EE16101 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING 3 0 0 3

(COMMON TO MECH / MCT/ AERO / AGRI / IT)

COURSE OBJECTIVES

- To analyze the various AC and DC circuits and find the circuit parameters.
- To introduce the principles of AC &DC fundamentals.
- To familiarize the relationship between Electric and Magnetic circuits.
- To study the basics of electronic devices and its applications.
- To learn various number systems and to realize the logic functions by using various gates.

UNIT I ELECTRICITY AND MAGNETISM 9

Coulomb's law, Flemings law, lenz law–Properties of Magnets, Laws of Magnetism, flux, flux density, Field strength, Permeability, Reluctance, Permeance, Types of Magnetic circuits – Comparison of Magnetic and Electric Circuits. Self and Mutual Inductance – Self and mutually induced emf.

UNIT II DC & AC CIRCUITS FUNDAMENTALS 9

DC: Ohm's Law- Limitations of Ohm's Law, Kirchhoff's' Laws, series– parallel resistive circuits, comparison of series and parallel circuits, Star - Delta Transformation – Problems.

AC Waveforms – RMS and Average value, Form Factor, Peak Factor. Single Phase AC Circuits – RL, RC, RLC series and parallel circuits– Impedance, Power, Power factor, Series and Parallel Resonance - Problems. Introduction to three phase AC circuits.

UNIT III MEASUREMENTS 9

Types of electrical measurement –construction and Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters. Types of errors.

UNIT IV SEMICONDUCTOR DEVICES 9

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

UNIT V DIGITAL ELECTRONICS 9

Binary Number System - Logic Gates - Boolean Algebra - Half and Full Adders - Flip-Flops - Registers and Counters - A/D and D/A Conversion.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- get the basic knowledge about the AC &DC Electric circuits.
- understand the basic quantities in measurements
- apply concepts and theories of electrostatics
- understand the concept of Semiconductor Devices and Applications
- acquire the knowledge of various types of digital electronics technique.

TEXT BOOKS

1. Muthusubramanian,R, Salivahanan,S and Muraleedharan,K.A, “Basic Electrical, Electronics and Computer Engineering” ,Tata McGraw Hill, Second Edition, 2006.
2. J.B. Gupta, “A Textbook of Basic Electrical and Electronics Engineering”, S.K. Kataria& Sons; Reprint 2013 edition ,2013.
3. M. Morris Mano, “Digital Logic and Computer Design”, Prentice Hall of India, 2002.

REFERENCES

1. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering”, Oxford press , 2005.
2. Rohit Mehta & V K Mehta, "Principles of Electronics”, S.Chand& Company Ltd, 2012.
3. MahmoodNahvi and Joseph A. Edminister, "Electric Circuits”, Schaum’ Outline Series, McGraw Hill, (2002).
4. Premkumar N, "Basic Electrical Engineering”, Anuradha Publishers, 2003
5. S.Salivahanan, “Electronic Devices and Circuits”, Tata McGraw Hill, 2008.

WEB LINKS

1. www.rejinpaul.com/.../ge6251-basic-electrical-and-electronics-engineeri...

2.www.faadooengineers.com/.../448-Basic-Electrical-Engineerin...

zebu.uoregon.edu/~rayfrey/432/DigitalNotes.pdf

CO-PO MAPPING

Mapping of Course Outcome (CO’s) with Programme Outcomes (PO’s) and Programme Specific Outcomes PSO’s (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO’s	PO’s												PSO’s	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	3	1	2
CO2	3	3	3	3	-	-	-	-	-	-	-	3	1	2
CO3	3	3	3	3	-	-	-	-	-	-	3	3	1	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	1	2
CO5	3	3	3	3	-	3	-	-	-	-	-	3	1	2

CH16202 **AGRICULTURAL CHEMISTRY** **2 0 2 3**

COURSE OBJECTIVES

To enable the students to

- know the basic aspects of soil .
- understand the chemical properties of soil.
- evaluate the nutrients in the soil.
- analyse the role of fertilizers in the soil.
- interpret information on pesticides and fungicides resistance and itsmanagement.

UNIT I ROCK AND SOIL **6**

Rocks and minerals-Weathering- Factors affecting weathering- Origin and process of soil formation-constituent of soil (phase, structure and texture)-physical and chemical properties acid, alkali and saline soils- soil reactions- soil nutrients- diagnosis –remediation of acid and salt affected soils –methods of reclamation and after care.

UNIT II CHEMISTRY ASPECTS OF SOIL **6**

Soil fertility- Decomposition on soil fertility-soil testing –concept, objectives and basis –soil sampling, tools, collection processing, and dispatch of soil samples –soil organic matter –its decomposition of soluble and insoluble substances -effect on soil fertility- role of organic matter.

UNIT III PLANT NUTRIENTS **6**

Plant nutrients –macro and micro nutrients –their role in plant growth –sources -factors affecting nutrient absorption -deficiency symptoms in plants –corrective measures –chemicals used for correcting nutritional deficiencies –nutrient requirement of crops –their availability fixation and release of nutrients.

UNIT IV FERTILIZERS **6**

Fertilizers –classification of fertilizers(mode of operation and elements) –sources -natural and synthetic organic –-straight –complex –liquid fertilizers, their properties, preparation, uses and relative efficiency secondary and micronutrient fertilizers–mixed fertilizers-integrated nutrient management-Fertilizer recommendation for different soils and crops.

UNIT V PESTICIDES AND FUNGICIDES **6**

Pesticides : definition –Classification –organic and inorganic pesticides –mechanism of action – characteristics safe handling of pesticides –impact of pesticides on soil, plants and environment. Fungicides : Definition –Classification –mechanism of action –sulphur, mercury compounds, dithanes, dithiocarbamate.

TOTAL PERIODS: 30

LIST OF EXPERIMENTS

1. Determination of soil moisture and pH by direct method.
2. Determination of Soil organic carbon by digestion method.

3. Estimation of Phosphorus content in fertilizers by spectrophotometer method.
4. Estimation of iron content of the given solution using potentiometer.
5. Estimation of calcium in soil by EDTA method.

TOTAL PERIODS: 30

COURSE OUTCOMES

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

- aware of importance of soils for environment, economy and society.
- carry out measurements of some soil chemical properties and interpret their results.
- know soil functions and factors determining soil fertility and productivity.
- classify the fertilizers, properties and its uses.
- know the impact of pesticides and fungicides on soil, plants and environment.

TEXT BOOKS

1. Margarita Stoytcheva and RoumenZlatev, "Agricultural Chemistry", Intech Publications, 2016.
2. G .Nagaraj,"Agricultural Plant Biochemistry ", New India Publishing Agency, 2018.

REFERENCE BOOKS

1. Marcelo L. Larramendy, Sonia Soloneski, "Pesticides: Toxic Aspects", InTech Publications ,2016.
2. Michael E. Essington."Soil and Water Chemistry: An Integrative Approach", Second Edition, CRC Press 2017.
3. Roland NuhuIssaka, "Soil Fertility ", InTech publications, 2015.
4. DejeneAyeleTessema, "Environmental Chemistry", African Virtual University, 2016.
5. Hartmann, Monika / Hesse, W. Joachim, "Agriculture and Food in the 21st Century", Peter Lang International Academic Publishers, Newyork, 2016.

6.

Mapping of Course Outcomes with Programme Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programmes Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	1	3	-	2	-	-	1	-	-
CO2	-	2	2	-	-	1	-	-	-	2	-	2	-	-
CO3	2	-	2	-	2	1	-	-	-	1	-	2	-	-
CO4	2	-	2	-	2	1	3	-	-	2	-	-	-	-
CO5	-	-	-	-	-	1	3	-	2	3	-	-	-	-

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

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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

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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

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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

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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

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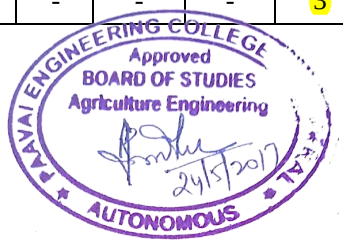
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	-	-	-	2	-	-	-	-	-	-	3	3	-
CO4	3	-	-	-	2	-	-	-	-	-	-	3	3	3
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

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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

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.

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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.

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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.

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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.

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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.

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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

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COs	**Programmes Outcomes(POs)**													
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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

AI16501 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 - scope & importance; 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; Irrigation Scheduling - Irrigation Requirement, Irrigation Frequency and Irrigation Efficiencies.

UNIT II METHODS OF IRRIGATION 12

Methods of Irrigation - Surface, Subsurface and Pressurised methods; Surface Methods - Border irrigation - (Hydraulics and Design) - Furrow Irrigation (Hydraulics and design) - Erodible and non-erodible channels - Materials for lining watercourses and field channel; Designing Drip and Sprinkler systems; Subsurface - designing underground pipeline irrigation system.

UNIT III DIVERSION AND CONTROL STRUCTURES 9

Water control structures - Head works; Diversion structure - spillways - sluices - Weirs; Impounding structures - Barrage; Dams - location of dams - Forces on a dam - Design of Gravity dams - Earth dams, Arch dams - Energy dissipaters.

UNIT IV CANAL, TANK IRRIGATION AND COMMAND AREA DEVELOPMENT 9

Canals - classification - alignment - Design of irrigation canals; Canal flow - Regime theories - Kennedy's and Lacey's theory; Canal head regulators - Canal drops - Cross drainage works - Lining and maintenance of canals; Tanks - system and non-system tanks - rehabilitation; Command area - Concept, Components of CADP; On Farm Development works - Farmer's committee - water distribution and system operation - rotational irrigation system.

UNIT V SPECIAL IRRIGATION SYSTEM 6

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

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, the students 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.

TEXT BOOKS

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

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CO1	2	-	-	2	-	2	-	-	1	2	-	-	1	2
CO2	1	2	2	2	2	-	-	1	-	-	2	1	1	3
CO3	2	2	3	2	1	-	2	-	1	-	3	-	-	2
CO4	2	2	-	2	-	3	-	3	3	3	-	1	1	2
CO5	2	1	2	2	3	-	2	1	-	-	2	-	2	3

AI16502 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 gain knowledge on machine dynamics and hitching.
- To study the working principles of tillage equipments.
- 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 FARM MECHANIZATION, TRACTOR AND POWER TILLER 9

Farm mechanization - objectives - scope and importance; Tractors - Selection and Classification - identification of major systems - components and their uses; 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 MACHINE DYNAMICS AND HITCHING 9

Dynamic soil properties affecting soil tool interaction; Force analysis of tillage tools and their measurement; Types of dynamometer - spring hydraulic, eddy current and strain gauge types; Hitching - horizontal - vertical and three point - adjustments; Yokes and harness for draught animals and mechanics of hitching.

UNIT III TILLAGE EQUIPMENTS 9

Primary Tillage Equipment - Mould board plough - animal and power operated, types and construction, working principles - accessories - forces acting on mould board bottom; Disc ploughs - types and construction, soil reaction, side thrust and draft; Secondary Tillage Equipment - cultivator - disc harrow - types and construction - Selection; Special tillage implements - Rotavators - five-bottom ploughs - sub-soiler - paddy puddler.

UNIT IV EQUIPMENTS FOR CULTURAL OPERATIONS 9

Sowing / seeding, planting and fertilizer application equipment - construction and working principles - Seed and fertilizer metering devices - furrow openers and covering devices - Calibration - field adjustment and operations - Paddy planters; Intercultural Equipment - Cultivators - rotary hoes - sweeps and shovels - types and uses; 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 HARVESTING & 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
- Gain sufficient knowledge on machine dynamics.
- Have knowledge on different types of tillage equipments.
- Get an idea about the mechanization for different crops.
- Analyse and estimate the performance and cost of equipments.

TEXT BOOKS

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

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.

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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

COURSE OBJECTIVES

- To expose fundamental knowledge in post harvesting technologies of agricultural produces.
- To understand the importance of drying process in agriculture produces.
- To impart knowledge in cleaning and grading of 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; Grain dryers - selection - design - construction - operation and maintenance.

UNIT III CLEANING AND GRADING 9

Cleaning - Principles - air screen cleaners - adjustments; Separators - cylinder - spiral - magnetic - colour sorter - inclined belt - disk - effectiveness of separation and performance index.

UNIT IV MATERIAL HANDLING 9

Material handling equipments - belt conveyor - screw conveyor - chain conveyor - bucket elevators - pneumatic conveyor - 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.

TEXT BOOKS

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.

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CO1	2	-	-	2	-	2	-	-	1	2	-	-	1	2
CO2	1	2	2	2	2	-	-	1	-	-	2	1	1	3
CO3	2	2	3	2	1	-	2	-	1	-	3	-	-	2
CO4	2	2	-	2	-	3	-	3	3	3	-	1	1	2
CO5	2	1	2	2	3	-	2	1	-	-	2	-	2	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 11

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 – (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; 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 8

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 in 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 landslide; 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 information technology on human population and environment protection.

TEXT BOOKS

1. AnubhaKaushik and C.P. Kaushik. "Environmental Science and Engineering", Fourth Edition, New Age International Publishers, New Delhi,2014.
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

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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

AI16505 SOIL AND WATER CONSERVATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To get a sound knowledge in the problems associated with soil erosion.
- To introduce the estimation of soil erosion.
- To impart knowledge in various practices to control erosion.
- To study about the water conservation principles and techniques.
- To get an idea about sedimentation and its control measures.

UNIT I SOIL EROSION PRINCIPLES 9

Erosion - Agents - factors affecting erosion - erosion problems; Water erosion - Types and mechanics of water erosion - Raindrop erosion - Sheet erosion - Rill erosion - Gully erosion & classification - Stream bank erosion; Wind erosion - types and mechanics; Landslides.

UNIT II ESTIMATION OF SOIL EROSION 7

Universal Soil Loss Equation - estimation by standard plots – Evaluation - Applications and Limitations - Modified Universal Soil Loss Equation; Permissible erosion - Land use capability classification - Classification of eroded soils.

UNIT III EROSION CONTROL MEASURES 11

Soil management practices - Agronomic practices - contour cultivation - strip cropping - tillage practices; Mechanical measures for plains - contour and graded Bunding - Types and design specifications; Mechanical measures for hill slopes - Terracing - Classification and design specification of bench terrace - contour stone wall - gabbions; Grassed waterways - Location - design, construction and maintenance; Types of temporary and permanent gully control structures; Wind control measures - wind breaks and shelter belts.

UNIT IV WATER CONSERVATION MEASURES 9

In-situ soil moisture conservation; Roof top water conservation; Water harvesting principles and techniques - Micro & Macro catchments - yield estimation using morphometric analysis; Water storage structures - percolation ponds - Farm ponds - Components - Design - Construction and Protection; Check dams - Earthen dam - Retaining wall.

UNIT V SEDIMENTATION 9

Sedimentation - Sources - Types of sediment load - Estimation of bed load; Mechanics of sediment transport Sediment Graph - Factors affecting sediment distribution pattern - Silt Detention Tanks; Reservoir sedimentation and estimation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Have knowledge on various types of soil erosion.
- Estimate the quantity of soil erosion.
- Adopt various erosion control measures.
- Implement water conservation principles and techniques.
- Familiar with sedimentation control techniques.

TEXT BOOKS

1. Suresh, R., "Soil and Water Conservation Engineering", Standard Publication, New Delhi, 2007.
2. Ghanshyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.
3. "Sedimentation Engineering", ASCE manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing, 2006.

REFERENCES

1. Murthy, V.V.N., "Land and Water Management Engineering", Kalyani Publishers, Ludhiana, 1998.
2. Gurmail Singh, "A Manual on Soil and Water Conservation", ICAR Publication, New Delhi, 1982.
3. Mal, B.C., "Introduction to Soil and Water Conservation Engineering", Kalyani Publishers, New Delhi, 2002.

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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

ME16509 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 lines - 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 in agriculture.

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.

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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

AI16506 **DRAWING OF FARM STRUCTURES** **0 0 4 2**

COURSE OBJECTIVES

- To conceive and design various farm structures related to agricultural engineering.
- To plan and draw layout for farm structures.
- To enhance the knowledge in design of various farm systems.
- To understand the layouts and design of sanitary and storage structures.

LIST OF EXERCISES

1. Planning and Layout of farmstead
2. Design of loose housing and milk parlours
3. Design of stanchion barn
4. Design of poultry house - Deep litter system
5. Design of poultry house - Cage system
6. Design of a sheep / goat house
7. Design of hog house
8. Design of ventilation system for dairy and poultry house
9. Design of silos - over ground and underground and hay storages
10. Design of farm fencing system
11. Design of farm trusses
12. Design of machinery and equipment shed and workshops
13. Design of septic tank and sanitary structures
14. Design of rural/farm roads and culverts.
15. Design of biogas plant.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- Design various farm structures related to agricultural engineering.
- Plan and layout the various farm structures.
- Draw machinery, equipment shed and workshops.
- Draft biogas plant and storage structures.

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	1	-	2	-	-	-	1	-	-	-	2	-	2	-
CO2	2	2	3	1	-	-	-	-	-	-	2	1	1	2
CO3	2	1	2	1	1	-	2	-	-	-	1	1	1	1
CO4	2	1	2	3	1	-	2	-	-	-	-	-	-	2

AI16507 SOIL MECHANICS AND WATER QUALITY LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To assess physical and engineering behaviour 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.

LIST OF EXERCISES

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

TOTAL PERIODS 60

COURSE OUTCOMES

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

- Know the techniques to determine engineering properties of soil by conducting tests.
- Gain knowledge on application of various field testing methods.
- Identify and classify the soil samples by sieve analysis.
- Get an idea about testing methods of various parameters of irrigation water.

CO/PO Mapping

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

AI16508 INDUSTRIAL TRAINING (Two weeks during V semester break) 0 0 2 1

COURSE OBJECTIVE

- to have a first hand knowledge and practical problems in Agricultural Engineering.
- experience and understand real life situations in industrial organizations and their related environments
- develop skills in work ethics, communication, management and others
- to gain the knowledge through hands on observation and job execution

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.

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

TOTAL PERIODS 30

CO/PO Mapping :

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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

SEMESTER VI

AI16601 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

Food - properties - 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 and Salwin-Slawson equations.

UNIT II PROCESSING AND PRESERVATION OF FOODS 10

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 - 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

Milk powder - manufacture - processing of milk products - Condensed milk - skim milk - butter milk - flavoured milk; Manufacture of By-products - whey - casein - yoghurt - paneer - butter - cheese - ghee - ice creams - frozen desserts; Standards for milk and milk products - characteristics of A1 and A2 milk; Packaging of milk - 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 - storage and food distribution - food industries; Quarantine requirements.

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.

TEXT BOOKS

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,"Quality Control for Food Industry",CBS Publishers,1996.

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.
5. Charm, S.E., "Fundamentals of Food Engineering", AVI Pub.Co.Inc, New York.
6. Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations", Laxmi Publications, New Delhi, 1999.

CO/PO Mapping

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CO1	-	3	-	3	-	-	3	-	-	-	-	2	-	-
CO2	1	2	-	2	-	2	3	-	2	-	-	2	-	2
CO3	-	3	3	1	1	-	2	1	-	2	3	1	-	1
CO4	-	2	-	2	-	1	3	-	-	-	2	-	2	-
CO5	2	2	3	2	3	-	2	2	2	-	3	-	3	2

AI16602 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 8

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 12

Biogas - production by 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; Bio-ethanol - feedstock - process - utilization; Composting - methods - machinery; Landfills - types and site selection.

UNIT III THERMO-CHEMICAL CONVERSION BY COMBUSTION 8

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

UNIT IV THERMO-CHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS 8

Biomass gasification - chemistry of gasification - types of gasifier - Gas cleaning & conditioning - utilization of producer gas - emissions; Pyrolysis - product recovery - types - bio-char and 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.

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CO1	3	2	1	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	2	3	1	-	-	-	3	-	-	-	2	2	2	2
CO5	2	3	2	3	2	3	3	-	-	-	2	2	3	2

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
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BOARD OF STUDIES
Agriculture Engineering
2/4/2018
AUTONOMOUS

AI16603 GROUNDWATER 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 AND INVESTIGATION 9

Groundwater - scope & importance - development in India - occurrence of groundwater - distribution; Water bearing properties of Rocks - Types of aquifer - confined - unconfined - perched - artesian - aquifuge - aquitard - aquiclude - Movement of groundwater; Geophysical investigation of groundwater - surface methods - Subsurface methods - aquifer mapping - uses - Water Balance.

UNIT II HYDRAULICS OF WELLS 10

Wells - classification - advantages of open well and bore wells - Hydraulics of wells - static water levels - piezometric level; Aquifer characteristics; Pumping tests - selection of well sites; Steady state radial flow - Dupit's equation - Theim's equation - Partially penetrating wells - interference of wells; Unsteady state flow - Theis method - Jacob's method; Recuperation test; Hydraulics of open wells - well losses; Introduction to groundwater models.

UNIT III WELL DRILLING METHODS 9

Construction - dug well - tube wells - sunk wells - well logging - Types of well screen - Design of well screen - Casing - Curb; Well development - yield testing - Sanitary protection; Well drilling Techniques for different formations - rock blasting units - hand boring - Percussion drilling & tools; Pneumatic drilling - down the hole hammer - drill bits - Wagon drills - Jack hammer; Rotary drilling; Yield increase - Augmentation & Recharging techniques.

UNIT IV SURFACE DRAINAGE 8

Agricultural drainage - Concept - Issues; Principles of flow through soils - Darcy's law - drainage coefficient - Infiltration theory; Surface drainage - methods - design - Random drainage - Herringbone - Grid iron types - Design of Open Drains.

UNIT V SUB SURFACE DRAINAGE 9

Subsurface drainage - Concept - Issues - Investigations; Steady State flow - Dupit'sForchimer assumptions - Hooghoudt's equation; Methods & Design - Mole drains - Drainage wells - Pipe materials - Envelope materials; Problem soils - Leaching Requirements; Land reclamation - 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.

TEXT BOOKS

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.

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CO1	3	-	2	3	-	-	2	-	-	-	-	2	2	3
CO2	3	1	-	2	1	-	3	-	-	-	-	2	3	2
CO3	3	2	1	1	3	-	2	-	-	-	-	3	2	1
CO4	2	1	1	3	2	-	-	-	-	-	-	2	2	1
CO5	2	1	1	3	2	-	-	-	-	-	-	2	2	1

AI16604 IT IN AGRICULTURAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To acquire acquaintance of IT in precision agriculture.
- To furnish knowledge about environmental control systems in agriculture.
- 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 IT IN PRECISION AGRICULTURE 9

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

UNIT II ENVIRONMENT CONTROL SYSTEMS 9

IT in controlled environment cultivation - Artificial light systems for cropping; Greenhouse management - for irrigation management - for cooling & heating - for simulation of CO_2 consumption - for on-line measurement of plant growth; Models of plant production - expert systems and crop doctors.

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT 9

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

UNIT IV WEATHER PREDICTION MODELS 9

Weather & Climate - Climate variability & climate change - Importance of climate variability; Forecasting - importance in agriculture - medium term & long term (seasonal) forecasting - Forecasting - statistical - dynamical; Climate prediction - understanding world's climate system - Global climatic models - Regional climate models - seasonal climate forecasting - climate projection.

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS 9

Agricultural and biological databases - e-commerce - e-business systems & applications; Technology enhanced learning systems and solutions - e-learning; On-line and Off- line information for the society.

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXT BOOKS

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

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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	2	2
CO2	3	3	2	-	-	-	-	-	-	-	2	2	2	1
CO3	3	-	-	-	-	-	-	-	-	-	1	2	2	1
CO4	2	-	-	-	2	1	-	-	1	-	2	3	2	3
CO5	3	2	2	-	1	-	-	-	1	-	-	2	2	1

AI16605 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 joints and gears.
- To design couplings and shafts for various equipments.
- To understand the underlying design of energy storing elements and bearings.
- To gain acquaintance on design of Power Transmission systems and its components.

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

UNIT I FUNDAMENTALS OF FARM MACHINE DESIGN 15

General considerations in farm machine design; Strength properties of engineering materials; Limits, tolerances and 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 - Rankine's theory, Guest theory, Saint Venant's theory and Von Mises theory; Stresses in thin cylindrical shells.

UNIT II DESIGN OF JOINTS AND GEARS 15

Joints - permanent joints - Welded joints - types of welded joints; Design of joints for farm machinery - transverse and parallel strength of fillet welds - butt joints; Rivets and riveted joints - comparison of welded and riveted joints - failure modes of riveted joints; Cotter and knuckle joints; Gears - spur gear, helical gear and spiral gear - terminology - strength of gear teeth - Lewis equation - Buckingham equation - failure of gear teeth - design of gears for farm machinery.

UNIT III DESIGN OF SHAFTS AND COUPLINGS 15

Farm machinery 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; Design of solid and hallow shafts based on strength and rigidity - shafts subjected to torsion, bending and combined stresses.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS & BEARINGS 15

Springs - Helical, leaf, disc and torsional springs under constant loads and varying loads - Concentric torsion springs - Design for farm machinery; Bearings - sliding contact and rolling contact types - principles behind selection of bearings; Design of journal bearings - Cubic mean load - Mckees equation - Lubrication in journal bearings - calculation of bearing dimensions.

UNIT V DESIGN OF POWER TRANSMISSION SYSTEM 15

Belt drives for farm machinery - flat belts - Euler's formula; V-belt design - power calculation and selection; Chain drive - components and design; Flywheel - fluctuation of speed and energy - energy stored in fly wheel; Clutches - types - friction material - design of clutches; Brakes - energy absorbed - design of single block brake and simple band brake.

TOTAL PERIODS 75

COURSE OUTCOMES

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

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

TEXT BOOKS

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.

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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

AI16606 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 - aeration system in silo; Rat proof godowns and rodent control; Stacking - method of stacking - preventive method; Engineering properties of stored products; Structural and thermal design of structures.

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 - application and advantages; 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 - need for protective packaging - functions of packaging; Effect of environmental factors, mechanical forces and biological factors on food quality and shelf life; Estimating the Shelf life requirement of food products for packaging - direct and indirect method - accelerated storage studies; 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.

UNIT V FILLING SYSTEMS AND LABELLING 9

Packaging - Aseptic - vacuum - cook-in/ship-in - bag-in box system – microwave ovenable and Retortable packages & pouches - types; Filling system - 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.

TEXT BOOKS

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,“Design and Operation of Cold Stores in Developing Countries”, FAO,1984.
2. Multon JL. (Ed), “Preservation and Storage of Grains, Seeds and their By-products”, CBS, 1989.
3. Shejbal J. (Ed), “Controlled Atmosphere Storage of Grains”, Elsevier, 1980.
4. Vijayaraghavan S, “Grain Storage Engineering and Technology”,Batra Book Service, 1993.
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)**													
	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	-	-	-	-	2	-	-
CO2	1	2	-	2	-	2	3	-	2	-	-	2	-	2
CO3	-	3	3	1	1	-	2	1	-	2	3	1	-	1
CO4	-	2	-	2	-	1	3	-	-	-	2	-	2	-
CO5	2	2	3	2	3	-	2	2	2	-	3	-	3	2

AI16902 CLIMATE CHANGE AND ADAPTATION 3 0 0 3

COURSE OBJECTIVES

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

UNIT I ATMOSPHERE COMPONENTS AND GLOBAL PHENOMENA 9

Atmosphere - Importance - Physical and Chemical Characteristics - Vertical structure - Temperature profile - Lapse rates - Temperature inversion and its effects - atmospheric stability; Green House gases - Radiative effects; Ozone layer - role in environment - ozone depleting gases; Global phenomena - Hydrological Cycle - Carbon Cycle - El Nino and Southern Oscillation (ENSO).

UNIT II CLIMATE CHANGE AND CAUSES 9

Climate - classification - Climate change - climate & weather - climate change & variability - natural variability - indicators of climate change - extreme weather events; Causes of climate change - Factors influencing - internal factors - external factors - Anthropogenic causes.

UNIT III OBSERVED AND PROJECTED CHANGES IN CLIMATE 9

Understanding terms - observation - analysis - forecast - predictions - projections; Evidence of observed climate change - temperature (global warming) - green house gases - sea level rise - precipitation; Future projections - Global climate models - Regional climate models - scenarios used (SRES and RCP) for projections - projections for world and India - uncertainties in projection; IPCC - working groups role - assessment reports released; UNFCC - role & initiatives.

UNIT IV IMPACTS OF CLIMATE CHANGE 9

Impacts of Climate Change on various sectors - Agriculture - Forestry - Coastal Ecosystem - Water Resources - Human Health - Industry - Settlement and Society; Crop yield impacts - temperature - precipitation - CO_2 - Assessment of impacts in agriculture - use of crop simulation models.

UNIT V CLIMATE CHANGE ADAPTATION AND MITIGATION 9

Understanding adaptation, mitigation and resilience; Key Mitigation Technologies and Practices - Energy Supply - Transport - Buildings - Industry - Agriculture - Forestry - Carbon sequestration - Carbon capture and storage; Adaptation technologies in agriculture; Resilience - climate change perspective - role of NICRA; National action plan for climate change - eight national missions - implementation; Clean Development Mechanism (CDM) - Kyoto protocol - reduction in emissions - possible clean technologies.

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXT BOOKS

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

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CO1	-	3	-	3	-	-	3	-	-	-	-	2	-	-
CO2	1	2	-	2	-	2	3	-	2	-	-	2	-	2
CO3	-	3	3	1	1	-	2	1	-	2	3	1	-	1
CO4	-	2	-	2	-	1	3	-	-	-	2	-	2	-
CO5	2	2	3	2	3	-	2	2	2	-	3	-	3	2

AI16607	OPERATION AND MAINTENANCE OF FARM MACHINERY LABORATORY	0 0 4 2

COURSE OBJECTIVES

- To practice different operations 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 - its 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 equipments and their adjustments
7. Field operation of planting equipment and their adjustments
8. Field operation of plant protection equipment
9. Field operation of weeders
10. Study of reapers and determination of field losses
11. Demonstration of combined harvester
12. Study of threshers and their performance evaluation
13. Repair - maintenance and off-season storage of farm equipment
14. Hitching of agricultural implements
15. Study on different types of trailers and hitching

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.

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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

AI16608 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 briquiliting techniques.
- To furnish the detail note on various gasifiers and pyrolysis process.
- To understand the different waste heat recovery systems.

LIST OF EXPERIMENTS

1. Characterisation of biomass - proximate and ultimate analysis.
2. Study on briquetting machine and its process.
3. Study of KVIC and Deenbandhu model biogas plant and design problems.
4. Purification of biogas - CO_2 and H_2S removal.
5. Estimation of manurial value of biodigested slurry.
6. Study on biogas appliances and utilization of biogas for engine running & Exposure visit.
7. Study on stoichiometric air calculation.
8. Study on different gasifiers.
9. Study on pyrolysis process.
10. Study on different waste heat recovery systems.

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.
- Understand various gasifiers and pyrolysis process.
- Have knowledge on different waste recovery systems.

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CO1	3	2	1	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	2	3	1	-	-	-	3	-	-	-	2	2	2	2
CO5	2	3	2	3	2	3	3	-	-	-	2	2	3	2

SEMESTER VII

AI15701 SOLAR AND WIND ENERGY ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To expose principles and applications of various renewable energy resources.
- To impart knowledge on applications of solar energy in agriculture.
- To get an idea about the photovoltaic technology.
- To understand the wind mapping analysis.
- To know about design and applications of windmill.

UNIT I INTRODUCTION OF RENEWABLE ENERGY 9

World energy scenario –Energy sources and their availability; Qualitative study of different renewable energy resources – Solar – wind – ocean – Biomass - Fuel cell - Hydrogen energy systems and hybrid renewable energy systems.

UNIT II SOLAR COLLECTORS AND APPLICATION 9

Solar radiation availability – Radiation measurement – collectors – Types - Flat-plate collector - Liquid collector- Air collectors (Solar air heaters) - concentrating collectors - Types – parabolic trough collector – Mirror strip reflector- Fresnel lens collector; Application of solar energy - solar thermal power station - solar furnace - solar greenhouses - Solar stills - solar pond – solar pump – solar drier.

UNIT III PHOTOVOLTAIC TECHNOLOGY 9

Photovoltaic Energy Conversion - solar cells and their characteristics - PV arrays -Electrical storage with batteries - inverter -selection of inverter - battery sizing - array sizing; PV Applications - Standalone inverters - Charge controllers - street lighting; Hybrid system - solar technology in green buildings.

UNIT IV WIND MAPPING ANALYSIS AND CHARACTERISTICS OF WIND 9

Nature of wind - wind structure and measurement - wind power laws - velocity and power duration curves - aerofoil – tip-speed ratio - torque and power characteristics - power coefficients - Betz coefficient.

UNIT V WINDMILL DESIGN AND APPLICATIONS 9

Turbines - Windmill - classification - power curve; Upwind and downwind systems - transmission rotors - pumps - generators - standalone system - grid system – batteries; Wind energy storage - wind farms - wheeling and banking - testing and certification procedures.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand the applications of different alternate energy resources.
- Know about the applications of solar energy in agriculture.
- Get an idea about the photovoltaic technology.
- Analyse the wind mapping.
- Gain sufficient knowledge on design of windmills.

TEXT BOOKS

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

REFERENCES

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

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CO1	3	3	-	1	2	-	2	-	-	-	3	2	2	3
CO2	3	1	-	1	3	-	2	-	1	1	3	1	2	3
CO3	3	2	3	-	-	1	1	-	-	-	1	2	3	1
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO5	3	2	3	-	1	-	-	-	-	-	-	1	1	2

AI15702 PROTECTED CULTIVATION AND PRECISION FARMING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I PROTECTED CULTIVATION AND ITS TYPES 12

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

UNIT II PROTECTED CULTIVATION OF VEGETABLE CROPS 7

Protected cultivation technology for vegetable crops - tomato - capsicum - cucumber - gherkins - strawberry and melons - integrated pest and disease management - post harvest handling.

UNIT III PROTECTED CULTIVATION OF FLOWER CROPS 6

Protected cultivation technology for flower crops - roses - chrysanthemum - carnation - gerbera - anthurium - orchids - foliages and fillers - integrated pest and disease management - post harvest handling.

UNIT IV PRECISION FARMING TECHNIQUES 12

Precision farming - introduction - concept and importance; Tools - Role of GIS and GPS - Un Manned Aerial Vehicle (UMAV) - Mobile mapping system and its application in precision farming; Design - layout and installation of drip and fertigation; Site specific management (SSM) - geo-referencing and photometric correction; Sensors - information gathering and application; Crop simulation models - role in precision farming.

UNIT V PRECISION FARMING OF CROPS 8

Precision farming technology- cotton - sugar cane - banana - turmeric - tomato - chillies - brinjal - bitter gourd - bottle gourd - cauliflower - cabbage - rose - chrysanthemum - tuberose.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand different types of protected cultivation system.
- Know protected cultivation techniques used in vegetable crops.
- Gain sufficient knowledge on protected cultivation of flower crops.
- Familiar with precision farming techniques.
- Apply precision farming technology in various crops.

TEXT BOOKS

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

REFERENCES

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

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CO1	1	-	-	-	-	-	2	1	3	2	3	1	3	-
CO2	-	3	3	-	2	-	-	1	2	-	-	1	-	3
CO3	-	-	-	3	-	2	-	-	2	-	3	-	-	1
CO4	2	3	-	3	-	2	1	1	1	1	2	-	3	2
CO5	-	1	-	-	-	1	-	-	-	-	1	-	-	1

AI15703 AGRICULTURAL ECONOMICS AND EXTENSION 3 0 0 3

COURSE OBJECTIVES

- To impart the fundamental knowledge of Economics, types of resources and Investment analysis.
- To analyse cost requirements
- To get an idea about management of resources
- To expose the different extension methods for communication to take the work from lab to field.
- To introduce the capacity building techniques.

UNIT I LAWS OF ECONOMICS 9

Agricultural Economics - definition and scope; Basic laws of economics - demand and supply concepts - law of increasing, diminishing and constant returns - Equi-marginal returns; Factor-Product relationship - Production function - definition and types - Optimum level of input and optimum level of output; Scale of Economies - external and internal economies and diseconomies; Cost concepts - types - opportunity cost - comparison of costs - cost curves

UNIT II PRODUCT RELATIONSHIP 9

Factor-factor relationship & concepts - principle of substitution - isoquant, isocline, expansion path, ridge line and least cost combination of inputs; Product-product relationship - Production possibility curve, Iso-revenue line and optimum combination of outputs; Estimation of cost of cultivation and production of crops - annual and perennial crops; Preparation of interview schedule and farm visit for data collection.

UNIT III MANAGEMENT OF RESOURCES AND FINANCIAL ANALYSIS 9

Risk and uncertainty – concept - causes for uncertainty - managerial decisions to reduce risks in production process; Management of resources - types of resources - land, labour, capital and measurement of their efficiencies; Mobilization of farm resources - Cost of machinery and maintenance - Break even analysis - Farm Investment analysis – Time comparison principles - Compounding &Discounting techniques; Farm financial analysis - Balance sheet - Income statement - Cash flow analysis; Farm planning - Elements of farm planning - Farm level management system; Farm budgeting - whole farm budgeting and partial budgeting - examples of farm planning and budgeting.

UNIT IV EXTENSION CONCEPT AND TEACHING METHODS 9

Extension – definition and meaning – Education - Types of Education – Difference between Formal and Extension Education - Function and scope of Extension - Principles of Extension - Steps in Extension Teaching; Communication - Basic functions of Communication - Models of Communication - Barriers of Communication; Extension teaching methods - Audio-Visual aids - definition - classification - purpose, planning and selection, combination and use - individual, group and mass contact methods - merits and demerits; Modern communication methods - internet, video and teleconferencing - Interactive Multimedia Compact Disk (IMCD) - Village kiosks - Kisan Call Centre (KCC) - mobile phone applications.

UNIT V DIFFUSION, ADOPTION AND CAPACITY BUILDING 9

Diffusion - meaning and elements; Adoption - meaning - adopter categories and factors influencing adoption - stages of adoption - Innovation - decision process - Innovation decision period - Rate of adoption - Over adoption - attributes of innovation - consequences of Innovation; Capacity building of extension personnel and

farmers - meaning - definition - types of training - training to farmers - farm women and rural youth - FTC & KVK.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand basics of agricultural economics.
- Plan the financial aspects in a cost effective manner.
- Know the different farm management techniques.
- Familiar with various extension methods, communication gadgets
- Get trained in capacity building techniques.

TEXT BOOKS

1. Johl, S.S., and Kapur, T.R., "Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007.
2. Subba Reddy, S., Raghu Ram, P., NeelakantaSastry T.V and Bhavani Devi, I., "Agricultural Economics" Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.
3. Ray, G.L., "Extension Communication and Management", NayaProkash, 206, BidhanSarani, Calcutta, 1999.
4. Sandhu, A.S., "Extension Programme Planning", Oxford & IBH Publishing Co. pvt. Ltd, New Delhi,1996.

REFERENCES

1. Subba Reddy, S., and Raghu Ram, P. "Agricultural Finance and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
2. Muniraj, R., "Farm Finance for Development", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.
3. Rogers, E.M,"Diffusion of Innovations", The Free Press, New York,1995.
4. Sandhu, A.S., "Agricultural Communication: Process and Methods", Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi,1996.

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CO2	3	1	-	1	3	-	2	-	1	1	3	1	2	3
CO3	3	2	3	-	-	1	1	-	-	-	1	2	3	1
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO5	3	2	3	-	1	-	-	-	-	-	-	1	1	2

AI15704 REMOTE SENSING AND GIS APPLICATION 3 0 0 3

COURSE OBJECTIVES

- To introduce the principles of Remote Sensing
- To know about the image interpretation techniques.
- To understand the basic concepts of GIS and GNSS.
- To get an idea about analysis techniques in RS & GIS
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources

UNIT I CONCEPTS OF REMOTE SENSING AND SATELLITES 9

Remote sensing – Definition - importance - Historical background; Components of remote sensing - Energy source, electromagnetic spectrum, radiation principle, platforms and sensors; Active and passive remote sensing - Atmospheric effects on remote sensing - Energy interaction with earth surface feature; Data acquisition - Reflectance, spectral signatures for water, soil and vegetation; Sensors – active and passive; Sensor resolution - spectral, spatial, radiometric and temporal resolution; Satellite orbits - Sun synchronous and Geo synchronous; Remote sensing satellites - LANDSAT, SPOT & IRS - Recent satellites with its applications

UNIT II DATA PRODUCTS AND IMAGE PROCESSING 9

Satellite Data products - based on level of processing - area/coverage - data availability - data ordering - data price; Digital image – concepts and satellite data format; Image interpretation - Visual interpretation elements - interpretation key; Digital image processing - Preprocessing - Radiometric and Geometric corrections, Image enhancement techniques, image classification - Supervised and unsupervised classification, Accuracy assessment - Vegetation Indices and its uses.

UNIT III CONCEPTS OF GIS AND GNSS 9

GIS Definition – Components and functions of GIS; History and development of GIS Map and their characteristics – Map projections, Coordinate systems – Geographic and projected co-ordinate systems; Map components - map element and map scale; Sources of spatial data – spatial data quality; Global Navigation Satellite System (GNSS) – Global Positioning System (GPS) - concepts, segments and working principle - GPS errors and Survey techniques.

UNIT IV DATA INPUT AND ANALYSIS 9

Data - Spatial, Non-Spatial; Data models - Raster and Vector data; Methods of Data input - Data Editing - Files and formats; Raster data analysis – Local, neighborhood and regional operations - map algebra; Vector data analysis – Buffering and overlay operations - topological analysis; GIS analysis - Measurements - Queries - Reclassification - Simple spatial analysis - Spatial interpolation - Network analysis; Modeling in GIS - Digital Elevation Modeling - Expert systems.

UNIT V APPLICATIONS 9

Soil survey and mapping - Land degradation mapping - modeling soil erosion; Land use / land cover mapping; Crop acreage estimation and yield forecasting; Crop Water Requirement - SWAT models; Inventory of water resources – mapping water spread area - Groundwater prospecting zone mapping; Spatial variability mapping – interpolation techniques; Application of Remote Sensing and GIS in Precision Agriculture - Monitoring Crop Health.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand the remote sensing principles and systems
- Gain sufficient knowledge on satellite data processing and available data products.
- Know the concept of GIS and its tools.
- Have knowledge on data input and analysis techniques.
- Utilize these advanced techniques in addressing the real world problems.

TEXT BOOKS

1. Anji Reddy. M, "Remote Sensing and Geographical Information Systems", BS Publications, Hyderabad, 2001.
2. Lilles and, T. M., and Kiefer, R.W., "Remote Sensing and Image Interpretation", John Wiley and Sons, New York, 2000.

REFERENCES

1. Bettinger, P., and Michael, G.W., "Geographical Information System: Applications in Forestry and Natural Resources Management", Tata McGraw-Hill Higher Education, New Delhi, 2003.
2. Ian Heywood., "An Introduction to GIS", Pearson Education, New Delhi, 2001.
3. Jeffery Star and John Estes, "Geographical Information System - An Introduction", Prentice Hall India Pvt. Ltd., New Delhi, 1998.
4. Patel A.N &Surendra Singh, "Remote sensing principles & applications", Scientific Publishers , Jodhpur 1992.

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	2	1	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	2	3	1	-	-	-	3	-	-	-	2	2	2	2
CO5	2	3	2	3	2	3	3	-	-	-	2	2	3	2

AI15454 AGRICULTURAL BUSINESS MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

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

UNIT I CONCEPTS OF AGRICULTURAL BUSINESS 9

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

UNIT II AGRI - BUSINESS ORGANIZATION 9

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

UNIT III AGRICULTURAL MARKETING 9

Functional areas of Agri-business - Production and Operations management - functions, planning physical facilities and managing quality; Agro-inputs and products inventory management - raw material procurement, inventory types and costs; Marketing management & environment - marketing mix - Agricultural input marketing firms.

UNIT IV AGRICULTURAL BUSINESS FINANCE 9

Forms of agri-business organizations - Role of lead bank in agribusiness finance - Financial management - Acquiring capital; Budget analysis - Concepts and determinants; Business project - scheduling of raw material procurement - production management - launching products (branding and placement).

UNIT V MARKET PROMOTION AND HUMAN RESOURCES 9

Agricultural products - marketing promotion activities - product pricing methods; District Industries Centre; Consumer survey - Agricultural inputs retailing - Market potential assessment - types of distribution channels - Return on Investment - Personnel management; Recruitment, selection and training - Technology in Agri Business.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Know the importance of Agri-business management, its characteristics and principles.
- Understand the methods of managing employees, quality control and SWOT Analysis.
- Familiar with the functions of Production and Operations management and marketing techniques.
- Have knowledge on various aspects of financial management in agri business, branding and promotion.

- Understand the methods of pricing, retailing, distribution and training in agricultural business.

TEXT BOOKS

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

REFERENCES

1. S. Diwase, "Indian Agriculture & Agri-Business Management", Scientific Publishers, 2nd edition, 2014.
2. Chandra Prasanna, "Projects: Preparation, Appraisal, Budgeting and Implementation", Tata McGraw Hill Publications, New Delhi, 2001.
3. Kotler, P., "Marketing Management Analysis, Planning and Control", Prentice Hall Inc., New York, 2001.
4. Rao, V.S.P., and Narayana, P.S., "Principles and Practices of Management", Konark Publishing Private Limited, New Delhi, 2001.
5. Tripathy, P.C., and Reddy, P.N., "Principles of Management", Tata McGraw Hill Publications, New Delhi,2000.

CO/PO Mapping

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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	1	-	-	-	-	-	2	1	3	2	3	1	3	-
CO2	-	3	3	-	2	-	-	1	2	-	-	1	-	3
CO3	-	-	-	3	-	2	-	-	2	-	3	-	-	1
CO4	2	3	-	3	-	2	1	1	1	1	2	-	3	2
CO5	-	1	-	-	-	1	-	-	-	-	1	-	-	1

PROGRAMME ELECTIVE - III

AI15351 SEED PRODUCTION TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

- To expose the scope and importance of good quality seed production.
- To acquaint with the principles and special techniques used in the process of good quality seedproduction.
- To understand components of seed processing and testing.
- To familiarize with planning, development and organization of seed programmes.
- To gain knowledge on principles and techniques used for seed production of horticulture crops.

UNIT I SEED CHARACTERS 9

Seed - Definition - characteristics - difference between seed & grain - good quality features; Importance of seed in successful crop production; Floral biology - self and cross pollination; Methods of genetic improvement of crop plants - selection - hybridization - mutation - polyploidy; Seed laws - history - importance.

UNIT II SEED PRODUCTION AND CERTIFICATION 9

Seed Multiplication - systems - classes of seed - multiplication ratio - field selection - planting ratio - isolation needs and rouging; Harvest and extraction of seed; Methods of hybrid seed production; Genetic deterioration during crop production cycles; Seed certification process - legal basis - pre-requisites for applicability – steps.

UNIT III SEED PROCESSING AND TESTING 9

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

UNIT IV DEVELOPING SEED PROGRAMMES 9

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

UNIT V SEED PRODUCTION IN SPECIFIC CROPS 9

Seed production techniques for selected crops: Rice, Maize, Black gram, Groundnut, Sunflower, Cotton, Tomato, Brinjal& Radish.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Acquire basic knowledge of seed production technologies.
- Know the different methods of seed production.
- Gain knowledge in processing and testing of seed.
- Have knowledge on planning and management of different seed programmes.
- Learn seed production technologies of important crops.

TEXT BOOKS

1. Singh, S.P., "Commercial Vegetable Seed Production", Kalyani Publishers, Chennai, 2001.
2. Agarwal,R.L., "SeedTechnology",OxfordIBHPublishingCo.,NewDelhi,1995.

REFERENCES

1. SubirSen and Ghosh, N., "Seed Science", Kalyani Publishers, Chennai, 1999.
2. Dahiya, B.S., and Rai, K.N., "Seed Technology", Kalyani Publishers, Chennai, 1997.
3. George, Raymond, A.T., "Vegetable Seed Production", Longman Orient Press, London and New York, 1985.
4. "Hand Book of Seedling Evaluation", ISTA, 1979.

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	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	-	-	-	3	2	-	-	-	-	-	-	3	2
CO3	-	3	-	-	-	2	3	-	-	-	-	2	3	3
CO4	-	-	2	-	-	3	3	-	-	2	3	2	3	3
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	2

AI15705 GIS LABORATORY FOR AGRICULTURE ENGINEERS 0 0 2 1

COURSE OBJECTIVES

- To introduce the principles of Remote Sensing
- To know about the image interpretation techniques.
- To understand the basic concepts of GIS software through hands on training
- To get an idea about analysis techniques in RS & GIS
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources.

LIST OF EXPERIMENTS

1. Aerial photo and Satellite images interpretation
2. Stereo viewing and area calculation
3. Measurement of relief displacement using parallax bar
4. Introduction to GIS software
5. Supervised and Unsupervised classification of digital image
6. Geo-referencing of images
7. Spatial data input and editing - Digitization
8. Raster analysis - Database query
9. GIS applications in DEM and its analysis
10. GIS application in erosion / runoff modeling

TOTAL PERIODS 30

COURSE OUTCOMES

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

- Understand the remote sensing principles and systems.
- Gain sufficient knowledge on satellite data processing and available data products.
- Know the concept of GIS and its tools.
- Have knowledge on data input and analysis techniques.
- Utilize these advanced techniques in addressing problems in various fields of agricultural engineering.

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	2	1	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	2	3	1	-	-	-	3	-	-	-	2	2	2	2
CO5	2	3	2	3	2	3	3	-	-	-	2	2	3	2

AI15706 CAD LABORATORY FOR AGRICULTURE ENGINEERS 0 0 4 2

COURSE OBJECTIVES

- To draft the agricultural engineering related machineries and structures by computer aided methods.
- To understand the plan and layout of Irrigation and underground pipeline systems.
- To get an idea about design of post harvesting units and check dams.
- To enhance the knowledge of 3D modeling softwares.

LIST OF EXPERIMENTS

1. Design and Drawing of Underground pipeline system
2. Design and Drawing of Drip irrigation system
3. Design and Drawing of Sprinkler irrigation system
4. Design and Drawing of Check dam
5. Design and Drawing of Mould board plough
6. Design and Drawing of Disk plough
7. Design and drawing of Seed Drill
8. Design and Drawing of Thresher
9. Design and Drawing of Winnower
10. Design drawing of graders
11. Design and drawing of farmstead
12. Design and drawing of dairy shed
13. Design and drawing of poultry shed
14. Design and Drawing of Biogas plant
15. Introduction & demonstration on 3D modeling software like Pro/E, Creo, Solid works, Solid Edge etc.

TOTALPERIODS 60

COURSE OUTCOMES

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

- Draft the farm machinery and structures by using computers.
- Get an idea about design of post harvesting units and check dams.
- Draw the components of irrigation systems using CAD.
- Get trained on 3D modeling softwares.

CO/PO Mapping :

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

AI15708 **MINI PROJECT** **0 0 2 1**

COURSE OBJECTIVE

- To improve the skills to formulate a technical project.
- To explain the various tasks of the project and standard procedures.
- To teach the use of new tools, algorithms and techniques required to carry out the projects.
- To analyze the various procedures for validation of the product and analyze the cost effectiveness.

Identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code / app. Demonstrate the novelty of the project through the results and outputs.

TOTAL PERIODS 30

COURSE OUTCOME

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

- formulate the real-world problem, identify the requirement and develop the design solutions.
- identify the technical ideas, strategies and methodologies and use the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- analyze and validate through conformance of the developed prototype and analysis the cost effectiveness.
- explain the acquired knowledge through preparation of report and oral presentations

CO /PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

SEMESTER VIII

AI15801 SUSTAINABLE AGRICULTURE AND FOOD SECURITY 3 0 0 3

COURSE OBJECTIVES

- To study the importance of land resources.
- To know the availability of water resources.
- To understand the importance of organic farming in sustainable agriculture.
- To get an idea about food production chain, food security and ecological balance.
- To enhance the knowledge on the policies and programmes for sustainable agriculture and food security.

UNIT I LAND RESOURCE 9

Land Resources of India and Tamil Nadu - Population and land - Land utilization - Net Area Sown - changes in cropping pattern - land degradation.

UNIT II WATER RESOURCE 9

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

UNIT III SUSTAINABLE AGRICULTURE & ORGANIC FARMING 9

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

UNIT IV FOOD PRODUCTION AND FOOD SECURITY 9

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

UNIT V SUSTAINABLE AGRICULTURE & FOOD SECURITY - POLICIES & PROGRAMMES 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Gain knowledge on the need of land resources for sustainable agriculture.
- Understand the importance of water resources for sustainability.
- Understand the relationship between organic farming and sustainable agriculture.
- Comprehend the need of food security and the nutritional Security on global level.
- Have knowledge on policies and programmes for sustainable agriculture and food security

TEXT BOOKS

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

REFERENCES

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

CO/PO Mapping :

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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	-	1	2	-	2	-	-	-	3	2	2	3
CO2	3	1	-	1	3	-	2	-	1	1	3	1	2	3
CO3	3	2	3	-	-	1	1	-	-	-	1	2	3	1
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO5	3	2	3	-	1	-	-	-	-	-	-	1	1	2

AI15452 MICRO-IRRIGATION SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To expose the fundamental knowledge of micro irrigation system.
- To introduce the various components used in micro-irrigation.
- To understand the design of drip irrigation system.
- To gain knowledge on design of sprinkler irrigation system.
- To study about different types of valves used in special irrigation system.

UNIT I MICRO-IRRIGATION CONCEPT AND APPLICATIONS 10

Micro-irrigation - comparison between traditional and micro-irrigation methods - merits and demerits of micro-irrigation system - types and components of micro-irrigation system - scope and potential problem of micro-irrigation - low cost micro irrigation technologies - gravity fed micro irrigation - care and maintenance of micro-irrigation System - Economics of micro-irrigation system - Automation in micro-irrigation - Surge irrigation and cablegation - Greenhouse irrigation system.

UNIT II COMPONENTS OF MICRO IRRIGATION SYSTEMS 8

Pump classification - Variable displacement pumps - Centrifugal pump - Submersible pump - Vertical Turbine pumps - Jet and Airlift pumps; Pump selection and installation - troubles and remedies; Types of valves - Pressure relief valve - Gate valve - Isolated valve - Non return valve - Butterfly valve - Solenoid valves - Selection, repair and maintenance.

UNIT III DRIP IRRIGATION DESIGN 10

Drip irrigation - Components - Dripper - types and equations governing flow through drippers - Wetting pattern - Fertigation and Herbigation - Pump capacity - Installation - Operation and maintenance of Drip irrigation system; Design of surface and sub-surface drip irrigation.

UNIT IV SPRINKLER IRRIGATION DESIGN 10

Sprinkler irrigation - Components and accessories - Hydraulic design - Sprinkler selection and spacing - Capacity of sprinkler system - types - Sprinkler performance - Sprinkler discharge - Water distribution pattern - Droplet size, filtering unit and system maintenance.

UNIT V SPECIAL PRESSURISED IRRIGATION SYSTEM 7

Principles, construction & operations of Mini sprinkler - Butterfly sprinkler - Pop-up sprinkler - under tree sprinkler & Rain gun; Pressurised irrigation techniques adopted in Green House, Poly house, Poly Tunnel, Net House, aeroponics - Spray Heads, Jets &Foggers and Venturi system.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Have a thorough knowledge on micro irrigation and its concepts.
- Get an idea about the use of various types of pumps in irrigation.
- Know design, operation and maintenance of Drip irrigation systems.
- Know design, operation and maintenance of Sprinkler irrigation systems.
- Learn pressurized and automated irrigation systems.

TEXT BOOKS

1. Suresh, R., "Principles of Micro-Irrigation Engineering", Standard Publishers Distributors, New Delhi, 2010.
2. Michael, A.M., "Irrigation Theory and Practice", Vikas Publishers, New Delhi, 2002.

REFERENCES

1. Modi, P.N., and Seth, S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 1991.
2. Jack Keller and RondBelisher., "Sprinkler and Trickle Irrigation", Vannistrand Reinhold, New York, 1990.
3. SivanappanR.K., "Sprinkler Irrigation", Oxford and IBH Publishing Co., New Delhi, 1987.
4. Keller.J and D. Karmeli, "Trickle Irrigation Design", Rainbird Sprinkler Irrigation Manufacturing Corporation, Glendora, California, USA.

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COs	**Programmes Outcomes(POs)**													
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CO1	2	1	2	2	1	-	1	-	-	-	2	-	2	-
CO2	1	-	-	2	1	-	-	-	-	-	2	1	1	-
CO3	2	1	2	2	-	1	-	-	-	2	3	1	1	3
CO4	2	1	2	2	1	-	-	-	2	1	2	-	1	2
CO5	1	2	-	2	2	-	-	-	-	1	2	-	2	1

AI15552 DISASTER MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

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

UNIT I INTRODUCTION TO DISASTERS 9

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

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

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

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

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

UNIT V DISASTER MANAGEMENT: APPLICATIONS, CASE STUDIES AND FIELD WORKS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Differentiate the types of disasters, causes and their impact on environment and society.
- Assess vulnerability, damage assessment and various methods of risk reduction measures as well as mitigation.

- Get an ideas about Climate change adaptation, IPCC Scenario and Scenarios in the context of India
- Know the various disaster risk management practices in India.
- Acquire knowledge on applications of disaster management.

TEXT BOOKS

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.
4. KapurAnu, "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.

CO/PO Mapping

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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	-	-	-	2	2	1	-	-	2	1	-	-
CO2	-	2	2	3	-	-	3	-	-	-	-	-	-	-
CO3	1	2	3	-	-	1	3	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	3	1	-	-	3	1	-	-
CO5	3	2	-	-	-	2	2	-	-	-	2	2	-	-

AI15802 **PROJECT WORK** **0 0 12 6**

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To analyze the various procedures for validation of the product and analyze the cost effectiveness
- To explain the various tasks of the project and standard procedures.
- To train the students in preparing project reports and to face reviews and viva voce examination.

Students in a group of 3 or 4 shall work on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on three reviews by the review committee constituted by the Head of the Department. The project work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.

TOTAL PERIODS 180

COURSE OUTCOME

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

- formulate the real-world problem, identify the requirement and develop the design solutions.
- identify the technical ideas, strategies and methodologies and use the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- analyze and validate through conformance of the developed prototype and analysis the cost effectiveness.
- explain the acquired knowledge through preparation of report and oral presentations.

CO/PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

AI15252 FARM POWER AND MACHINERY MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To acquire knowledge on design criteria in farm power and machinery system.
- To provide sufficient knowledge of mechanization status in the country and management techniques for future requirements.
- To acquaint and equip with system approach in machinery management.
- To gain knowledge about planning of various machinery used in farm.
- To know the performance evaluation of different farm machinery.

UNIT I INTRODUCTION TO FARM POWER AND DESIGN CRITERIA 8

Design and development of farm power - Modern trends - principles - procedures - fundamentals and economic considerations - Reliability criteria in design and its application.

UNIT II MACHINERY MANAGEMENT 10

Maintenance and scheduling of operations - Repairs and maintenance of agricultural machinery - Replacement of old machines; Inventory control of spare parts - work study - productivity - method study; First order Markov chains and their applications in sales forecasting - problems of inventory control - modeling of workshop processes and quality control.

UNIT III SYSTEMS APPROACH 9

System approach in farm machinery management - application of programming techniques to the problems of farm power and machinery selection.

UNIT IV PLANNING OF MACHINERY 9

Time and motion study; Man-machine task system in farm operations - planning of work system in agriculture; Mechanization planning - Computer application in selection of power units - optimizing mechanization system.

UNIT V ECONOMIC ANALYSIS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Have knowledge on design criteria in farm power and machinery system.
- Learn the management techniques in farm power operations and plan for the future.
- Use various systems in the farm power and machinery management.
- Get an idea about planning of optimum utilization of machineries in farm.
- Know the performance evaluation of different farm machineries

TEXT BOOKS

1. Bainer, R. Kepner, R.A. and Barger, E.L.,"Principles of farm machinery", John Wiley and Sons. New York,1978.
2. Liljedahl, B: Tumquist, PK: Smith, DW; and Hoki, M, "Tractor and its Power Units",VanNostrandReinhold,1989.
3. Culpin, C. "Farm Machinery",Granada Publishing Ltd., London,1978.

REFERENCES

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

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	-	-	-	-	2	-	1	-	3	-
CO2	3	-	-	3	-	-	-	-	-	1	2	-	-	3
CO3	2	-	-	-	-	-	-	3	-	2	-	-	3	-
CO4	-	-	-	-	-	-	-	-	-	3	2	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	3	-	2	3

AI15253 WATERSHED MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on various types of watersheds and it characteristics.
- To study about the principles in planning of watershed.
- To provide a comprehensive treatise on the engineering practices in watershed management.
- To know about the water conservation practices in irrigated and dry lands.
- To get an idea about various watershed development programmes.

UNIT I INTRODUCTION 9

Watershed - Definition - concept - Objectives - classification - priority watersheds; Watershed characteristics - Land capability classification - land resource regions in India - watershed atlas.

UNIT II WATERSHED PLANNING 9

Planning principles - land use and collection of data; Preparation of watershed development plan - Estimation of costs and benefits - Financial plan - selection of implementing agency - Monitoring and evaluation system.

UNIT III WATERSHED MANAGEMENT 9

Watershed Management - concept and advantages - participatory management; Runoff management - Factors affecting runoff - Temporary & Permanent gully control measures; Use of Aerial photography and Remote sensing in watershed management.

UNIT IV WATER CONSERVATION PRACTICES 9

In-situ & Ex-situ soil and moisture conservation principles and practices - irrigated lands - drylands; Water harvesting - Micro catchment - Groundwater recharge - percolation ponds; Farm pond - Supplemental irrigation; Evaporation suppression - Seepage reduction - Afforestation for conservation.

UNIT V WATERSHED DEVELOPMENT PROGRAMME 9

River Valley Project (RVP) - Hill Area Development Programme (HADP) - National Watershed Development Programme for Rainfed Agriculture (NWDPRA) - Integrated Watershed Development Programme (IWDP) - Other similar projects operated in India - Govt. of India guidelines on watershed development programme - Watershed based rural development - infrastructure development; Role of NGOs in watershed development.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Know the characteristics of watershed.
- Prepare plan for watershed development.
- Utilize the engineering practices inwatershed management.
- Adopt conservation practices in irrigated and dry lands.
- Implement watershed development programmes.

TEXT BOOKS

1. Suresh, R. 2005, "Soil and Water Conservation Engineering", Standard Publishers & Distributors, New Delhi.
2. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.

REFERENCES

1. Gurmel Singh et al,"Manual of soil and water conservation practices", Oxford& IBH publishing Co. New Delhi,2004.
2. Suresh, R., "Land and water management principles",Standard Publishers &Distributors,New Delhi,2008.
3. Tripathi R.P. and H.P.Singh, "Soil erosion and conservation", Willey Eastern Ltd., New Delhi, 2002.
4. Murthy, V.V.N., "Land and water management", Kalyani publishing, New Delhi, 2005.
5. Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 1996.

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	2	1	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	2	3	1	-	-	-	3	-	-	-	2	2	2	2
CO5	2	3	2	3	2	3	3	-	-	-	2	2	3	2

BA15251 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

- To demonstrate an understanding of entrepreneurial concepts and processes.
- To understand key components of building successful ventures and quality management.
- To describe the basic aspects in finance, National Policy and principles in taxation.
- To discuss the steps involved in formation of business and preparation of project reports.
- To become familiar with the small business, government policies and growth strategies.

UNIT I INTRODUCTION TO ENTREPRENEURSHIP 9

Concept of entrepreneur and entrepreneurship; entrepreneurial and managerial characteristics; Distinction between an entrepreneur and a manager - Agri-entrepreneurship - concept - need and scope - Ethics in Entrepreneurship; Managing an enterprise; Motivation and entrepreneurship development; importance of Planning - budgeting - monitoring - evaluation and follow up in running an enterprise.

UNIT II ENTREPRENEURSHIP ANALYSIS AND OPPORTUNITIES 9

Innovation - principles of innovation - SWOT analysis; Sources of innovative opportunities - unexpected success & failure - unsatisfied needs - process improvement - changes in industry structure - changes in demography and perception - new knowledge; Create a customer - utility - pricing - adaptation to customer needs and deliver value to customer - Market research - customer need - competitors.

UNIT III FINANCING, ACCOUNTING, TAX AND LEGAL ISSUES 9

Finance - government policies - Government Schemes and Incentives for Promotion of Entrepreneurship - Venture capital financing – concept - purpose and schemes - Role of financial institutions for funding enterprises; Capital markets - shares and securities; Accounting - concepts and conventions of accounting - double entry system of book keeping - Problems in Accounting Systems; National agricultural policy - Government policies and regulations for agribusiness; Principles of taxation and tax structure in India - Legal issues in agribusiness - Role of District Small Industry Association.

UNIT IV BUSINESS 9

Small Enterprises - Definition - Classification - Characteristics - Ownership Structures - Project formulation - Steps involved in setting up a Business - identifying & selecting a Good Business opportunity; Market Survey and Research - Techno Economic Feasibility Assessment - Preparation of Preliminary Project Reports - Project Appraisal - Sources of Information - Classification of Needs and Agencies.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business - Concept - Magnitude - Causes and Consequences; Corrective Measures - Business Incubators - Government Policy for Small Scale Enterprises - Growth Strategies in small industry - Expansion - Diversification - Joint Venture - Merger and Sub Contracting.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Explain the basic concepts in entrepreneurship and its processes.
- Describe the key components of building successful ventures and quality management.
- Familiar with the basic aspects in finance, National Policy and principles in taxation.
- Implement the steps in formation of business and preparation of project reports.
- Discuss the role of small business, government policies and growth strategies.

TEXT BOOKS

1. Robert D Hisrich and Michael P Peters, "Entrepreneurship", Irwin McGraw - Hill Inc, 4th edition, 1998.
2. Dale H.Besterfield, Carol Besterfield - Michna, Glen H. Besterfield, Mary Besterfield - Sacre, Hermant - Urdhwareshe, RashmiUrdhwareshe, "Total Quality Management", 3rd edition, Pearson Education, 2011.

REFERENCES

1. Jeffry A. Timmons, "New Venture Creation: Entrepreneurship for the 21st Century", Fifth Edition, Irwin McGraw-Hill Publishers, Boston, MA (ISBN 0-356-19756-3).
2. Sharma D.D. DhaniejaS.K.Gurjar B.R, "Entrepreneurship, Strategic Management and Globalization", Rawat Publications, Jaipur, 1999.
3. Sulakshan Mohan, "Making of an Entrepreneur, how to set up your own enterprise and manage it Successfully", Indian Publishers distributors, Delhi, 2000.
4. David H Hott, "Entrepreneurship, New Venture Creation", Prentice - Hall of India Pvt. Ltd., New Delhi, 2000.
5. ShridharaBhat K, "Total Quality Management - Text and Cases", Himalaya Publishing House, 1st Edition, 2002.

CO/PO Mapping :

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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	1	-	-	-	-	-	2	1	3	2	3	1	3	-
CO2	-	3	3	-	2	-	-	1	2	-	-	1	-	3
CO3	-	-	-	3	-	2	-	-	2	-	3	-	-	1
CO4	2	3	-	3	-	2	1	1	1	1	2	-	3	2
CO5	-	1	-	-	-	1	-	-	-	-	1	-	-	1

AI15352 SPECIAL FARM MACHINERY AND EQUIPMENTS 3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on weeders used for agricultural applications.
- To study the applications of sprayers and dusters.
- To know about the mechanism of mowers and harvesters.
- To gain sufficient knowledge on working principles of various farm machinery.
- To study about special farm equipment.

UNIT I WEEDING EQUIPMENT 9

Weeding and intercultural equipment - junior hoe - guntaka - blade harrow - rotary weeders for upland and low land; Weeders - selection - constructional features and adjustments; Weed management - mulching - applicators.

UNIT II SPRAYERS AND DUSTERS 9

Sprayers - types - operation - precaution - coverage - factors affecting drift; Rotating disc sprayers - controlled Droplet Application (CDA) - electrostatic sprayers - aerial spraying - air assisted sprayers - orchard sprayers; Dusters - types - mist blower cum duster - other plant protection devices - care and maintenance.

UNIT III MOWERS AND HARVESTERS 9

Mower - mechanism - construction - adjustments - registration and alignment; Windrowers - reapers - reaper-cum-binders and forage harvesters; Diggers - potato - groundnut and other tubers; Harvesters - Sugarcane harvesters - cotton pickers - corn harvesters - fruit crop harvesters - vegetable harvesters and combine harvesters.

UNIT IV THRESHERS AND OTHER MACHINERY 9

Thresher - construction and working of multi crop thresher; Forest machinery - shrub cutters - tree cutting machines - post hole diggers - chaff cutter - flail mowers - lawn mowers - tree pruners.

UNIT V ADVANCED FARM EQUIPMENTS 9

Pneumatic planters - air seeders - improved ploughs - reversible ploughs - suction traps - seed and fertilizer broadcasting devices - manure spreaders - sweep weeders - direct paddy seeders - direct paddy cum daincha seeder - coconut tree climbing devices - tractor operated hoist - tractor operated rhizome planter.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Have a thorough knowledge on various types of weeders.
- Familiar with different sprayers and dusters.
- Construct and use various types of mowers and harvesters.
- Work on threshers and other farm machinery.
- Acquire complete knowledge on special farm equipments.

TEXT BOOKS

1. JagdishwarSahay., “Elements of Agricultural Engineering”, Standard Publishers Distributors,2010.
2. Michael and Ojha, “ Principles of Agricultural Engineering”, Jain brothers,2005.

REFERENCES

1. Kepner, R.A., et al., " Principles of farm machinery", CBS Publishers and Distributers, Delhi,1997.
2. Harris Pearson Smith et al., "Farm machinery and equipments",Tata McGraw-Hill pub,1996.
3. Srivastava, A.C.," Elements of Farm Machinery", Oxford and IBH Pub. Co., New Delhi,1990.

CO/PO Mapping

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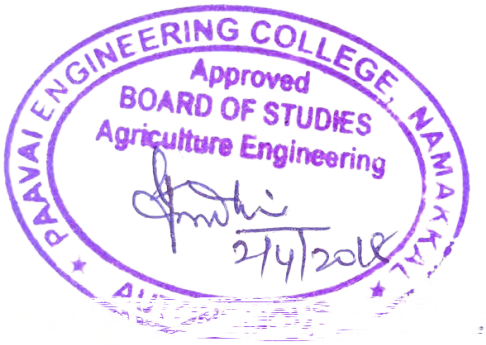
COs	**Programmes Outcomes(POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	-	-	-	-	-	2	1	3	2	3	1	3	-
CO2	-	3	3	-	2	-	-	1	2	-	-	1	-	3
CO3	-	-	-	3	-	2	-	-	2	-	3	-	-	1
CO4	2	3	-	3	-	2	1	1	1	1	2	-	3	2
CO5	-	1	-	-	-	1	-	-	-	-	1	-	-	1



AI15353 ENERGY AND ENVIRONMENTAL AUDITING AND ITS MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To study about the energy audits.
- To impart knowledge on energy management, performance, and conservation measures.
- To understand about environment audit, its assessment, tools and techniques used in auditing.
- To gain knowledge about environment impact assessment, cost and benefits of EIA.
- To study about the principles preparation and concepts of EMS.

UNIT I INTRODUCTION TO ENERGY AUDIT 9

Energy audit - Definition - need - Types (pre and detailed); Identification of Energy Conservation Opportunities - Classification and evaluation of Energy Conservation Measures - Reporting Format - Description of production process - Energy and utility - energy efficiency; Energy audit instruments.

UNIT II 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 - Energy savings without suffering - Fuel and energy substitution; Case study examples - Energy saving calculations.

UNIT III INTRODUCTION TO ENVIRONMENT AUDIT 9

Environment audit - definition - need - scope - history and benefits - Distinctions between financial audits and environmental audits; Different types of environmental audits - management - compliance - assessment - waste audits; Development of environment audits - structure - steps involved - Tools and techniques for auditing; Public sector environmental auditing; Environmental auditing and decision making; Case studies.

UNIT IV ENVIRONMENT IMPACT ASSESSMENT (EIA) 9

EIA - purpose and aims - administration and practice - concept of associated assessment processes - key elements of the EIA process - undertaking an EIA - role of public participation - stages that follow EIA - costs and benefits of undertaking EIA - understanding strengths and limitations of EIA - case studies.

UNIT V ENVIRONMENT MANAGEMENT SYSTEMS (EMS) 9

Objectives - principles and components of Environmental Management Systems - General requirements of ISO 14001:2004 - Environmental Management tools and techniques for planning - operation and maintenance of EMS - Management review and continual improvement - Preparation and Process for ISO 14001 EMS Registration.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Acquire knowledge on energy auditing and its management.
- Learn about environmental auditing, impact assessment and environment management systems.
- Have knowledge of different types of environmental audits and management.
- Gain knowledge about administration and practice.
- Expertise in management review and continual improvement.

TEXT BOOKS

1. Y. P. Abbi, Shashank Jain, "Handbook on Energy Audit and Environment Management", The Energy and Resources Institute (TERI), Business & Economics - 302 pages,2006.
2. Canter, R.L., "Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1996.

REFERENCES

1. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.
2. Buckley RC ,"Environmental audit: course handbook", Bond University, Gold Coast.(2nd and 3rd editions, 1990).
3. Buckley, R., "Perspectives in Environmental Management", Springer Publications,1991.

WEB LINKS

1. http://www.em-ea.org/gbook1.asp
2. http://www.keralaenergy.gov.in/pdf/EMC%20Energy%20Audit%20Draft%20Manual.pdf

CO/PO Mapping :

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
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CO1	2	3	2	-	1	-	-	-	-	-	-	1	-	-
CO2	3	-	-	2	-	-	2	-	-	2	3	-	-	-
CO3	-		3	-	3	-	-	-	-	-	2	-	1	-
CO4	-	2	2	-	-	3	-	-	2	-	-	1	-	-
CO5	3	2	-	-	2	1	-	1	-	1	3	-	-	-

AI15354 ON FARM WATER MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To understand the fundamental design of irrigation channels and diversion structures.
- To study about Command area development.
- To know about availability and utilization of water resources.
- To impart knowledge on water use efficiency.
- To get an idea about automation of irrigation systems and water policies.

UNIT I DESIGN OF IRRIGATION CHANNELS 9

Design of Erodible (earthen), Non-Erodible (lined) & Alluvial channels (pre-fabricated) - Kennedy's and Lacey's Theories; Materials for Lining watercourses and field channel; Water control and Diversion structure - Design - Land grading - Land Levelling methods.

UNIT II COMMAND AREA 9

Command area - Concept - CADA Programmes in Tamil Nadu; Duty of water - expression - relationship between duty and delta; Warabandhi - water distribution and Rotational Irrigation System - Participatory irrigation management.

UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER 9

Availability of water - rainfall, canal supply and groundwater - conjunctive use - crop calendar - Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water - Dependable rainfall - Rainfall analysis by Markov chain method - Probability matrix.

UNIT IV WATER BALANCE 9

Groundwater balance model - Weekly water balance - Performance indicators - Appropriateness, Adequacy, Dependability, Equity, Reliability, Timeliness and efficiency - conjunctive use plan by optimization; Agricultural productivity indicators - Water use efficiency.

UNIT V SPECIAL TOPICS 9

Automation of micro-irrigation system - Time based - Volume based - Sensor based - National water policy - Institutional aspects - Socio-economic perspective; Reclamation of salt affected soils; Seepage loss in command area; Irrigation conflicts - Water productivity - Water pricing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Designirrigation channels and diversion structures.
- Know about different CADA programmes.
- Get an idea about conjunctive use of water resources.
- Gain sufficient knowledge on optimum use of water.
- Familiar with latest technologies and national water policy.

TEXT BOOKS

1. Michael, A.M. 2006. “Irrigation Theory and practice”, Vikas publishing house, New Delhi

REFERENCES

1. Keller, .J. and BliesnerD.Ron, “Sprinkler and Trickle irrigation”, Anari book, Published by Van No strand Rein hold New York, 2001.
2. Israelson,“Irrigation principles and practices”, John Wiley & sons, New York, 2002.
3. Modi, P.N., “Irrigation and water resources and water power engineering”, StandardBook House, New Delhi,2002.
4. Michael, A.M. and Ojha, T.P. “Principles of Agricultural Engineering -Vol II “,Jain Brothers, New Delhi,2002.
5. Suresh, R., “Land and water management principles”, Standard Publishers & Distributors, New Delhi,2008.

CO/PO Mapping :

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CO1	3	2	1	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	2	3	1	-	-	-	3	-	-	-	2	2	2	2
CO5	2	3	2	3	2	3	3	-	-	-	2	2	3	2

PROGRAMME ELECTIVE - II

AI15251 INDUSTRIAL SAFETY MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

- To know the concepts and techniques of industrial safety management.
- To acquire knowledge in safety audit and performance monitoring.
- To calculate the accident rate and about the accident indices.
- To learn principles and practices of safety management in industries.
- To gain knowledge about the safety education and training systems.

UNIT I CONCEPTS AND TECHNIQUES 10

Safety Management - history - evolution - general concepts - planning - optimization of productivity - quality and safety - line and staff functions for safety - budgeting for safety - safety policy; Incident Recall Technique (IRT) - disaster control - job safety analysis - safety survey - safety inspection - safety sampling - evaluation of performance of supervisors on safety.

UNIT II SAFETY AUDIT 10

Safety audit - components - types - methodology - non conformity reporting (NCR) - audit checklist and report - review of inspection - remarks by government agencies, consultants, experts - perusal of accident and safety records, formats - implementation of audit indication - liaison with departments to ensure co-ordination - check list - identification of unsafe acts of workers - unsafe conditions in the shop floor.

UNIT III ACCIDENT INVESTIGATION AND REPORTING 10

Concept of an accident - reportable and non-reportable accidents - reporting to statutory authorities - principles of accident prevention - accident investigation and analysis - records for accidents - departmental accident reports - documentation of accidents - unsafe act and condition - domino sequence - supervisory role - role of safety committee - cost of accident.

UNIT IV SAFETY PERFORMANCE MONITORING 8

Recommended practices for compiling and measuring work - injury experience - permanent total disabilities - permanent partial disabilities - temporary total disabilities - Calculation of accident indices - frequency rate - severity rate - frequency severity incidence - incident rate - accident rate - safety “t” score - safety activity rate - problems.

UNIT V SAFETY EDUCATION AND TRAINING 7

Importance of training - identification of training needs - training methods - programmes, seminars, conferences & competitions - method of promoting safety practice - motivation - communication; Role of government agencies and private consulting agencies in safety training - creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme & safety campaign - Domestic Safety and Training; Overview of factories acts.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Learn the principles and practices of safety management in industries.
- Acquire knowledge in safety audit and performance monitoring.
- Calculate the accident rate and the accident indices.
- Monitor the safety performance.
- Have knowledge about safety education and training.

TEXT BOOKS

1. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.
2. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay,1997.
3. Lees, F.P., "Loss Prevention in Process Industries" Butterworth publications, London, 2nd edition,1990.
4. John Ridley, "Safety at Work", Butterworth and Co., London, 1983.

REFERENCES

1. Dan Petersen, "Techniques of Safety Management", McGraw-Hill Company, Tokyo, 1981.
2. Relevant India Acts and Rules, Government of India.
3. Relevant Indian Standards and Specifications, BIS, New Delhi.
4. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973.
5. "Safety and Good House Keeping", N.P.C., New Delhi, 1985.
6. "Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982.
7. Journal by Insurance company surveyors and loss assessors - Mumbai – publishedby Insurance companies.

CO/PO Mapping :

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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	2	-	-	1	2	-	-	-	1	-	-	-
CO2	2	-	2	2	-	3	2	-	-	-	2	2	-	-
CO3	-	-	1	2	-	3	2	-	-	1	-	-	-	-
CO4	1	2	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	3	3	2	3	1	1	2	-	-	2	-	-	-

AI15453 MECHANICS OF TILLAGE AND TRACTION 3 0 0 3

COURSE OBJECTIVES

- To impart fundamental knowledge of mechanics in various tillage implements.
- To study the dynamics in various tillage implements.
- To understand the traction and its mechanism.
- To know about tyres and its testing.
- To study the applications of tillage and traction.

UNIT I MECHANICS OF TILLAGE 9

Tillage – history - soil-machine-crop system - mechanics of tillage tools; Engineering properties of soil - physical and mechanical - principles and concepts - stress strain relationship.

UNIT II DYNAMICS OF TILLAGE 9

Design of tillage tools - principles of soil cutting - design equation - force analysis - application of dimensional analysis in soil dynamics - performance of tillage tools.

UNIT III TRACTION 9

Traction - introduction - mechanics - parameters; Off road traction and mobility - traction model - traction testing - traction improvement - traction performance - traction prediction.

UNIT IV TYRES 9

Tyres - tyre size and its effects - effects of tyre pressure - tyre lug geometry and their effects - ballasting for tyre life - tyre testing.

UNIT V APPLICATIONS 9

Soil compaction and plant growth - mechanical and hydraulic properties of compacted soil - soil physical properties and plant growth - measures for optimising crop growth by avoiding excessive soil compaction - variability and geo statistics - application of GIS in soil dynamics.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand the concepts of mechanics.
- Know the principles of dynamics and traction.
- Understand about traction implements and its mechanism.
- Acquire knowledge on tyres and its testing.
- Apply the tillage and traction for soil compaction and plant growth optimization.

TEXT BOOKS

1. Klenin, N.L.; Popov, I.F. and V.A. Sakum, “Agricultural machines”,Amerind Pub. Co. New York,1985.
2. J. B. Liljedahl, P. K. Turnquist, D. W. Smith, & M. Hoki ,“Tractors and their power units”, Fourth ed. American Society of Agricultural Engineers, ASAE,1996.
3. Kepner, R. A., Roy Bainer and E. L. Barger.“Principles of farm machinery”,Third edition; AVI Publishing Company Inc: Westport, Connecticut,1978.

REFERENCES

1. Ralph Alcock., “Tractor Implements System.”,AVI Publ,1986.
2. S. C. Jain, “Farm Machinery- An Approach”.

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	2	1	-	-	-	-	-	-	-	2	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	2	3	1	-	-	-	3	-	-	-	2	2	2	2
CO5	2	3	2	3	2	3	3	-	-	-	2	2	3	2

PROGRAMME ELECTIVE - IV

AI15451 ORGANIC FARMING TECHNOLOGIES 3 0 0 3

COURSE OBJECTIVES

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

UNIT I INTRODUCTION TO ORGANIC FARMING 9

Organic farming - concept - History - genesis and status of Organic farming in India - Impact of Green Revolution; Bio-diversity - importance in agro-ecology and environment - conservation; Natural resources - potential and utilization - exploitation and its impact - Difference between conventional and organic agriculture.

UNIT II SOIL MANAGEMENT IN ORGANIC FARMING 9

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

UNIT III PRODUCTION TECHNOLOGIES FOR ORGANIC FARMING 9

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

UNIT IV CROP PROTECTION 9

Weeds, insects and diseases management under organic farming; Biological agents and pheromones, bio-pesticides for crop protection; Sustainable crop protection practices - ITK's in crop protection.

UNIT V POST HARVEST AND CERTIFICATION 9

Post harvest technology - preservation - value addition - quality parameters - marketing and export avenues; Organic certification - Standards and agencies - marketing and export avenues - certification for exports; Sustainability indices for evaluating long term and indirect benefits; Economic evaluation of organic agricultural technologies.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Learn principles and practices of organic farming for sustainable crop production.
- Acquire knowledge on soil management practices in organic production technology.
- Gain knowledge on organic production technology.
- Know about the post-harvest technologies used in organic farming.
- Understand the organic certification procedures for export.

TEXT BOOKS

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

REFERENCES

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

CO/PO Mapping :

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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	2
CO2	3	-	-	2	3	-	-	-	-	-	-	-	3	2
CO3	2	-	-	2	-	3	3	2	-	-	-	-	3	3
CO4	3	-	2	-	3	-	-	-	-	-	-	-	3	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	3	-

PROGRAMME ELECTIVE - V

AI15551 HORTICULTURE CROP PROCESS ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To understand various processing technology on different horticultural crops and their importance.
- To impart knowledge on different packaging and grading techniques.
- To study about processing of coffee, tea and cocoa.
- To know about the by-products utilization and processing of oil seeds.
- To get an idea about processing of medicinal crops.

UNIT I IMPORTANCE AND PROCESSING OF HORTICULTURAL CROPS 9

Unit operations in horticulture - scope and importance - primary and secondary processing - processing technologies - equipment - operations in grading - pre-treatment; Principles and techniques in preservation of foods and vegetables - cold storage - freezing - addition of chemicals - dehydration and canning - packaging; Value added products in horticultural crops.

UNIT II PACKAGING, GRADING AND QUALITY ANALYSIS OF SPICES 9

Cleaning and grading of spices - packaging and storage of spices; Grading specifications - AGMARK, ASTA, ESA specifications - processes involved in the manufacture of oleoresins and essential oils - quality analysis of spices and their derivatives.

UNIT III PROCESSING OF COFFEE, TEA AND COCOA 9

Processing of coffee, tea and cocoa - methods - process and equipment - value added products - grading and types - packaging and storage.

UNIT IV PROCESSING OF COCONUT, OILPALM, ARECANUT AND CASHEW 9

Processing of plantation crops - production and importance - processing of coconut - oil palm - arecanut - cashew - drying - cleaning and grading - production of value added products - packaging and storage of produces.

UNIT V PROCESSING OF MEDICINAL CROPS 9

Processing of medicinal crops - equipments used - principles and operations; Active principles in various medicinal plants - application and uses - extraction methods.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Learn all the Horticultural crop processing techniques.
- Get knowledge on cleaning, grading and packaging of processed horticultural by products.
- Familiar with processing of tea, coffee and cocoa.
- Understand the processing of plantation crops.
- Gain knowledge on processing of medicinal crops.

TEXT BOOKS

1. Pandey, P. H., “Post Harvest Engineering of Horticultural Crops through Objectives”, SarojPrakasam, Allahabad,2002.

2. Pruthi, J.S., “Major Spices of India - Crop Management and Post Harvest Technology”, Indian Council of Agricultural Research, KrishiAnusandhanBhavan, Pusa, New Delhi. PP. 514,1998.

REFERENCES

1. ASTA, “Official analytical methods of the American Spice Trade Association”, Fourth Edition,1997.
2. Purseglove, J.W.,E.G.Brown, G.L.Green andS.R.J.Robbins,“Cardamom – Chemistry”,1981.
3. “Spices, Vol. I, Tropical Agricultural Series”, Longman, London, 1: 605.
4. Pruthi, J.S., “Spices and Condiments: Chemistry, Microbiology and Technology”. First Edition.Academic Press Inc., New York, USA. pp. 1-450, 1980.

WEB LINKS

1. www.indianspices.com
2. www.coconutboard.gov.in
3. www.tide-india.org/projects/06diffusion-arecanut-processing.html

CO/PO Mapping

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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	2
CO2	3	-	-	2	3	-	-	-	-	-	-	-	3	2
CO3	2	-	-	2	-	3	3	2	-	-	-	-	3	3
CO4	3	-	2	-	3	-	-	-	-	-	-	-	3	2
CO5	3	-	-	-	-	-	-	-	-	-	-	3	3	-

AI15553 LANDSCAPE DESIGN AND SITE PLANNING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I BASICS OF LANDSCAPING 9

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

UNIT II SITE SELECTION AND PLANTING PRINCIPLES 9

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

UNIT III PLANTING PRACTICES 9

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

UNIT IV LANDSCAPE APPLICATIONS 9

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

UNIT V SURFACE TREATMENTS IN LANDSCAPING 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand the basic concept of landscape design.
- Select the suitable site and plants for designing landscape.
- Analyse the different gardening requirement.
- Design the landscape for different type of gardening.
- Apply the different treatments and maintenance procedure.

TEXT BOOKS

1. Rita Buchanan, “Taylor's Master Guide to Landscaping, Houghton Mifflin Gardening”, ISBN: No. 0618055908, 2000.
2. Jack E Ingels, “Landscaping”, Thomson Delmar Learning, ISBN No.: 082736735X,1997.

REFERENCES

1. Steven Angleyet.al., “Landscape Estimating and Contract Administration”, Thomson Delmar Learning, ISBN: No. 0618055908,2001.

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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	-	-	-	-	-	-	-	-	-	1	1
CO2	1	1	3	-	-	-	-	-	-	-	-	-	1	1
CO3	1	1	2	3	-	-	1	-	-	-	-	-	1	1
CO4	-	-	3	-	2	-	-	-	-	-	-	-	1	1
CO5	1	1	-	-	2	-	-	-	-	-	1	-	1	1

AI15554 RENEWABLE ENERGY RESOURCES AND TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

- To impart knowledge in solar energy, its conversions and applications
- To gain fundamental knowledge in wind energy and its applications
- To understand bio-chemical conversion of biomass
- To impart knowledge in thermo-chemical conversion of biomass
- To expose the fundamentals of energy auditing and management

UNIT I INTRODUCTION TO RENEWABLE ENERGY RESOURCES AND SOLAR ENERGY ENGINEERING 9

World energy scenario - Energy sources and their availability; Qualitative study of different renewable energy resources – Solar – wind – ocean – Biomass - Fuel cell - Hydrogen energy systems and hybrid renewable energy systems; Solar energy and its prospects - Solar radiation measurement - Solar collectors - energy balance - performance - solar air heaters - Focusing collectors; Application of solar energy - Water heaters, Pumps, Driers - photovoltaic systems - Selective surface for solar energy conversion.

UNIT II WIND ENERGY ENGINEERING 9

Nature of wind - power - Site selection and characteristics - measuring instruments - air foils - rotor classifications - velocity and power duration curve; Windmill components - performance of windmill - applications - water lifting and power production - economics.

UNIT III BIO-CHEMICAL CONVERSION TECHNOLOGY 9

Bio-resources - origin - type and biomass characteristics - biomass conversion technologies - bio degradation - factors affecting biogas production; Biogas plants - types - design & construction details - operation and maintenance - slurry handling, utilization and enrichment - utilization of biogas; Bio-fuel production - utilization - Lighting and running of IC engines.

UNIT IV THERMO-CHEMICAL CONVERSION TECHNOLOGY 9

Principles of combustion - gasification - down draft gasifier - updraft gasifier - utilization of producer gas - pyrolysis - incineration - charcoal making - scrubbers - burners; Improved wood burning stove; Briquetting-concepts - advantages; Cogeneration - energy plantation.

UNIT V ENERGY AUDITING AND MANAGEMENT 9

Energy conservation - future strategy - energy conservation acts; Energy management and audit - objectives - types - Reporting format - energy costs; Bench marking and energy performance - maximizing efficiency - fuel substitution; Industrial energy auditing and conservation measures - Policy recommendations; Economics of use of various alternative sources of energy in agriculture.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- Understand renewable energy resources & solar energy, its conversions and applications.
- Know the fundamentals of wind energy and its applications.
- Understand about bio-chemical conversion of biomass.

- Understand thermo-chemical conversion of biomass.
- Have knowledge in energy auditing and management.

TEXT BOOKS

1. Chawla, O.P. "Advances in Biogas Technology". ICAR Publication, New Delhi,1986.
2. More, H.S and R.C. Maheshwari, "Wind Energy Utilization in India" CIAE Publication – Bhopal,1982.
3. Rai., G.D. "Solar Energy Utilization" Khanna publishers, New Delhi,2002.
4. BEE, "General aspects of energy management and energy audit", bureau of Energy Efficiency, DOE, New Delhi,2005..

REFERENCES

1. Bailey James E. & David F. Ollis, "Biochemical Engineering Fundamentals" TATA - McGraw Hill Publishing Company, Tokyo,2001.
2. Rai. G.D. "Non Conventional Sources of Energy", Khanna Publishers, New Delhi,2002.
3. Rao, S. and B.B. Parulekar, "Energy technology - Non conventional, renewable and conventional"Khanna publishers, New Delhi,2002.
4. Twidell. J.W and A.D. Weir, "Renewable Energy Sources" ELPS, E and F.N. Spon. Ltd, London,1996.
5. Albert Thumann, P.E., and William J.Younger, "Hand book of energy audits", the Fairmont press, Inc., Libum, Geogia,2008..
6. Murphy,W.R., G.McKay, "Energy Management", ButteeworthHeninemann; publications,2001.

CO/PO Mapping

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CO1	3	3	-	1	2	-	2	-	-	-	3	2	2	3
CO2	3	1	-	1	3	-	2	-	1	1	3	1	2	3
CO3	3	2	3	-	-	1	1	-	-	-	1	2	3	1
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO5	3	2	3	-	1	-	-	-	-	-	-	1	1	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

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CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	2	-	-	-	3	-	-	-	-	-	-	3
CO4	-	-	3	-	-	-	3	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	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

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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.
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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