PAAVAI ENGINEERING COLLEGE NAMAKKAL – 637018

AUTONOMOUS

DEPARTMENT OF AGRICULTURE ENGINEERING

REGULATIONS 2015

CURRICULUM

SEMESTER V

S.No	Category	Course Code	Course Title	L	T	P	C
THEORY							
1	PC	AI15501	Irrigation Engineering	3	0	0	3
2	PC	AI15502	Operation of Farm Machinery and Equipments	3	0	0	3
3	PC	AI15503	Post Harvest Technology	3	0	0	3
4	HS	AI15504	Environmental Science and Engineering	3	0	0	3
5	PC	AI15505	Groundwater and Drainage Engineering	3	0	0	3
6	ES	ME15509	Refrigeration & Air conditioning	3	0	0	3
PRACTICALS							
7	PC	AI15506	Operation and Maintenance of Farm Machinery Laboratory	0	0	4	2
8	ES	AI15507	Soil Mechanics and Water Quality Laboratory	0	0	4	2
9	EE	EN15501	Career Development Laboratory-I	0	0	2	1
			TOTAL	**18**	**0**	**10**	**23**

SEMESTER VI

S.No	Category	CourseCode	CourseTitle	L	T	P	C
THEORY							
1	PC	AI15601	Food and Dairy Process Engineering	3	0	0	3
2	PC	AI15602	Bio and Thermo-Chemical Conversion of Biomass	3	0	0	3
3	PC	AI15603	Storage and Package Engineering	3	0	0	3
4	PC	AI15604	IT in Agricultural Systems	3	0	0	3
5	PC	AI15605	Design of Farm Machinery and Equipments	3	2	0	4
6	OE	AI1515*	Open Elective-I	3	0	0	3
PRACTICALS							
7	PC	AI15606	Biomass Energy Conversion Laboratory	0	0	2	1
8	EE	EN15601	Career Development Laboratory-II	0	0	2	1
9	EE	AI15607	Industrial Training (minimum two weeks V sem break)	0	0	2	1
			TOTAL	**18**	**2**	**6**	**22**

LIST OF OPEN ELECTIVES

OPEN ELECTIVE-I

CATEGORY	COURSE CODE	COURSE TITLE	L	T	P	C
OE	AI15151	Energy Management In Agriculture	3	0	0	3
OE	AI15152	Climate Change And Adaptation	3	0	0	3
OE	AI15153	Professional Ethics In Agriculture Engineering	3	0	0	3
OE	AI15154	System Analysis And Soft Computing In Agriculture Engineering	3	0	0	3

SEMESTER V

AI15501 IRRIGATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I WATER RESOURCES AND IRRIGATION REQUIREMENT 9

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

UNIT II METHODS OF IRRIGATION 12

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

UNIT III DIVERSION AND CONTROL STRUCTURES 9

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

UNIT IV CANAL, TANK IRRIGATION AND COMMAND AREA DEVELOPMENT 9

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

UNIT V SPECIAL IRRIGATION SYSTEM 6

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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

AI15502 OPERATION OF FARM MACHINERY AND EQUIPMENTS 3 0 0 3

COURSE OBJECTIVES

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

UNIT I TRACTOR AND POWER TILLER 9

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

UNIT II TILLAGE EQUIPMENTS 9

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

UNIT III MACHINE DYNAMICS AND HITCHING 9

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

UNIT IV EQUIPMENTS FOR OTHER OPERATIONS 9

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

UNIT V EQUIPMENTS FOR SPECIAL OPERATIONS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

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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

AI15503 POST HARVEST TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

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

UNIT I FUNDAMENTALS OF POST HARVESTING 9

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

UNIT II PSYCHROMETRY AND DRYING 9

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

UNIT III CLEANING AND GRADING 9

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

UNIT IV MATERIAL HANDLING 9

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

UNIT V PADDY AND CROP PROCESSING 9

Paddy processing - parboiling of paddy - methods - merits and demerits - de-husking of paddy -methods - merits and demerits - rice polishers - types - constructional details - polishing - layout of modern rice mill - wheat milling - pulse milling methods - oil seed processing - extraction methods, refining and hydrogenation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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

AI15504 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

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

UNIT II ENVIRONMENTAL POLLUTION 10

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

UNIT III NATURAL RESOURCES 10

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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

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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

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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

AI15505 GROUND WATER AND DRAINAGE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I HYDRO-GEOLOGIC PARAMETERS 9

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

UNIT II HYDRAULICS OF WELLS 10

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

UNIT III WELLS AND WELL DRILLING 9

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

UNIT IV SURFACE DRAINAGE 8

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

UNIT V SUB SURFACE DRAINAGE 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

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

TEXTBOOKS

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

REFERENCES

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

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

ME15509 REFRIGERATION AND AIR CONDITIONING 3 0 0 3

COURSE OBJECTIVES

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

UNIT-I REFRIGERATION PRINCIPLES 9

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

UNIT-II VAPOUR COMPRESSION REFRIGERATION AND COMPONENTS 9

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

UNIT-III REFRIGERANTS AND VAPOUR ABSORPTION CYCLE 9

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

UNIT-IV PSYCHROMETRY 9

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

UNIT-V AIR CONDITIONING SYSTEM 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXT BOOKS

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

REFERENCES

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

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

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

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

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

TOTAL PERIODS 60

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

LIST OF EQUIPMENTS REQUIRED

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

CO/PO Mapping

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

AI15507 SOIL MECHANICS AND WATER QUALITY LABORATORY 0 0 4 2

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

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

TOTAL PERIODS 60

COURSE OUTCOMES

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

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

REFERENCE BOOKS

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

LIST OF EQUIPMENTS REQUIRED

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

CO/PO Mapping

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

EN15501 CAREER DEVELOPMENT LABORATORY - I 0 0 2 1

COURSE OBJECTIVES

To enable students to

- enhance their own potential strength and reduce weakness to survive in corporate world
- evaluate their own personality skills to face the interviews in a successful way
- solve the quantitative aptitude problems and improve their problem-solving skills
- solve the quantitative aptitude in advance level tests to get placed in Tier 1 companies
- improve their reasoning skills to get placed in reputed companies

UNIT I PERSONALITY DEVELOPMENT 1 6

Introduction - self explorations - character building - self-esteem- self-confidence- positive thinking - leadership qualities- time management.

UNIT II PERSONALITY DEVELOPMENT 2 6

Grooming- role play - good etiquettes - extempore - writing skills: email, paragraph - team building- body language - non-verbal communication

UNIT III QUANTITATIVE APTITUDE (QA) 1 6

Time , speed & distance -- simple interest & compound interest - percentage - height & distance - time & work - number systems - L.C.M & HCF - ratio proportion- area - directions.

UNIT IV LOGICAL REASONING (LR) 1 6

Analogies - letter & symbol series - number series - cause & effect - essential part - verbal reasoning.

UNIT V VERBAL REASONING (VR) 1 6

Blood relation - Venn diagrams - analogy - character puzzles - logical sequence - classification -verification of truth - seating arrangement.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- demonstrate the interpersonal skills in Group Discussions
- enhance their verbal and written ability
- practice soft skills to excel in their jobs
- compute problems based on quantitative aptitude
- reveal their logical and verbal reasoning by scoring the expected percentage to get placed in reputed companies

REFERENCE BOOKS

1. Agarwal, R.S." A modern approach to verbal &Non verbal reasoning", S.Chand& Co Ltd, New Delhi.
2. AbhijitGuha, "Quantitative aptitude", Tata-Mcgraw Hill.
3. Word Power Made Easy by Norman Lewis, WR.Goyal Publications.
4. Johnson, D.W. (1997) Reaching out - Interpersonal effectiveness and Self Actualization, Boston: Allyn and Bacon.
5. Agarwal, R.S. " Objective general English", S.Chand& Co
6. Infosys campus connect program - Students' Guide for Soft Skills.

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	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	-	-	3	-	-	-	-	2	-	2	3
CO5	2	3	3	2	1	1	3	1	-	1	2	-	2	3

SEMESTER VI

AI15601 FOOD AND DAIRY PROCESS ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I FOOD AND ITS PROPERTIES, REACTION AND KINETICS 9

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

UNIT II PROCESSING AND PRESERVATION OF FOODS 10

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

UNIT III PROPERTIES AND PROCESSING OF MILK 9

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

UNIT IV DAIRY PRODUCTS 9

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

UNIT V QUALITY CONTROL 8

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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

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

COURSE OBJECTIVES

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

UNIT I BIOMASS CHARACTERIZATION 9

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

UNIT II BIOCHEMICAL CONVERSION 9

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

UNIT III THERMO-CHEMICAL CONVERSION BY COMBUSTION 9

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

UNIT IV THERMO-CHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS 9

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

UNIT V CO-GENERATION AND WASTE HEAT RECOVERY 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXT BOOKS

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

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

REFERENCES

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

CO/PO Mapping

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

AI15603 STORAGE AND PACKAGE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I INTRODUCTION AND STORAGE STRUCTURES 10

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

UNIT II CONTROLLED ATMOSPHERE STORAGE 8

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

UNIT III INTRODUCTION TO PACKAGING 9

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

UNIT IV FOOD CONTAINERS 9

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

UNIT V FILLING SYSTEMS AND LABELLING 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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

AI15604 IT IN AGRICULTURAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

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

UNIT I PRECISION FARMING 9

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

UNIT II ENVIRONMENT CONTROL SYSTEMS 9

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

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT 9

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

UNIT IV WEATHER PREDICTION MODELS 9

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

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	3	-	-	-	-	3	-	-	3	2
CO2	-	3	-	3	-	-	-	-	-	-	-	-	-	3
CO3	-	3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	3	3	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	2	-	3	-	-	-	-	-	-	3

AI15605 DESIGN OF FARM MACHINERY AND EQUIPMENTS 3 2 0 4

COURSE OBJECTIVES

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

UNIT I FUNDAMENTALS OF MACHINE DESIGN 9

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

UNIT II DESIGN OF FASTENINGS 9

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

UNIT III DESIGN OF POWER TRANSMISSION SYSTEM 9

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

UNIT IV DESIGN OF SHAFTS AND COUPLINGS 9

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

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

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

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

REFERENCES

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

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

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

CO/PO Mapping

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

AI15606 BIOMASS ENERGY CONVERSION LABORATORY 0 0 2 1

COURSE OBJECTIVES

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

LIST OF EXPERIMENTS

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

TOTAL PERIODS 30

COURSE OUTCOMES

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

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

REFERENCES

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

CO/PO Mapping

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

EN15601 CAREER DEVELOPMENT LABORATORY – II 0 0 2 1

COURSE OBJECTIVES

To enable students to

- enhance their own potential strength and reduce weakness to survive in corporate world
- evaluate their own personality skills to face the interviews in a successful way
- solve the quantitative aptitude problems and improve their problem-solving skills
- solve the quantitative aptitude in advance level tests to get placed in Tier 1 companies
- improve their reasoning skills to get placed in reputed companies

UNIT I CORPORATE READINESS 6

Business communication - inter & intra personal skills - business etiquettes - corporate ethics - communication media etiquette.

UNIT II INTERVIEW SKILLS 6

Resume building - group discussions - presentation skills - entrepreneur skills - psychometric assessment - mock interview.

UNIT III QUANTITATIVE APTITUDE (QA) 2 6

Profit & loss - clock - power & square roots - train - boats & streams - probability - calendars - permutations & combinations - partnership - simplification - pipes & cisterns - puzzles.

UNIT IV LOGICAL REASONING (LR) 2 6

Statements & assumptions - matching definitions - logical games - making judgements - statements & conclusions - verbal classifications.

UNIT V VERBAL REASONING (VR) 2 6

Syllogisms - data sufficiency - dice - series completion - character puzzles - cube & cuboid - arithmetic reasoning.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- demonstrate the interpersonal skills in Group Discussions
- enhance their verbal and written ability
- practice soft skills to excel in their jobs
- compute problems based on quantitative aptitude
- reveal their logical and verbal reasoning by scoring the expected percentage to get placed inreputed companies

REFERENCES

1. Agarwal, R.S.” A modern approach to verbal &Non verbal reasoning”, S.Chand& Co Ltd, New Delhi.
2. AbhijitGuha, “Quantitative aptitude”, Tata-Mcgraw Hill.
3. Word Power Made Easy by Norman Lewis, WR.Goyal Publications.
4. Johnson, D.W. (1997) Reaching out - Interpersonal effectiveness and Self Actualization, Boston: Allyn and Bacon.
5. Infosys campus connect program - Students’ Guide for Soft Skills.
6. Mitra, Barun.K, “ Personality Development & Soft skills” , Oxford University.

CO/PO Mapping

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

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

COURSE OBJECTIVES

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

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

TOTAL PERIDS:30

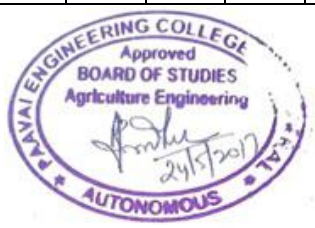
COURSE OUTCOME

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

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

CO/PO Mapping:

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



AI15151 ENERGY MANAGEMENT IN AGRICULTURE 3 0 0 3

COURSE OBJECTIVES

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

UNIT I ENERGY RESOURCES IN THE FARM 9

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

UNIT II ENERGY ANALYSIS AND ASSESSMENT 9

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

UNIT III ENERGY CONSERVATION AND PLANNING 9

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

UNIT IV ENERGY MANAGEMENT 9

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

UNIT V ENERGY AUDIT AND CASE STUDIES 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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

AI15152 CLIMATE CHANGE AND ADAPTATION 3 0 0 3

COURSE OBJECTIVES

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

UNIT I EARTH'S CLIMATE SYSTEM 9

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

UNIT II ATMOSPHERE AND ITS COMPONENTS 9

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

UNIT III IMPACTS OF CLIMATE CHANGE 9

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

UNIT IV OBSERVED CHANGES AND ITS CAUSES 9

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

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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

AI15153 PROFESSIONAL ETHICS IN AGRICULTURE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

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

UNIT I HUMAN VALUES 10

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

UNIT II ENGINEERING ETHICS 9

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

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

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

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

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

UNIT V GLOBAL ISSUES 8

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

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

REFERENCES

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

CO/PO Mapping

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

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

COURSE OBJECTIVES

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

UNIT I SYSTEM CONCEPTS 9

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

UNIT II LINEAR PROGRAMMING & DYNAMIC PROGRAMMING 9

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

UNITIII SIMULATION 9

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

UNIT IV NEURAL NETWORKS 9

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

UNIT V FUZZY LOGIC AND GENETIC ALGORITHM 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXT BOOKS

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

REFERENCES

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

CO/PO Mapping

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