICES OF FLOWERS AND MEDICINAL PLANTS 8

Cultural requirements of commercial flower crops: jasmine, rose, marigold, tuberose, crossandra, chrysanthemum, cut flower production in rose, orchids, gerbera, anthurium. Commercial medicinal plants - Area - production - Production technology: Senna, Periwinkle, Phyllanthus, Aswagandha, Coleus, Gloriosa, Aloe

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire knowledge in factors affecting growth and production of horticultural crops.
- understand the horticultural crop management practices.
- analyse the choice of practices to be followed for better growth of fruits, spices and plantation crops
- identify the best practices to be followed for higher yield of vegetable crops.
- gain ideas about the production technology of flowers and medicinal plants.

TEXTBOOKS

1. Kumar, N., Introduction to Horticulture, Rajalakshmi Publications. Nagercoil, 1993.
2. Edmond, J.B.Musser, A.M. and Andrews, F.S.1957. Fundamentals of Horticulture - McGraw Hill Book Co., New York.
3. Shanmugavelu, K.G. 1989. Production Technology of Vegetable Crops, Oxford India Publication, N.D.
4. Chattopadyay, T.K. 1998. A Text Book on Pomology (Vol.1-4), Kalyani publishers, New Delhi.

REFERENCES

1. Horticultural Crop Production Guide, Tamil Nadu Agricultural University Publication, Coimbatore. 2005
2. Kumar, N., Abdul Khader, M. Rangaswami, P. and Irulappan, I. Introduction to spices, plantation crops, medicinal and aromatic plants. Rajalakshmi Publications, Nagercoil. 1993.
3. Shanmugavel, K.G. Production Technology of Vegetable Crops. Oxford India Publications, New Delhi. 1989.
4. Bose T. K. and L.P.Yadav. Commercial Flowers, Nayaprakash, Calcutta.1989.
5. Handbook of Agriculture. ICAR Publications, New Delhi.

CO/PO Mapping :

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	-	3	2	-	-	2	3	-	-	-	-	3	3	2
CO4	-	3	2	-	-	-	2	-	-	-	-	3	3	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	2

AI16404 FLUID MECHANICS AND HYDRAULICS 2 2 0 3

COURSE OBJECTIVES

- To introduce the students the mechanics of fluids through a thorough the properties and behaviour of fluids under static conditions.
- To impart idea in the dynamics of fluids through the control volume approach
- To expose the applications of the conservation laws
- To study the various hydraulic engineering problems like open channel flows and hydraulic pumps.
- To understand and practice the theory related to hydraulic engineering.

UNIT I PROPERTIES OF FLUIDS 12

Properties of fluids - definition - units of measurement - Mass density - specific weight, specific volume - specific gravity - equation of state - perfect gas - Viscosity - vapour pressure - compressibility and elasticity - surface tension - capillarity. Fluid pressure and measurement - simple and differential manometers - Mechanical gauges - calibration. Hydrostatic forces on surfaces - total pressure and centre of pressure. Archimedes principles - buoyancy - meta centre - meta centric height.

UNIT II FLUID FLOW ANALYSIS 12

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

UNIT III FLOW MEASUREMENTS 12

Bernoulli's equation - applications - Venturimeter - orifice meter - rota meter - pitot tube - Orifice - Flow through orifice under variable head - time of emptying a tank with and without inflow. Flow through pipes - laminar and turbulent flow in pipes - Reynold's experiment - Darcy - Weisbach equation for friction head loss - Chezy's formula - Manning's formula - Hazen-William‟s formula - Major and minor losses in pipes

UNIT IV OPEN CHANNEL FLOW 12

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

UNIT V PUMPS 12

Pump terminology - suction lift, suction head, delivery head, discharge, water horse power - selection of pump capacity. Centrifugal pumps - components - working - types of pumps and impellers - Priming - cavitation - specific speed - characteristic curves. Turbine and submersible pumps - Jet pump - jet assembly - Other pumps - Air lift pump - reciprocating pump - sludge pump and vacuum pump - Hydraulic ram.

TOTALPERIODS 60

COURSE OUTCOMES

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

- understand the properties, behavior of fluids under static conditions.
- relate the theory and practice problems in hydraulic engineering.
- get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- know various hydraulic engineering problems like open channel flows and hydraulic pumps
- apply physical laws in addressing problems in hydraulics

TEXTBOOKS

1. Modi, P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Publishers Distributors, New Delhi, 2010.
2. Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002.
3. JagdishLal,. Hydraulic Machines. Metropolitan Book House, New Delhi, 2000.
4. Subramanya K., "Flow in Open Channels", Tata McGraw-Hill Publishing Company 2010

REFERENCES

1. Garde, R.J., Fluid Mechanics through problems. New Age International Publishers (P) Ltd., New Delhi, 2002.
2. Michael A.M. and S.D.Khepar, Water Well and Pump Engineering. Tata McGraw Hill Co. New Delhi, 2005.
3. Michael A.M. Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 2008.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	3	1	-	-	-	-	-	-	-	1	1
CO2	2	3	2	3	1	-	-	-	-	-	-	-	1	1
CO3	2	3	2	3	1	1	-	-	-	-	1	1	3	3
CO4	2	3	2	3	1	1	-	-	-	-	1	1	2	2
CO5	2	3	2	3	1	1	-	-	-	-	1	1	3	3

AI16405 SOIL SCIENCE AND ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To introduce the fundamental knowledge in soil physical parameters.
- To impart knowledge in types and methods of soil survey and interpretative groupings.
- To understand the phase relationship and laboratory soil compaction methods.
- To gain fundamental knowledge in engineering properties of different types of soil.
- To study bearing capacity of different types of soil.

UNIT I INTRODUCTION AND SOIL PHYSICS 9

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

UNIT II SOIL CLASSIFICATION AND SURVEY 9

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

UNIT III PHASE RELATIONSHIP AND SOIL COMPACTION 9

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

UNIT IV ENGINEERING PROPERTIES OF SOIL 9

Shear strength of cohesive and cohesion-less - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Tri-axial 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 PERIODS 45

COURSE OUTCOMES

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

- gain ideas in fundamentals of soil physical parameters and classification of soils.
- acquire knowledge in the procedures involved in soil survey, field soil mapping and suitability of soil.
- understand the soil compaction and engineering classification of soil.
- analyse engineering properties of soil and darcy law.
- apply the concepts of bearing capacity, slope stability and BIS standard for soil.

TEXTBOOKS

1. Nyle C. Brady, "The Nature and Properties of Soil", Macmillan Publishing Company, 10th Edition, New York, 2008.
2. Punmia, B.C., "Soil Mechanics and Foundation "Laxmi Publishers, New Delhi, 2007.

REFERENCES

1. Edward J. Plaster., "Soil Science", Cengage Learning India Ltd, New Delhi, 2009.
2. Arora, K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2007.
3. Murthy, V.N.S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2007.
4. Sehgal, S.B., "Text Book of Soil Mechanics", CBS Publishers and Distributors New Delhi, 2007.

CO/PO Mapping :

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	2	-	-	1	-	-	-	1	1	3	3
CO2	2	1	-	3	-	-	1	-	-	-	1	1	3	3
CO3	2	1	-	3	-	-	1	-	-	-	1	1	3	3
CO4	3	2	-	2	1	-	-	-	-	-	1	1	3	3
CO5	3	2	-	2	1	-	-	-	-	-	1	1	3	3

ME16411 **THERMAL ENGINEERING** **3 0 0 3**

COURSE OBJECTIVES

- To understand the fundamental concepts and first law of thermodynamics.
- To know the second law and its application.
- To study the principle of operation of IC engines and boilers.
- To impart knowledge in the properties of mixture of gases.
- To introduce modes of heat transfer.

(Use of standard and approved steam table, Mollier chart and Heat and Mass Transfer data book permitted)

UNIT-I BASIC CONCEPTS AND FIRST LAW **9**

Thermodynamics and Energy – Comparison of microscopic and macroscopic approach – Intensive and extensive properties. Systems and their types. Thermodynamic process and cycles – Simple problems on processes – Concept of Temperature and heat- Zeroth law of thermodynamics- First law of Thermodynamics – steady flow processes – solving problems on the applications of Thermodynamics.

UNIT-II SECOND LAW OF THERMODYNAMICS **9**

Heat reservoir – Source,sink - Heat engine, Refrigerator, heat pump - statements of second law and its corollaries – Carnot Cycle, Reversed Carnot cycle, performance –Clasius Inequality- Introduction to Pure substances- Formation of steam and its thermodynamic properties – use ofsteam tables and Mollier chart.

UNIT III IC ENGINES AND BOILERS **9**

Internal combustion engines – C.I and S.I Engines – Four stroke and two stroke engines – Simple carburetor and fuel injector-Lubrication and cooling system- Boilers –Classifications -Fire tube and water tube boilers – Construction and working of low pressure and high pressure boilers –Boiler mountings and accessories.

UNIT IV IDEAL AND REAL GASES AND GAS MIXTURES **9**

Properties of Ideal gas – Ideal and Real gas comparison – Vander Waals equations – Dalton law of Gibbs – Dalton law – compressibility chart – properties of mixture of gases – Simple problems on Gas mixtures.

UNIT V HEAT TRANSFER **9**

Conduction – Plane wall, hollow cylinder, Composite walls –Fins – Convection – Forced convection and Free convection – Flow over flat plate and flow through pipes. Radiation - heat exchange between two grey surfaces.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gain knowledge on Thermodynamic principles and first law.
- acquire knowledge on thermodynamic second law and its applications.
- understand the working principle of IC engines and boilers.
- know the properties of gases and vapour mixtures.
- differentiate three modes of heat transfer.

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Third Edition, Tata McGraw hill, 2005.
2. R.K.Rajput, "Thermal Engineering", Laxmi publication (p) Ltd., New Delhi, 2010.

REFERENCES

1. YunusA.Cengel, M.Boles, "Thermodynamics – An Engineering Approach", Tata McGraw Hill, 2010.
2. Ganesan.V "Internal Combustion Engines" Tata McGraw Hill,2007
3. Domkundwar.S, C.P.Kothandaraman, "A course in Thermal Engineering", DhanpatRai& Co (P) Ltd, 2000.
4. Natarajan.E, "Engineering Thermodynamics: Fundamental and Application", Anuragam publications, 2012.
5. Rudramoorthy.R ,"Thermal Engineering" Tata McGraw Hill New Delhi,2003
6. Khurmi.R.S "Steam tables" S.Chand& Company Ltd, New Delhi, 2014
7. Kothandaraman.C.P and Subramanyan.S " Heat and Mass Transfer Data Book" New Age International Publishers,2014

CO/PO Mapping :

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	3	1	-	-	-	-	-	-	-	1	1
CO2	2	3	2	3	1	-	-	-	-	-	-	-	1	1
CO3	2	3	2	3	1	1	-	-	-	-	1	1	3	3
CO4	2	3	2	3	1	1	-	-	-	-	1	1	2	2
CO5	2	3	2	3	1	1	-	-	-	-	1	1	3	3

AI16406 FLUID MECHANICS AND STRENGTH OF MATERIALS LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To verify the various principles of fluid flow by performing the experiments in lab.
- To determine the major and minor losses of fluid flow through pipes.
- To understand the working principles of various pumps by doing performance test.
- To expose the testing of different materials under the action of various forces
- To determine the properties of various materials experimentally.

LIST OF EXPERIMENTS - FLUID MECHANICS

A. Flow Measurement

1. Flow through Venturimeter and circular Orifice
2. Verification of Bernoulli's Theorem
3. Flow through a Triangular and Rectangular Notches

B. Losses in Pipes

1. Determination of friction coefficient in pipes
2. Determination of losses due to bends, fittings and elbows

C. Pumps

1. Performance test on Centrifugal pump
2. Performance test on Reciprocating pump
3. Performance test on submersible pump

LIST OF EXPERIMENTS - STRENGTH OF MATERIALS

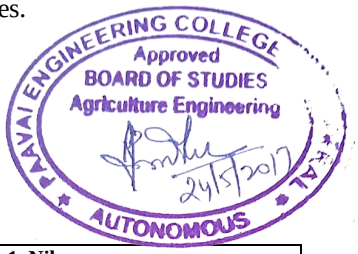
1. Tension test on mild steel rod
2. Compression test on wood
3. Torsion test on mild steel rod
4. Impact test on metal specimen (Izod and Charpy)
5. Hardness test on metals (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Compression test on helical spring

TOTAL PERIODS 60

COURSE OUTCOMES

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

- determine the coefficient of discharge through various flow measuring devices.
- measure flow in pipes and determine frictional losses.
- develop characteristic curves of pumps.
- acquire knowledge in the area of material testing
- understand the behavior of various materials.



CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	2	1	1	1	3	-	-	-	-	-	1	1	3	3
CO2	1	2	1	2	3	-	-	-	-	-	2	1	2	2
CO3	2	2	3	2	2	1	-	-	-	-	1	1	3	3
CO4	2	1	1	1	3	-	-	-	-	-	1	1	3	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SEMESTER V

AI15501 IRRIGATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To inculcate various water resources available for irrigation requirement and its efficiency.
- To understand different kinds of irrigation system and choose appropriate system for a given environment.
- To introduce different types of water control and diversion structures for planning the irrigation system.
- To understand canal and tank irrigation for command area development.
- To know the recent trends in irrigation system and their effectiveness.

UNIT I WATER RESOURCES AND IRRIGATION REQUIREMENT 9

Water Resources, Development and Utilisation in India; Irrigation - Definition, Advantage and Disadvantages; Duty and delta of water; Rooting Characteristics and Moisture use pattern; Evaporation and Evapotranspiration - Measurement of ET - Crop Water requirement - Effective Rainfall, Factors Affecting Effective Rainfall; Scheduling - Irrigation Requirement, Irrigation Frequency and Irrigation Efficiencies.

UNIT II METHODS OF IRRIGATION 12

Methods of Irrigation - Surface, Subsurface and Pressurised methods; Major, minor and micro irrigation - Surface Methods - Border irrigation - Hydraulics and Design, Furrow Irrigation - Hydraulics and design, Designing Drip and Sprinkler systems, Erodible and non-erodible channels, Kennedy's and Lacey's theories, Materials for lining watercourses and field channel, Subsurface - Underground pipeline irrigation system and design considerations.

UNIT III DIVERSION AND CONTROL STRUCTURES 9

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

UNIT IV CANAL, TANK IRRIGATION AND COMMAND AREA DEVELOPMENT 9

Classification of canals - Alignment of canals - Design of irrigation canals - Regime theories - Canal Head works - Canal regulators - Canal drops - Cross drainage works - Canal Outlet, Escapes. Lining and maintenance of canals - Tanks - system and non-system tanks - Command area - Concept, Components of CADP - On Farm Development works, Farmer's committee - its role for water distribution and system operation - rotational irrigation system.

UNIT V SPECIAL IRRIGATION SYSTEM 6

Surge and Cablegation. Greenhouse and shade-net irrigation system design. Types of valves - pressure relief valve - Gate valve. Non-return valve - butterfly valve, Solenoid valves - smart irrigation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Get equipped on moisture use pattern, irrigation efficiency and requirements of the irrigation system.
- Have knowledge on different methods of irrigation system and its management.
- Know various diversion and water control structures.
- Gain knowledge in command area development programme.
- Get expertise in recent special irrigation system and their operation.

TEXTBOOKS

1. Dilip Kumar Majumdar., "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Michael, A.M., "Irrigation Engineering", Vikas Publishers, New Delhi, 2008.
3. Garg, S.K., "Irrigation Engineering," Laxmi Publications, New Delhi, 2008.

REFERENCES

1. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2008.
2. Murthy, V.V.N. Land and water management, Kalyani publishing, New Delhi, 1998.
3. Irrigation water Management, Training Manual No 6, Drainage of Irrigated Lands, Food and Agriculture Organization, Rome 1996.

CO/PO Mapping

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	-	-	-	2	-	1	-	-	-	-	-	2
CO2	3	2	-	-	-	-	1	-	-	2	2	-	3	2
CO3	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	2	-	-	-	-	-	-	-	-	-	3	2	-	3
CO5	3	2	-	-	-	-	-	-	1	-	-	-	3	-

AI15502 OPERATION OF FARM MACHINERY AND EQUIPMENTS 3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on different farm mechanized machinery like tractor, power tiller, their utilities and maintenance.
- To study the working principles of tillage equipments.
- To gain knowledge on machine dynamics and hitching.
- To introduce knowledge on equipments likely to be used in various activities of crop plantation.
- To get an idea about the harvesting and threshing equipments.

UNIT I TRACTOR AND POWER TILLER 9

Farm mechanization - objectives - Tractors - Selection and Classification - identification of major systems - components and their uses. Types of hitch systems and adjustments. Preliminary checkups and safety aspects before starting a tractor and power tiller - procedure for starting, running and stopping the tractor and power tiller - precautions in driving tractor and power tiller on road and field.

UNIT II TILLAGE EQUIPMENTS 9

Primary Tillage Equipment - Mould board plough - animal and power operated, types and construction, working principles. Accessories of M.B. plough - forces acting on mould board bottom. Disc ploughs, types and construction, soil reaction, side thrust and draft of disk ploughs, and special tillage implements such as rotavators, five-bottom ploughs, sub-soiler, paddy puddler. Secondary Tillage Equipment - cultivator, disc harrow - types and construction - Selection.

UNIT III MACHINE DYNAMICS AND HITCHING 9

Dynamic soil properties affecting soil tool interaction. Atterberg, soil and metal friction - Force analysis of tillage tools and their measurement. Types of dynamometer - spring hydraulic, eddy current and strain gauge types - Virtual and real hitching for single point, single axis and double hitch implements - Yokes and harness for draught animals and mechanics of hitching.

UNIT IV EQUIPMENTS FOR OTHER OPERATIONS 9

Construction and working principles of sowing / seeding, planting and fertilizer application equipment, seed and fertilizer metering devices, furrow openers and covering devices, calibration, field adjustment and operations, paddy planters - Intercultural Equipment - Cultivators, sweeps and shovels - types and uses, rotary hoes, weeders - classification of weeders according to power sources - Plant protection equipments, types construction and working principle. Selection of equipment for spraying and dusting - Safety aspects.

UNIT V EQUIPMENTS FOR SPECIAL OPERATIONS 9

Harvesting and Threshing - Classification, construction and working principles of reapers mowers, combined harvesters and power threshers - Specialized Crop Equipment for maize, cotton, sugarcane, root crops and horticultural crops - land clearing and earth moving machinery. Selection of Farm Machinery - Performance evaluation, cost analysis and management of farm equipment. Ergonomics studies and safety of Farm Machinery & Equipment.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand the operations of various farm equipments and machinery for farm mechanizations
- Have knowledge on different types of tillage equipments.
- Gain sufficient knowledge on machine dynamics.
- Get an idea about the mechanization of crop plantation.
- Analyse and estimate the performance and cost of equipments.

TEXTBOOKS

1. Jain, S.C. and C.R. Rai. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi, 1999.
2. JagadishwarSahay. 2016. Elements of Agricultural Engineering, Standard Publishers Distributors, New Delhi.
3. Ojha,T.P. and A.M.Michael. 2014. Principles of Agricultural Engineering Volume-I, Jain Brothers, New Delhi

REFERENCES

1. John A Havers and Frank W Stubbs, Hand book of Heavy Construction, McGraw - Hill book Company, New York, 1971.
2. Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.
3. Herbert L.Nichols Sr. Moving the Earth, D. Van Nostrand company Inc. Princeton, 1959,

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	3	-	-	-	-	2	-	1	-	3	-
CO2	3	-	-	3	-	-	-	-	-	1	2	-	-	3
CO3	2	-	-	-	-	-	-	3	-	2	-	-	3	-
CO4	-	-	-	-	-	-	-	-	-	3	2	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	3	-	2	3

AI15503 POST HARVEST TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

- To expose fundamental knowledge in post harvesting technologiesof agricultural produces.
- To understand the importance of drying process in agriculture produces.
- To impart the knowledge in cleaning and grading agricultural produces.
- To get an idea about the material handling equipments and its operation.
- To understand different post harvest operations and processing methods of harvested crops and storage of crops.

UNIT I FUNDAMENTALS OF POST HARVESTING 9

Post harvest technology - introduction - objectives - post harvest losses in cereals, pulses and oilseeds - importance - optimum stage of harvest. Threshing - traditional methods mechanical threshers and shellers - 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 - disk separators - effectiveness of separation and performance index.

UNIT IV MATERIAL HANDLING 9

Material handling equipments - belt conveyor - screw conveyor - chain conveyor - bucket elevators - pneumatic conveying - principles and operation

UNIT V PADDY AND CROP PROCESSING 9

Paddy processing - parboiling of paddy - methods - merits and demerits - de-husking 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 - extraction methods, refining and hydrogenation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain knowledge in engineering properties of agricultural produces.
- Get expertise in drying process of harvested crops.
- Gain sufficient knowledge in cleaning and grading operation.
- Know the different types of material handling techniques.

  Get exposure on latest trends in food grains and oil seed processing.\

TEXTBOOKS

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

REFERENCES

1. Pande, P.H. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana, 1994.
2. Henderson, S.M. and R.L. Perry. Agricultural Process Engineering. John Wiley and Sons, New York. 1955.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	2	-	-	1	-	-	3	3
CO2	3	-	2	-	-	-	1	-	-	-	-	-	2	3
CO3	-	-	-	-	-	-	-	3	-	2	-	-	3	-
CO4	3	-	-	-	3	-	-	-	-	-	3	-	-	3
CO5	2	-	-	-	-	-	3	-	3	-	2	-	-	3

AI15504 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To impart scientific knowledge on environment and its impact on associated biological systems.
- To study about the different types of pollution ,its causes and effects on environment.
- To understand the use of natural resources and exploitation of these resources by socio economic activities of human.
- To impart knowledge on social issues related to environment.
- To know the role of human population in environment.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Environment - definition, scope and importance - Chemical, Physical, Biological hazards in the environment - ecosystem - concept, structure and functions - producers, consumers and decomposers. Oxygen and Nitrogen cycle - energy flow in the ecosystem. Ecological succession processes - types, characteristic features. Structure and function of ecosystem - forest, grassland, desert, aquatic ecosystems. Biodiversity - definition, genetic, species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity: consumptive and productive use - social, ethical, aesthetic and option values. Biodiversity at global, national and local levels - hot-spots of biodiversity in India. Threats to biodiversity - habitat loss, poaching, man-wildlife conflicts - endangered and endemic species of India - In-situ and ex-situ conservation of biodiversity

UNIT II ENVIRONMENTAL POLLUTION 10

Definition - causes, effects and control measures of: (a) Air pollution (Chemical composition of the atmosphere; Chemical and photochemical reactions in atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry; Control of particulate and gaseous emission) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters - physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes - (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards-role of an individual in prevention of pollution - pollution case studies.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people; Water resources - Use and overutilization of surface and ground water, dams-benefits and problems; Mineral resources - Use and exploitation, environmental effects of extracting and using mineral resources, case studies; Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies; Energy resources - Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Energy Conversion processes - Biogas - production and uses.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development - urban problems related to energy - water Conservation, rain water harvesting, watershed management - resettlement and rehabilitation of people; its problems and concerns, case studies - role of non-governmental organization environmental ethics: Issues and possible solutions -

Principles of green chemistry- nuclear accidents and holocaust, case studies. - wasteland reclamation - consumerism and waste products - environment production act - Air act - Water act - Wildlife protection act - Forest conservation act - The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labelling of environmentally friendly products (Eco mark). Enforcement machinery involved in environmental legislation- central and state pollution control boards disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare -Environmental impact analysis (EIA) - GIS-remote sensing-role of information technology in environment and human health - Case studies.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Acquire scientific knowledge on environment and its impact on Eco systems.
- Learn about pollution of natural resources by socio economic activities of human.
- Understand the natural resources and its exploitation.
- Gain awareness about environmental organisation, conservation laws and enforcements.
- Know the role of human population, information technology on environment protection.

TEXTBOOKS

1. AnubhaKaushik and C.P. Kaushik. 2014. "Environmental Science and Engineering", Fourth Edition, New Age International Publishers, New Delhi.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2004
3. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, New Delhi,2006.

REFERENCES

1. Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Dharmendra S. Sengar, "Environmental law", Prentice Hall of India PVT LTD, New Delhi,2007.
3. Rajagopalan R, "Environmental Studies - From Crisis to Cure", Oxford University Press,2005

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	3	-	-	-	-	2	-	1	-	3	-
CO2	3	-	-	3	-	-	-	-	-	1	2	-	-	3
CO3	2	-	-	-	-	-	-	3	-	2	-	-	3	-
CO4	-	-	-	-	-	-	-	-	-	3	2	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	3	-	2	3

AI15505 GROUND WATER AND DRAINAGE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To introduce the concepts of water balance, groundwater, its availability and assessment.
- To know the important parameters influencing flow in wells and equations used for flow analysis.
- To know about the classification, utilization including design, construction, management and drilling of wells.
- To acquire knowledge on surface drainage systems.
- To understand the concept of subsurface drainage in agriculture and soil reclamation methods.

UNIT I HYDRO-GEOLOGIC PARAMETERS 9

Water Balance - Distribution of subsurface water - Water bearing properties of Rocks - Groundwater development in India - occurrence of groundwater - Types of aquifer - confined - unconfined - perched - artesian - aquifuge - aquitard - aquiclude. Movement of ground water - Geophysical investigation of ground water - surface methods - Subsurface methods of investigation - aquifer mapping - uses.

UNIT II HYDRAULICS OF WELLS 10

Hydraulics of wells - static water levels - piezometric level - pumping water level - drawdown - cone of depression - radius of influence - well yield - specific capacity - Transmissibility - Coefficient of storage - specific yield - specific retention - selection of well sites - Steady state radial flow into the wells - derivation of Dupit's equation - Derivation of Theim's equation - Partially penetrating wells - Unsteady state flow into the wells - Theis method - Jacob's method - derivation - Hydraulics of open wells - recuperation test - well losses.

UNIT III WELLS AND WELL DRILLING 9

Wells - classification - advantages of open well and bore wells - Construction of dug well - sunk wells - Increasing the yield of open well - well logging - Types of well screen - Design of well screen - Casing - Curb - Well development - yield testing - Sanitary protection. Well drilling Techniques for different formations - hand boring - Percussion drilling rig - string of tools for percussion drilling - pneumatic drilling - down the hole hammer - Rotary drilling - drill bits - Wagon drills - Jack hammer.

UNIT IV SURFACE DRAINAGE 8

Agricultural drainage - Problems - Concept - Drainage Coefficient - Principles of flow through soils - Darcy's law - Infiltration theory - Surface drainage systems - various methods - Random drainage - Herringbone - Grid iron types - Design of Open Drains.

UNIT V SUB SURFACE DRAINAGE 9

Subsurface drainage - Investigations - Hydraulic Design for Steady State flow - Dupuit-Forchimer assumptions - Hooghoudt's Steady State equation - Design of subsurface drainage - Mole drains - Drainage wells - Pipe materials - Envelope materials. Land reclamation - Leaching Requirements - methods of Reclamation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain knowledge on the concepts of water balance, groundwater, its availability and assessment techniques.
- Understand the well hydraulics, flow in wells and related theorems.

- Learn about the different well systems, their classification and well drilling techniques.
- Acquire knowledge on surface drainage systems.
- Gain exposure on different systems of subsurface drainage.

TEXTBOOKS

1. Karanth, K.R. Groundwater Assessment, Development and Management. Tata Mc-Graw Hill, 2008.
2. Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2000.
3. Ritzema, H.P., "Drainage Principles and Applications", Publication No. 16, International Institute of Land Reclamation and Improvement, Netherlands, 1994.

REFERENCES

1. Rastogi, A.K. Numerical Groundwater Hydrology, Penram International Publishing. Pvt.Ltd., Bombay, 2008.
2. David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc. 2007
3. Fletcher. G. Driscoll, "Groundwater and Wells", Johnson Revision, New York, 1987.
4. Bhattacharya, A.K., and Michael, A.M., "Land Drainage - Principles, Methods and Applications", Konark Publishers Pvt. Ltd., New Delhi, 2003.
5. Kessler, J., "Drainage Principles and Applications", Vol. II and IV, International Institute of Land Reclamation and Improvement, Netherlands, 1979.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	3	-	-	-	-	2	2	1	-	3	-
CO2	3	-	-	3	-	-	-	-	-	1	2	-	-	3
CO3	2	3	-	-	-	-	-	3	-	2	-	-	3	3
CO4	3	-	-	-	-	2	-	-	-	3	2	-	-	3
CO5	3	-	-	-	-	2	-	-	-	-	3	-	2	3

ME15509 REFRIGERATION AND AIR CONDITIONING 3 0 0 3

COURSE OBJECTIVES

- To understand the underlying principles of operations in different Refrigeration systems.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems.
- To know the concept of vapour compression refrigeration system.
- To acquire knowledge on psychrometry.
- To learn the principle of operation in different Air conditioning systems.

UNIT-I REFRIGERATION PRINCIPLES 9

Refrigeration – principles – refrigeration effect – coefficient of performance – units of refrigeration – simple vapour compression cycle – T-S diagram – p-h chart – application of refrigeration and air conditioning.

UNIT-II VAPOUR COMPRESSION REFRIGERATION AND COMPONENTS 9

Vapour compression system – refrigeration components – compressor and condenser – types construction and working – expansion device and evaporators – types, construction and working.

UNIT-III REFRIGERANTS AND VAPOUR ABSORPTION CYCLE 9

Refrigerants – properties – classification – comparison and advantages – chloro flouro carbon(CFC) Refrigerants – effect on environmental pollution – alternate refrigerants – vapour absorption cycle -Theoretical – deviation in practice –Food storage plant – Milk chilling plant

UNIT-IV PSYCHROMETRY 9

Properties of moist air, psychrometric properties and measurement – psychrometric chart – saturation line – relative humidity line – constant specific volume liens – constant thermodynamic wet bulb temperature lines – constant enthalpy lines – different psychrometric process – air mixing process and simple air conditioning process – solving problems using psychrometric chart

UNIT-V AIR CONDITIONING SYSTEM 9

Air conditioning systems – winter and summer air conditioning system – cooling and heating coils – bypass factor – effective sensible heat factor, determination of apparatus dew point (ADP) – air distribution system – room air distribution system – ducts classification – evaporative cooling and its application –application of refrigeration and air conditioning.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain knowledge on refrigeration principles.
- Acquire knowledge on vapour compression system and its components.
- Understand the concepts of refrigerants and vapour absorption cycle.
- Know the psychrometric properties and processes.
- Attain in-depth knowledge of air conditioning system.

TEXT BOOKS

1. R.K.Rajput, "Refrigeration and Air conditioning", Laxmi publication (P) Ltd, New delhi, 2008.
2. R.S.Khurmi and J.K.Gupta "A Text book of Refrigeration and Air conditioning" Eurasia Publishing House (P) Ltd, Ram Nagar, New Delhi, 2002.

REFERENCES

1. Arora, C.P," Refrigeration and Air conditioning", Tata-McGraw Hill publishing Co., New Delhi,1981
2. William, H.S., R.F. Julian,"Air Conditioning and Refrigeration". John Wiley & Sons, Inc London.1986
3. Bellaney, P.L,"Thermal Engineering", Khanna Publishers, New Delhi, 2001
4. Shan K. Wang,"Handbook of Air Conditioning and Refrigeration", McGraw-Hill Publishers,2000
5. Rex Miller,Mark.R.Miller,"Air Conditioning and Refrigeration",McGraw-Hill Publishers,2006

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	3	-	-	-	-	2	-	1	-	3	-
CO2	3	-	2	3	-	-	-	-	-	1	2	-	-	3
CO3	3	-	-	-	3	-	-	3	-	2	-	1	3	-
CO4	3	-	3	-	-	2	-	-	-	3	2	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	3	2	2	3

AI15506 OPERATION & MAINTENANCE OF FARM MACHINERY LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To practice different aspects in tractor, power tiller and studying various components of them.
- To study field operations of primary and secondary tillage implements and their adjustments.
- To have knowledge on field operation of land farming, sowing, plant protection equipments and their adjustments
- To learn operation of various types of sprayers, dusters,weeders and trailers in field level.
- To determine field losses and study about harvesting, threshing equipments.

LIST OF EXPERIMENTS

1. Identification of major components of a tractor and preliminary check measures before starting a tractor - procedure for starting, running and stopping the tractor
2. Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller.
3. Field operation and adjustments of primary tillage implements
4. Field operation and adjustments of Secondary tillage implements
5. Field operation and adjustments of land forming implements
6. Field operation of sowing and planting equipment and their adjustments
7. Field operation of plant protection equipment
8. Field operation of weeders
9. Study of reapers and combine harvester and determination of field losses
10. Study of threshers and their performance evaluation
11. Repair, maintenance and off-season storage of farm equipment
12. Hitching of agricultural implements and trailers
13. Study on different types of trailers

TOTAL PERIODS 60

COURSE OUTCOMES

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

- Practice operation of tractor and power tiller at field level.
- Gain in depth knowledge on field operation of tillage implements.
- Get experience in usage of sprayers, dusters and weeders in field level.
- Evaluate the performance of harvesting and threshing equipments
- Depict the requirement of repair, maintenance and off-season storage of farm equipment

TEXTBOOKS

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

REFERENCES

1. John A Havers and Frank W Stubbs, Hand book of Heavy Construction, McGraw - Hillbook Company, New York, 1971.
2. Barger, E.L., J.B. Liljedahl and E.C. McKibben, Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi, 1997.

LIST OF EQUIPMENTS REQUIRED

1. Tractor - 1 no.
2. Power tiller - 1 no.
3. Disc plough - 1 no.
4. Disc harrow - 1 no.
5. Multi tyne cultivator - 1 no.
6. Paddy Transplanter - 1 no.
7. Seed drill - 1 no.
8. Sprayer - 1 no.
9. Mower - 1 no.
10. Weeder -1 no.
11. Power weeder - 1 no.
12. Trailer - 1no

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	3	-	-	-	-	2	-	1	-	3	3
CO2	3	-	3	3	-	-	3	-	-	1	1	-	-	3
CO3	3	-	-	-	2	-	-	3	2	2	-	-	3	-
CO4	-	-	3	-	-	-	1	-	-	3	1	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	3	-	3	3

AI15507 SOIL MECHANICS AND WATER QUALITY LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To assess Physical and Engineering behavior of soils through laboratory testing procedures.
- To determine the in-situ field density of soil by various methods.
- To gain knowledge on classification of soils.
- To understand the characterization of irrigation water.
- To determine the various parameters of irrigation water through laboratory testing.

LIST OF EXPERIMENTS

1. Determination of field density by core cutter method
2. Determination of field density by sand replacement method
3. Determination of grain size distribution of soil by sieve analysis
4. Determination of hydraulic conductivity by constant permeameter and variable head permeameter.
5. Proctor compaction test on soils.
6. Problems on weight - volume relationships.
7. Collection of soil samples and study of soil profile
8. Determination of soil moisture
9. Textural analysis of soil by international pipette method.
10. Direct shear test on soils
11. Determination of COD and BOD in Irrigation water
12. Determination of turbidity and Hardness in Irrigation water
13. Determination of Ammoniacal Nitrogen and chlorides in irrigation water
14. Determination of total solids, suspended solids and dissolved solids in irrigation water
15. Estimation of gypsum requirements

TOTAL PERIODS 60

COURSE OUTCOMES

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

- Know the techniques to determine index properties and engineering properties of soil by conducting appropriate tests.
- Gain knowledge on the applications of core cutter method, sand replacement method in field test.
- Identify and classify the soil samples by sieve analysis
- Characterize irrigation water and appropriate corrective measures.
- Get an idea about testing methods of various parameters of irrigation water.

REFERENCE BOOKS

1. Bharat Singh, 1990. “A text book of soil mechanics”, Nemchand and Bros, Roorkee
2. Garg, S.K. 1989. “ Soil mechanics”, Khanna publishers, New Delhi.
3. Punmia, B.C. 1992. ”Soil mechanics and foundation”. Laxmi publishers, New Delhi.
4. Standards Methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 1989.

LIST OF EQUIPMENTS REQUIRED

1. Rammer and core cutter - 1set
2. Porous cylinder - 1 set
3. Sieves and sieve shaker - 1set
4. Permeameter - 1 set
5. Proctor compaction apparatus - 1 set
6. Direct shear apparatus - 1 set
7. Field density measuring device - 1 set
8. International pipette stand - 1 set
9. BOD analyzer - 1 set

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	3	-	-	-	-	2	-	1	2	3	-
CO2	3	-	-	3		-	-	-	-	1	2	-	-	3
CO3	3	-	-	-	-	-	-	3	-	2	-	-	3	3
CO4	2	-	-	-	2	-	3	-	-	3	2	-	-	3
CO5	3	-	-	3	-	-	-	-	3	-	3	-	2	3

SEMESTER VI

AI15601 FOOD AND DAIRY PROCESS ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To expose the fundamental knowledge of food, its properties, reaction and kinetics.
- To understand about food processing and preservation techniques.
- To introduce dairy industries, types of milk, its properties and processing.
- To acquire details about manufacturing, processing and treatment of dairy products.
- To Gain knowledge of quality control and quality evaluation of food & dairy industries.

UNIT I FOOD AND ITS PROPERTIES, REACTION AND KINETICS 9

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

UNIT II PROCESSING AND PRESERVATION OF FOODS 10

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

UNIT III PROPERTIES AND PROCESSING OF MILK 9

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

UNIT IV DAIRY PRODUCTS 9

Manufacture of Milk Powder - Processing of Milk Products - Condensed Milk - Skim milk – Butter milk - Flavoured Milk, whey, casein, yoghurt and paneer - Manufacture of Butter - Cheese Ghee, ice creams and frozen desserts - standards for milk and milk products - Characteristics of A1 and A2 milk - Packaging of Milk and Milk Products - Cleaning and Sanitation - Dairy effluent treatment and disposal .

UNIT V QUALITY CONTROL 8

General principles of Quality Control - Food quality evaluation - Food Safety - Hazards - Food toxins - Pesticide and metal contamination - permissible limits of food additives- Standards for food packaging and labeling - Food adulteration - Hygienic handling of foods- National Food laws and standards - PFA, FPO, BIS, AGMARK, MPO, MMPO, APEDA,MPEDA - International Standard - FDA, ISO, GRASS, CAC, TQM, HACCP - Quality control system in storage and food distribution – Quarantine requirements Quality control aspects in food industries

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Attain sufficient knowledge about Food, its properties reaction and kinetics.
- Get an idea about recent trends in Food processing and preservation.
- Gain sufficient knowledge about Dairy industries and milk processing techniques.
- Get exposure on Manufacturing, processing and treatment of dairy products.

- Attain in- depth knowledge on Quality control and evaluation of food &dairy industries.

TEXTBOOKS

1. Chandra GopalaRao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad, 2006.
2. Walstra. P., Jan T. M. Wouters., Tom J. Geurts "Dairy Science and Technology", CRC press, 2005.
3. Krammar&Twigg, (1996), Quality Control for Food Industry. CBS Publishers.

REFERENCES

1. Subbulakshmi.G., and Shobha A. Udipi, Food Processing and Preservation, New Age International Publications, New Delhi, 2007.
2. Toledo, R.T., "Fundamentals of Food Process Engineering", CBS Publishers and Distribution, New Delhi, 1997.
3. Tufail Ahmed., "Dairy Plant Engineering and Management", KitabMahal Publishers, Allahabad, 1997.
4. Dairy Science and Technology Handbook, Volumes 1-3, John Wiley & Sons,1993.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	--	3
CO5	-	-	-	-	-	3	-	-	-	-	-	-	-	3

AI15602 BIO AND THERMO-CHEMICAL CONVERSION OF BIOMASS 3 0 0 3

COURSE OBJECTIVES

- To impart understanding of Biomass characterization and its processing.
- To expose different biochemical conversion process and utilities of biogas.
- To understand the gasification and combustion technology of MSW.
- To generate knowledge on different types of thermo-chemical conversion techniques.
- To get an idea about co-generation and waste heat recovery technologies.

UNIT I BIOMASS CHARACTERIZATION 9

Biomass - types - Terms and units used in biomass production. Biomass fuel characterization - fuels from biomass - physical, chemical and thermal - energy release. Supply chain - harvesting / collection - transportation and processing. Briquetting - types - pelletizing.

UNIT II BIOCHEMICAL CONVERSION 9

Biochemical degradation - factors affecting biogas production - types of biogas plants -construction details - operation and maintenance - utilization of biogas - slurry handling, utilization and enrichment - high rate bio-methanation process - landfills - bio-ethanol - feedstock - process - utilization - composting - methods - machinery.

UNIT III THERMO-CHEMICAL CONVERSION BY COMBUSTION 9

Thermo-chemical degradation - stoichiometric air requirement - Combustion process - chemistry of combustion - combustion zones - emissions. Co-firing of biomass - Incinerators - layout. Combustion of wastes and Municipal Solid Waste. Wood burning stoves - types- operation.

UNIT IV THERMO-CHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS 9

Biomass gasification - chemistry of gasification - types of gasifier - Gas cleaning & conditioning - utilization of producer gas - emissions - commercial gasifier plants. Pyrolysis - product recovery - types - bio-char - bio-oil - operation - recovery.

UNIT V CO-GENERATION AND WASTE HEAT RECOVERY 9

Co-generation technologies - cycles - topping - bottoming - problems - applications - selection. Waste heat recovery - plate heat exchangers - waste heat boilers - heat pumps - thermic fluid heaters - selection of waste heat recovery.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Know the Biomass characterization, transportation and processing.
- Attain sufficient knowledge on different biochemical conversion techniques.
- Gain exposure on the gasification and combustion technology of MSW
- Get an idea on various Thermo-chemical conversion techniques such as gasifiers and pyrolysis
- Familiar with Co-generation and waste heat recovery technologies.

TEXT BOOKS

1. Bailey James E. & David F. Ollis “Biochemical Engineering Fundamentals” - McGraw - Hill Publishing Company, Tokyo
2. Rai. G.D. 1995 “Non Conventional Sources of Energy”, Khanna Publishers, New Delhi.

3. Rao. S and B.B. Parulekar. Energy Technology - Non conventional, Renewable and Conventional. Khanna Publishers, Delhi, 2000.

REFERENCES

1. Chawla, O.P.1986. "Advances in Biogas Technology". ICAR Publication, New Delhi.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	3	-	3	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	3	-	3	1
CO5	3	-	-	3	-	-	-	-	-	-	-	-	3	2

AI15603 STORAGE AND PACKAGE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To introduce knowledge on storage of grains and various grain storage structures.
- To gain acquaintance with controlled atmosphere storage for durable and perishable commodities.
- To appraise on food packaging methods for enhancing shelf life of food items.
- To furnish details about different food containers used in markets.
- To familiarize with filling and different labelling systems

UNIT I INTRODUCTION AND STORAGE STRUCTURES 10

Storage of grains, biochemical changes during storage, production, distribution and storage capacity estimate models, storage factors affecting losses. Storage requirements - Bag and bulk storage, godowns, bins and silos, rat proof godowns and rodent control, method of stacking, preventive method, bio-engineering properties of stored products, function, structural and thermal design of structures, aeration system - Grain markets.

UNIT II CONTROLLED ATMOSPHERE STORAGE 8

Cold storage, controlled and modified atmosphere storage, effects of nitrogen, oxygen, and carbon dioxide on storage of durable and perishable commodities, irradiation, storage of dehydrated products, food spoilage and preservation, BIS standards.

UNIT III INTRODUCTION TO PACKAGING 9

Protection of Food products - major role of food packaging - Functions of packaging, Effect of environmental factors, mechanical forces and biological factors on food quality and shelf life, Need for protective packaging. Estimating the Shelf life requirement of food products for packaging - accelerated storage studies etc. - Methods to extend shelf life - Special problems in packaging of food stuff

UNIT IV FOOD CONTAINERS 9

Rigid containers, glass, wooden boxes, crates, plywood and wire bound boxes, corrugated and fibre board boxes, textile and paper sacks, corrosion of containers (tin plate); Flexible packaging materials and their properties; Aluminium as packaging material; Evaluation of packaging material and package performance - types of pouches, Retortable pouches.

UNIT V FILLING SYSTEMS AND LABELLING 9

Filling systems for aseptic packaging, vacuum packaging, cook in / ship in packaging, bag in box system, microwave ovenable and retortable packages - filling system for form fill sealing system - bottle filling system - labels and bar coding - importance and application - printing - different types of printing on packaging materials.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain knowledge on Storage of grains and various grain storage structures.
- Get familiarize with Controlled atmosphere storage for durable and perishable commodities.
- Get exposure on Food packaging and methods to enhance shelf life of food items.
- Have acquaintance on different food containers used in markets.
- Implement advanced filling, labelling and bar-coding systems on packaging materials.

TEXTBOOKS

1. Hall CW. 1970. Handling and Storage of Food Grains in Tropical and Sub-tropical Areas. FAO Publ. Oxford & IBH.
2. Gordon L. Robertson: Food Packaging - Principles and Practice Marcel Dekker Inc, USA (1993)
3. J. R.D.David, R. H Graves and V.R.Carlson: Aseptic Processing and Packaging of Foods: CRC Press, New York

REFERENCES

1. FAO. 1984. Design and Operation of Cold Stores in Developing Countries. FAO
2. Multon JL. (Ed). 1989. Preservation and Storage of Grains, Seeds and their By-products. CBS
3. Shejbal J. (Ed). 1980. Controlled Atmosphere Storage of Grains. Elsevier.
4. Vijayaraghavan S. 1993. Grain Storage Engineering and Technology. Batra Book Service.
5. Mathlouthi M. (Editor): Food Packaging and Preservation Elsevier Applied Science Publications Essex, UK (1986)
6. NIIR Board: Food Packaging Technology Handbook National Institute of Industrial Research, New Delhi (2004)

CO/PO Mapping

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	3	-	-	-	-	-	-	-	-	-	2	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	-	2	-	-	-	-	-	-	-	2	-	-	2

AI15604 IT IN AGRICULTURAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To acquire acquaintance of precision farming and crop simulation modeling.
- To furnish knowledge about environmental control systems in agriculture and horticulture.
- To expose agricultural system management for optimizing the use of resources.
- To know the weather prediction models and their application in seasonal climate forecasts.
- To introduce E-governance in agriculture systems for the benefits of farming society.

UNIT I PRECISION FARMING 9

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

UNIT II ENVIRONMENT CONTROL SYSTEMS 9

Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in Horticulture.

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT 9

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and Decision Support Systems (DSS).

UNIT IV WEATHER PREDICTION MODELS 9

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

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Possess sufficient knowledge of precision farming and application of Remote sensing, GPS, GIS in crop simulation modeling.
- Have acquaintance on Environmental control systems in agriculture and horticulture.
- Identify agricultural system management for optimizing the use of resources.
- Familiar with weather prediction models and their application in seasonal climate forecasts.
- Implement E-governance in agriculture systems for the benefits of farming society.

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	3	-	-	-	-	3	-	-	3	2
CO2	-	3	-	3	-	-	-	-	-	-	-	-	-	3
CO3	-	3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	3	3	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	2	-	3	-	-	-	-	-	-	3

AI15605 DESIGN OF FARM MACHINERY AND EQUIPMENTS 3 2 0 4

COURSE OBJECTIVES

- To provide knowledge on fundamentals of machine design in various aspects.
- To furnish the details about design of fastenings.
- To gain acquaintance on design of Power Transmission systems and its components.
- To design couplings and shafts for various equipments.
- To understand the underlying design of energy storing elements, gears and bearings.

UNIT I FUNDAMENTALS OF MACHINE DESIGN 9

General considerations in machine design - strength properties of engineering materials. Limits and tolerances - Types of Fits - simple stresses in machine elements - tension - compression - shear and bearing stresses. Torsional and bending stresses in machine parts - torsional stresses in shafts, bending stresses in beams. Theories of failure - Rankein's theory, Guest theory, Saint Venants theory and Von Mises theory - Stresses in thin cylindrical shells.

UNIT II DESIGN OF FASTENINGS 9

Design of permanent joints - Welded joints - comparison of welded and riveted joints - types of welded joints - transverse and parallel strength of fillet welds - design of butt joints - Rivets and riveted joints - failure modes of riveted joints - design of non-permanent joints - threaded fasteners - stresses in screwed fastening due to static loading.

UNIT III DESIGN OF POWER TRANSMISSION SYSTEM 9

Belt drives - flat belts - Euler's formula - V-belt design - power calculation and selection - chain drive - components - design. Bearings - rolling contact bearings - types of bearings - principles behind selection of bearings. Flywheel - fluctuation of speed and energy - energy stored in fly wheel. Springs - types of springs - properties of spring material - terminology - design of helical springs. Clutches - types - friction material - design of single plate clutch. Brakes - energy absorbed - Design of single block brake and simple band brake.

UNIT IV DESIGN OF SHAFTS AND COUPLINGS 9

Keys and couplings - Design of keys - keyways and splines strength of sunk keys-Shaft couplings - design of sleeve coupling and flange coupling. Design of bolts and nuts - cotter and knuckle joints - Design of solid and hallow shafts based on strength and rigidity - shafts subjected to torsion, bending and combined stresses. Power screws - design of screw jack.

UNIT V DESIGN OF ENERGY STORING ELEMENTS, GEARS & BEARINGS 9

Design of helical, leaf, disc and torsional springs under constant loads and varying loads -Concentric torsion springs. Gears - spur gear and helical gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation. - Failure of gear teeth. Design of bearings - sliding contact and rolling contact types. - Cubic mean load - Design of journal bearings - Mckees equation - Lubrication in journal bearings - calculation of bearing dimensions.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain knowledge on fundamentals of machine design in various aspects.
- Furnish the details on design of fastenings.
- Design power Transmission systems and its components
- Design couplings and shafts for various equipments.
- Have knowledge on design of energy storing elements, gears and bearings.

TEXTBOOKS

1. Khurmi R.S and Gupta J.K, A Textbook of Machine Design, Euarsia publication house,2005.

2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.

REFERENCES

1. Norton R.L, Machine Design - An Integrated Approach, Pearson Publications, 3rd Edition,2006.

2. Srivastava A.K., Goering.C.E. andRohrbach R.P. Engineering Principles of AgriculturalMachines. Revised Printing by American Society of Agricultural Engineers. 1993.

3. Gary Krutz, Lester Thompson and Paul Clear., "Design of Agricultural Machinery", John Wiley and Sons, New York, 1984.

CO/PO Mapping

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	-	3	2	3	-	-	-	-	-	-	2	-	3
CO3	-	-	3	2	3	-	-	-	-	-	-	-	-	3
CO4	-	-	3	2	3	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-

AI15606 BIOMASS ENERGY CONVERSION LABORATORY 0 0 2 1

COURSE OBJECTIVES

- To introduce and explain the biomass characterization and design of Biogas plant.
- To enhance the knowledge on purification and effective utilization of Biogas
- To acquire knowledge on estimation of manurial value of digested slurry of biogas plant and briquilitingtechniques.
- To furnish the detail note on various gasifiers performance evaluation and pyrolysis process.
- To understand the testing procedures of solar appliances.

LIST OF EXPERIMENTS

1. Characterisation of biomass
2. Design of KVIC model / Deenbandhu model of biogas plant
3. Purification of biogas - CO2 and H2S removal
4. Study on biogas appliances and utilization of biogas for engine running.
5. Estimation of manurial value of biodigested slurry
6. Study on briquetting and Stoichiometric calculations
7. Performance evaluation of agro residue gasifier
8. Study on pyrolysis plant
9. Testing of solar water heater
10. Testing of solar drier and lantern

TOTAL PERIODS 30

COURSE OUTCOMES

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

- Understand the biomass characterization and design of Biogas plant
- Have knowledge on purification and effective utilization of Biogas
- Estimate manurial value of digested slurry of biogas plant and briquiliting techniques.
- Evaluate various gasifiers performance and pyrolysis process.
- Know the testing procedures of solar appliances.

REFERENCES

1. Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata McGraw Hill Pub. Co.Ltd., New Delhi.
2. Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. Technology and application of biogas, Jain Brothers, New Delhi.
3. Mathur, A.N.and Rathore,N.S.1993.,Biogas production Management and Utilisation. Himanshu Publication. New Delhi.
4. Chakraverty, A. 1993. Biotechnology and other alternate technologies for utilisation of biomass. Oxford and IBH Publishing Co., New Delhi
5. Rao. S and B.B. Parulekar. 2000. Energy Technology - Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	3	2
CO4	3	2	-	3	-	-	-	-	-	-	-	-	3	2
CO5	-	-	-	-	3	-	-	-	-	-	-	3	-	3

AI15607 INDUSTRIAL TRAINING (Minimum 2 Weeks during V semester break) 0 0 2 1

COURSE OBJECTIVES

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

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

TOTAL PERIDS:30

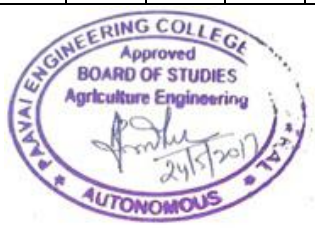
COURSE OUTCOME

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

- gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.
- capability to acquire and apply fundamental principles of engineering.
- become master in one's specialized technology.
- become updated with all the latest changes in technological world

CO/PO Mapping:

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	3	-	3	-	-	-	-	-	-	1	-	3	3
CO2	1	1	-	2	-	-	3	3	-	-	-	3	2	1
CO3	2	2	-	-	-	-	2	2	-	-	2	2	-	2
CO4	2	2	-	-	-	-	2	-	-	-	3	-	2	2



AI15151 ENERGY MANAGEMENT IN AGRICULTURE 3 0 0 3

COURSE OBJECTIVES

- To acquaint about the Energy resources on the farm.
- To equip with energy analysis and assessment techniques.
- To expose the methods of energy conservation and planning.
- To study about the energy management in agricultural production system.
- To understand the concept of energy audit.

UNIT I ENERGY RESOURCES IN THE FARM 9

Energy resources on the farm: conventional and non-conventional forms of energy and their use. Heat equivalents and energy coefficients for different agricultural inputs and products. Pattern of energy consumption and their constraints in production of agriculture. Direct and indirect energy.

UNIT II ENERGY ANALYSIS AND ASSESSMENT 9

Identification of energy efficient machinery systems, energy losses and their management. Energy analysis techniques and methods: energy balance, output and input ratio, resource utilization, Assessment of Impact on land, water, air, social & cultural activities and on flora & fauna - Mathematical models - Public participation .

UNIT III ENERGY CONSERVATION AND PLANNING 9

Energy conservation planning and practices. Energy forecasting, Energy economics, Energy pricing and incentives for energy conservation, factors affecting energy economics. Energy modeling.

UNIT IV ENERGY MANAGEMENT 9

Energy management approach - understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

UNIT V ENERGY AUDIT AND CASE STUDIES 9

Definition, Energy audit- need, Types of energy audit - pre and detailed, Identification of Energy Conservation Opportunities - Classification and evaluation of Energy Conservation Measures. Reporting Format - Description of production process and Energy and utility system and their energy efficiency. Case studies – example of fuel substitution (Gas with Diesel in oil engine)

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain acquaintanceabout the various Energy resources available on the farm.
- Identify energy analysis and assessment techniques.
- Implement the energy conservation and planning methods for effective utilization.
- Apply the energy management techniques in agricultural production system to optimize the performance.
- Gain sufficient knowledge about the concept of energy audit and economics.

TEXTBOOKS

1. Y. P. Abbi, Shashank Jain, 2006. Handbook on Energy Audit and Environment Management. The Energy and Resources Institute (TERI), Business & Economics - 302 pages
2. Wayne C. Turner, 2001. Energy management handbook, John Wiley and Sons
3. Barun Kumar De. 2015. Energy Management, Audit and Conservation (Kindle eBook)

REFERENCES

1. Paul, O. Callaghan, Energy management, Mcgraw Hill, New Delhi
2. Mashburn, William H., Managing Energy Resources in Times of Dynamic Change, Fairmont Press, 1992
3. Brown, R.J. and R.R. Yanuck, 1980, Life Cycle Costing: A Practical Guide for Energy Managers, The Fairmont Press, Inc., Atlanta, GA.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	2	-	-	-	3	-	-	-	-	-	-	3
CO4	-	-	3	-	-	-	3	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	3	-	3	-

AI15152 CLIMATE CHANGE AND ADAPTATION 3 0 0 3

COURSE OBJECTIVES

- To know the basics, importance of global warming and climate change.
- To understand the characteristics of atmosphere and it components.
- To study the Impacts of Climate Change on various sectors.
- To expose the observed climate changes and its causes.
- To know the concept of adaptation and mitigation measures against climate change.

UNIT I EARTH'S CLIMATE SYSTEM 9

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

UNIT II ATMOSPHERE AND ITS COMPONENTS 9

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

UNIT III IMPACTS OF CLIMATE CHANGE 9

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

UNIT IV OBSERVED CHANGES AND ITS CAUSES 9

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

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES 9

Clean Development Mechanism - Carbon Trading- examples of future Clean Technology - Biodiesel - Natural Compost - Eco-Friendly Plastic - Alternate Energy - Hydrogen - Bio-fuels - Solar Energy - Wind - Hydroelectric Power - Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices - Energy Supply - Transport - Buildings - Industry - Agriculture - Forestry - Carbon sequestration - Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste) - International and Regional cooperation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand the importance of global warming and climate change.
- Know the characteristics of atmosphere and it components.
- Gain sufficient knowledge about the Impacts of Climate Change on various sectors.
- Get exposure on the observed climate changes and its causes.
- Learn about mitigation and adaptation measures (including vulnerability assessments) in different Sectors

TEXTBOOKS

1. Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

REFERENCES

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

CO/PO Mapping

***CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -**														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	2	-	-	-	-	1	-	-	-	-	3	-
CO4	3	-	2	-	-	-	-	-	1	-	-	-	3	-
CO5	-	3	3	-	-	3	-	-	-	-	-	-	-	3

AI15153 PROFESSIONAL ETHICS IN AGRICULTURE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To create an exposure on Human Values.
- To equip with Engineering Ethics and its related theories.
- To instill Moral and social responsibility of engineers.
- To give awareness about safety, responsibilities and rights.
- To know the global issues related to ethical values.

UNIT I HUMAN VALUES 10

Morals, values and Ethics - Integrity - Work ethic - Service learning - Civic virtue - Respect for others - Living peacefully - Caring - Sharing - Honesty - Courage - Valuing time - Cooperation - Commitment - Empathy - Self confidence - Character - Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of Engineering Ethics - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral Autonomy – Kohlberg's theory – Gilligan's theory - Consensus and Controversy - Models of professional roles - Theories about right action - Self-interest - Customs and Religion - Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES 8

Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Code of Conduct - Corporate Social Responsibility

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain exposure on Human Values.
- Apply Ethics theories in the agriculture profession.
- Understand the social responsibility and Loyalty of engineers.
- Realize the need of safety, responsibilities and rights in the society.
- Familiar with global issues related to ethical values.

TEXTBOOKS

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics -Concepts and Cases”, Cengage Learning, 2009
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi,2003
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists andEngineers”, Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for PersonalIntegrity and Social Responsibility” McGraw Hill education, India Pvt. Ltd., New Delhi 2013
6. World Community Service Centre, „ Value Education“, Vethathiri publications, Erode, 2011

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO2	-	2	-	-	-	3	-	3	-	-	-	-	-	3
CO3	3	-	-	-	-	3	3	-	-	-	-	-	-	3
CO4	-	-	1	-	-	3	3	3	-	-	-	-	-	3
CO5	-	-	-	-	-	3	3	3	-	-	-	-	-	3

AI15154 SYSTEM ANALYSIS AND SOFT COMPUTING IN AGRICULTURE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To introduce the application of systems concept to agricultural engineering problems, planning and management.
- To study about linear & dynamic programming related to agricultural engineering.
- To know the simulation techniques foe modeling different problems in the field of agricultural engineering.
- To describe the application of neural networks.
- To understand the basic concept of fuzzy logic and genetic algorithm.

UNIT I SYSTEM CONCEPTS 9

Definition, classification, and characteristics of systems - Scope and steps in systems engineering - Need for systems approach to water resources and irrigation.

UNIT II LINEAR PROGRAMMING & DYNAMIC PROGRAMMING 9

Introduction to operations research - Linear programming, problem formulation, graphical solution, solution by simplex method - Sensitivity analysis - application – Bellman's optimality criteria, problem formulation and solutions - application.

UNITIII SIMULATION 9

Basic principles and concepts - Random variate and random process - Monte Carlo techniques - Model development - Inputs and outputs - Deterministic and stochastic simulation - Irrigation Scheduling - application.

UNIT IV NEURAL NETWORKS 9

Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: networks, Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory - Architecture: model, solution, single layer and multilayer perception model; back propagation learning methods, applications.

UNIT V FUZZY LOGIC AND GENETIC ALGORITHM 9

Basic concepts of fuzzy logic, Fuzzy set theory and operations, Properties of fuzzy sets, Membership functions, interference in fuzzy logic, Fuzzy implications and Fuzzy algorithms, Fuzzy Controller, Industrial applications. Genetic Algorithm (GA) - Basic concepts, working principle, procedures, flow chart, Genetic representations, encoding, Initialization and selection, Genetic operators, Mutation – applications

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain knowledge on system concepts for solving agricultural engineering problems, planning and management.
- Apply linear & dynamic programming techniques in agricultural engineering.
- Implement simulation modeling techniques in the field of agricultural engineering.
- Understand the soft computing platform such as neural networks in agriculture engineering
- Use optimization techniques like FL and GA for problems in agriculture.

TEXT BOOKS

1. Vedula, S., and Majumdar, P.P. Water Resources Systems - Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
2. Gupta, P .K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.
3. S. Rajsekaran& G.A. VijayalakshmiPai, "Neural Networks,Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.

REFERENCES

1. Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi, 1997.
2. Taha, H.A., "Operations Research", McMillan Publication Co., New York, 1995.
3. Hiller, F.S., and Liebermann, G.J., "Operations Research", CBS Publications and Distributions, New Delhi, 1992.
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

CO/PO Mapping

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
Cos	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	3	3	3	3	-	-	-	-	-	-	-	-	3
CO2	-	-	3	-	3	-	-	-	-	-	-	-	-	3
CO3	-	-	3	-	3	-	-	-	-	-	-	-	-	3
CO4	3	-	2	-	3	-	-	-	-	-	-	-	-	2
CO5	-	-	3	-	3	-	-	-	-	-	-	-	-	3