

PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018
(AUTONOMOUS)
B.E – AGRICULTURE ENGINEERING
REGULATIONS 2016
CHOICE BASED CREDIT SYSTEM
CURRICULUM
SEMESTER V

S.No	Category	Course Code	Course Title	L	T	P	C
THEORY							
1	PC	AI16501	Irrigation Engineering	3	0	0	3
2	PC	AI16502	Operation of Farm Machinery and Equipments	3	0	0	3
3	PC	AI16503	Post-Harvest Technology	3	0	0	3
4	HS	AI16504	Environmental Science and Engineering	3	0	0	3
5	PC	AI16505	Soil and Water Conservation Engineering	3	0	0	3
6	ES	ME16509	Refrigeration & Air conditioning	3	0	0	3
PRACTICALS							
7	PC	AI16506	Drawing of Farm Structures	0	0	4	2
8	ES	AI16507	Soil Mechanics and Water Quality Laboratory	0	0	4	2
9	EE	EN16501	Career Development Laboratory - I	0	0	2	1
10	EE	AI16508	Industrial Training (minimum 2 wks V sem break)	0	0	2	1
			TOTAL	18	0	12	24

SEMESTER VI

S.No	Category	Course Code	Course Title	L	T	P	C
THEORY							
1	PC	AI16601	Food and Dairy Process Engineering	3	0	0	3
2	PC	AI16602	Bio and Thermo-Chemical Conversion of Biomass	3	0	0	3
3	PC	AI16603	Groundwater and Drainage Engineering	3	0	0	3
4	PC	AI16604	IT in Agricultural Systems	3	0	0	3
5	PC	AI16605	Design of Farm Machinery and Equipments	3	2	0	4
6	PC	AI16606	Storage and Package Engineering	3	0	0	3
7	OE	AI1690*	Open Elective - I	3	0	0	3
PRACTICALS							
8	PC	AI16607	Operation and Maintenance of Farm Machinery Laboratory	0	0	4	2
9	PC	AI16608	Biomass Energy Conversion Laboratory	0	0	2	1
10	EE	EN16601	Career Development Laboratory - II	0	0	2	1
			TOTAL	21	2	8	26

OPEN ELECTIVE (OE) - I

Category	Course Code	Course Title	L	T	P	C
OE	AI16901	Energy Management in Agriculture	3	0	0	3
OE	AI16902	Climate Change and Adaptation	3	0	0	3
OE	AI16903	Professional Ethics in Agriculture Engineering	3	0	0	3
OE	AI16904	System Analysis and Soft Computing in Agriculture 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.

CO/PO Mapping :

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
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	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	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 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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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

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CO3	2	-	-	-	-	-	-	3	-	2	-	-	3	-
CO4	-	-	-	-	-	-	-	-	-	3	2	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	3	-	2	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 - gabions; 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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CO2	-	3	2	-	-	-	-	-	-	-	-	3	3	2
CO3	2	3	-	-	-	2	-	-	-	-	-	-	3	2
CO4	-	3	2	-	-	2	-	-	-	-	-	3	3	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	2



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 fluoro 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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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



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.

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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

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

COURSE OBJECTIVES

- To understand their capabilities and enhance their grooming and showcasing his/her capabilities to a prospective employer.
- To provide opportunity for the students to become acquainted with corporate opportunities relevant to their academic learning.
- To articulate their thoughts on a given topic - in English and also to make decent write ups in English on any given topic.
- To practice and score well in Aptitude tests conducted by corporate / prospective employers.
- To prepare for any group discussion evaluation or presenting their credentials during a face -to- face interview leading to selection and employment.

UNIT I BASICS - SELF ANALYSIS**10**

Introduction - Self Explorations - Who Am I, Personal Attributes, Self Confidence and Self Esteem; Communication Skills - Introduction to communication - Flow of communication, Listening, Barriers of communications - How to overcome the barriers of communications; Leadership Qualities - Skills for a good Leader - Leadership styles - SWOT Analysis; Time Management - Time is a resource - Identify Time wasters - Time Management Styles - Techniques for better time management; Group Dynamics/ Team Building - Importance of group in organizations - Team Building - Interaction with the team - How to build the good team.

UNIT II PERSONALITY DEVELOPMENT**5**

Motivation - Introduction - Relevance and types of motivation - Analysis of motivation; Attitude - Factors - Influencing Attitude - Challenges and lessons from attitude; Creativity - Out of box thinking - Lateral thinking; Goal Setting - Wish list - Blue print for success - Short, long, life time goals.

UNIT III QUANTITATIVE APTITUDE**5**

Number System - LCM & HCF - Square root & Cube root - Percentage - Time speed & Distance

UNIT IV QUANTITATIVE APTITUDE**5**

Trains - Boats & Streams - Average - Ages – Area

UNIT V LOGICAL AND VERBAL REASONING**5**

Series Completion - Number Series, Letter series, Symbol Series; Blood Relation - Coding and decoding - Logical Sequence - Analogy - Character Puzzles - Classification - Data sufficiency.

TOTAL PERIODS 30**COURSE OUTCOMES**

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

- Demonstrate aptitude and reasoning skills
- Enhance verbal and written ability
- Improve his/her grooming and presentation skills
- Interact effectively on any recent event / happenings / current affairs.
- Be a knowledgeable person on the various evaluation processes leading to employment and face the same with Confidence.

TEXT BOOKS

1. Agarwal, R.S., "A modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.
2. Abhijit Guha, "Quantitative Aptitude", Tata-Mcgraw Hill.
3. Word Power Made Easy By Norman Lewis, W.R. Goyal Publications.
4. Johnson, D.W. "Reaching out - Interpersonal Effectiveness and self actualization", Boston: Allyn and Bacon.
5. Agarwal, R.S. "Objective General English", S.Chand & Co

REFERENCES

1. Infosys Campus Connect Program - students guide for soft skills

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



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

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



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.

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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



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.

CO/PO Mapping

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CO1	3	2	1	-	-	-	-	-	-	-	2	3	3	2
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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



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's Forchimer 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



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 CO₂ consumption - for on-line measurement of plant growth; Models of plant production - expert systems and crop doctors.

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT 9

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

UNIT IV WEATHER PREDICTION MODELS 9

Weather & Climate - Climate variability & climate change - Importance of climate variability; Forecasting - 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.

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



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 hollow 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 - McKee's 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. and Rohrbach R.P. “Engineering Principles of Agricultural Machines”, Revised Printing by American Society of Agricultural Engineers. 1993.
3. Gary Krutz, Lester Thompson and Paul Clear., “Design of Agricultural Machinery”, John Wiley and Sons, New York, 1984.

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



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.

CO/PO Mapping

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COs	Programmes Outcomes(POs)													
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	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



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 briquilliting 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 - CO₂ and H₂S 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 briquilliting techniques.
- Understand various gasifiers and pyrolysis process.
- Have knowledge on different waste recovery systems.

**CO/PO Mapping**

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	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
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

COURSE OBJECTIVES

- To understand their capabilities and enhance their grooming and showcasing his/her capabilities to a prospective employer.
- To provide opportunity for the students to become acquainted with corporate opportunities relevant to their academic learning.
- To articulate their thoughts on a given topic - in English and also to make decent write ups in English on any given topic
- To practice and score well in Aptitude tests conducted by corporate / prospective employers
- To prepare for any group discussion evaluation or presenting their credentials during a face -to- face interview leading to selection and employment
- To become a knowledgeable person on the various evaluation processes leading to employment

UNIT I CORPORATE READINESS**10**

Business communication - Email, Paragraph, Letter Writing Skills; Public speaking skills - Rules of Public speaking skills - Extempore - JAM; Inter and intra personal skills - Introduction - Need for Inter and Intra personal skills in organizations - Stress management - Causes of stress and its impact, How to manage and distress, Circle of control, stress busters; Emotional Intelligence - What is emotional Intelligence, Why Emotional Intelligence Matters, Managing Emotions.

UNIT II INTERVIEW SKILLS**5**

Interview Basics - General Selection process, Grooming, Dress code, Supporting Documents to carry; Resume Building - Impact of Powerful CV, Do's and don'ts in CV; Group Discussion - Introduction to GD, Important of Listening and Speaking skills, Do's and Don'ts in GD; Face to face interview / Hire me - Rules for face to face interview, body language, Self Introduction; Psychometric Assessment - Importance of Psychometric assessment, Why psychometric assessment.

UNIT III QUANTITATIVE APTITUDE**5**

Simplification - Time and work - Pipes and cisterns - Ratio and Proportion - Partnership.

UNIT IV QUANTITATIVE APTITUDE**5**

Simple interest and Compound interest - Profit and loss - Permutation and combination; Probability - Calendar.

UNIT V LOGICAL AND VERBAL REASONING**5**

Seating arrangement - Direction - Arithmetic reasoning - Syllogisms - Making Judgments - Statements and conclusions - Matching definition - Cause and effect.

TOTAL PERIODS 30**COURSE OUTCOMES**

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

- Demonstrate aptitude and reasoning skills
- Enhance verbal and written ability
- Improve his/her grooming and presentation skills
- Interact effectively on any recent event / happenings / current affairs
- Be a knowledgeable person on the various evaluation processes leading to employment and face the same with Confidence.

TEXT BOOKS

1. Agarwal, R.S., "A modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.
2. Abhijit Guha, "Quantitative Aptitude", Tata-Mcgraw Hill.
3. Word Power Made Easy By Norman Lewis, W.R. Goyal Publications.
4. Johnson, D.W. "Reaching out - Interpersonal Effectiveness and self actualization", Boston: Allyn and Bacon.
5. Agarwal, R.S. "Objective General English", S.Chand & Co

REFERENCES

1. Infosys Campus Connect Program - students guide for soft skills.
2. Mitra, barun.k, "Personal Development & Softskills", Oxford University.

CO/PO Mapping

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	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	3	3	1	-	-	-	-	-	-	3	2
CO2	-	2	3	-	2	-	2	-	-	-	-	-	3	2
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	3
CO4	3	2	2	-	-	1	-	-	-	-	2	-	2	3
CO5	2	3	3	2	1	3	3	1	-	1	2	-	2	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 - 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; Impact assessment 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.

UNIT V ENERGY AUDIT AND CASE STUDIES 9

Energy audit - definition - need - types of energy audit - pre and detailed - Energy audit instruments; Identification of Energy Conservation Opportunities - Classification and evaluation of Energy Conservation Measures; Reporting Format - Description of production process, Energy 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 acquaintance about 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.

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. Wayne C. Turner, “Energy management handbook”, John Wiley and Sons, 2001.
3. Barun Kumar De., “Energy Management, Audit and Conservation”, (Kindle eBook), 2015.

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.

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



COURSE OBJECTIVES

- To understand the characteristics of atmosphere and its 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; UNFCCC - 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 - CO₂ - 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 its 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.

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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



COURSE OBJECTIVES

- To create an exposure on Human Values.
- To equip with Engineering Ethics and its related theories.
- To instil Moral and social responsibility of engineer.
- 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.

TEXT BOOKS

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 and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility", McGraw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	-	-	-	2	-	3	2	2	2	-	-	1
CO2	3	-	-	1	2	-	2	3	-	2	-	2	-	-
CO3	-	3	3	-	-	3	-	3	2	-	1	1	-	-
CO4	2	3	3	2	1	2	1	3	2	1	1	2	-	-
CO5	1	2	2	2	1	3	2	3	1	1	2	2	-	-



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 for 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 - characteristics of systems - Scope and steps in systems engineering - Need for systems approach to agriculture.

UNIT II LINEAR PROGRAMMING & DYNAMIC PROGRAMMING 9

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

UNIT III SIMULATION 9

Basic principles and concepts - Random variate and random process - Monte Carlo techniques - Model development - Inputs and outputs - Deterministic and stochastic simulation - Simulations modeling in agriculture.

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 hetero-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 - inference in fuzzy logic - Fuzzy implications and Fuzzy algorithms - Fuzzy Controller - Industrial applications; Genetic Algorithm (GA) - Basic concepts - working principle - procedures - flow chart - Genetic representations - encoding - Initialization and selection - Genetic operators - Mutation - applications.

TOTAL PERIODS 45**COURSE OUTCOMES**

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

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

TEXT BOOKS

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

REFERENCES

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

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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

