PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018
(AUTONOMOUS)
B.E – AGRICULTURE ENGINEERING
REGULATIONS 2019
CURRICULUM
(For candidates admitted during the Academic Year 2019-2020)
(CHOICE BASED CREDIT SYSTEM)

SEMESTER V

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	PC	AI19501	Operation of Farm Machinery and Equipments	3	0	0	3
2.	PC	AI19502	Soil Science and Engineering	3	0	0	3
3.	PC	AI19503	Unit Operations in Agricultural Processing	3	0	0	3
4.	PC	AI19504	Bio and Thermo-Chemical Conversion of Biomass	3	0	0	3
5.	PC	AI19505	Applications of IT in Agricultural System	3	0	0	3
6.	PC	AI19506	Irrigation and Drainage Engineering	3	0	0	3
Practical							
7.	PC	AI19507	Operation of Farm Machinery and Equipment Laboratory	0	0	2	1
8.	PC	AI19508	CAD Laboratory for Agriculture Engineering	0	0	4	2
9.	EE	EN19501	Career Development Laboratory I	0	0	2	1
			TOTAL	**18**	**0**	**8**	**22**

SEMESTER VI

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	PC	AI19601	Design of Farm Machinery and Equipments	3	1	0	4
2.	PC	AI19602	Soil and Water Conservation Engineering	3	0	0	3
3.	PC	AI19603	Post Harvest Technology	3	0	0	3
4.	PE	AI1961*	Professional Elective I	3	0	0	3
5.	PE	AI1962*	Professional Elective II	3	0	0	3
6.	OE	AI1990*	Open Elective-I	3	0	0	3
Practical							
7.	PC	AI19604	Soil Mechanics and Water Quality Laboratory	0	0	4	2
8.	EE	EN19601	Career Development Laboratory II	0	0	2	1
9.	EE	AI19605	Internship Training(Two Weeks During 5 Semester-Winter)	0	0	2	1
			TOTAL	**18**	**1**	**8**	**23**

OPEN ELECTIVE (OE)

OPEN ELECTIVE -I

Category	Course Code	Course Title	L	T	P	C
OE	AI19901	Agricultural waste Management	3	0	0	3
OE	AI19902	Energy Management in Agriculture	3	0	0	3

PROFESSIONAL ELECTIVE (PE)

ELECTIVE – I

Category	Course Code	Course Title	L	T	P	C
PE	AI19151	Storage And Packaging Engineering	3	0	0	3
PE	AI19152	Industrial Safety Management	3	0	0	3
PE	AI19153	Farm Power and Machinery Management	3	0	0	3
PE	BA19154	Entrepreneurship Development	3	0	0	3

ELECTIVE – II

Category	Course Code	Course Title	L	T	P	C
PE	AI19251	Food and Diary Process Engineering	3	0	0	3
PE	AI19252	Special Farm Machinery and Equipment	3	0	0	3
PE	AI19253	Energy and Environmental Auditing and its Management	3	0	0	3
PE	AI19254	On-Farm Water Management	3	0	0	3

AI19501 OPERATION OF FARM MACHINERY AND EQUIPMENTS 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I FARM MECHANIZATION, TRACTOR AND POWER TILLER 9

Farm mechanization – objectives, scope and importance; Tractors - Selection and Classification, identificationof 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, verticaland 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
- describe the sufficient knowledge on machine dynamics.
- identify 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.

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.
4. Ojha,T.P. and A.M.Michael, "Principles of Agricultural Engineering Volume-I", Jain Brothers, New Delhi,2014.

CO/PO Mapping

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

AI19502 SOIL SCIENCE AND ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I INTRODUCTION AND SOIL PHYSICS 9

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

UNIT II SOIL CLASSIFICATION AND SURVEY 9

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

UNIT III PHASE RELATIONSHIP AND SOIL COMPACTION 9

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

UNIT IV ENGINEERING PROPERTIES OF SOIL 9

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

UNIT V BEARING CAPACITY AND SLOPE STABILITY 9

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- identify the soil physical parameters and classification of soils.
- apply the procedures involved in soil survey, field soil mapping and suitability of soil.
- classify the soil types and compaction procdures.
- analyse engineering properties of soil .
- apply the concepts of bearing capacity, slope stability in agriculture lands.

TEXTBOOKS

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

REFERENCES

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

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

AI19503 UNIT OPERATIONS IN AGRICULTURAL PROCESSING 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I EVAPORATION AND CONCENTRATION 9

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

UNIT II FILTRATION AND SEDIMENTATION 9

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

UNIT III SIZE REDUCTION 9

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

UNIT IV PROCESSING 9

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

UNIT V CRYSTALLISATION AND DISTILLATION **9**

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXTBOOKS

1. Earle, R.L., "Unit operations in Food Processing", Pergamon Press, Oxford, U.K, 1985.
2. Sahay. K.M. and Singh, K.K., "Unit Operations of Agricultural Processing", Vikas Publishing House Pvt.Ltd., New Delhi, 2008.

REFERENCE

1. Coulson, J.M., and Richardson, J.F., "Chemical Engineering", Vol. 1, ThePergamonress New York,1977.
2. McCabe, W.L., and Smith, J.C., "Unit Operations of Chemical Engineering", Mc-Graw-Hill Inc.,Kosaido Printing Ltd., Tokyo, 1990.

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

AI19504 BIO AND THERMO-CHEMICAL CONVERSION OF BIOMASS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- impart understanding of Biomass characterization and its processing.
- expose different biochemical conversion process and utilities of biogas.
- understand the gasification and combustion technology of MSW.
- generate knowledge on different types of thermo-chemical conversion techniques.
- 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 - transportationand 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 andMunicipal 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 wasteheat 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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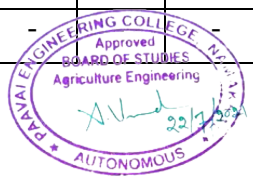
Cos	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	3	2
CO4	3	2	-	3	-	-	-	-	-	-	-	-	3	2
CO5	-	-	-	-	3	-	-	-	-	-	-	3	-	3



AI19505 APPLICATIONS OF IT IN AGRICULTURAL SYSTEM 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I IT IN PRECISION AGRICULTURE 9

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

UNIT II ENVIRONMENT CONTROL SYSTEMS 9

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

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT 9

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

UNIT IV WEATHER PREDICTION MODELS 9

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

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

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

TEXT BOOKS

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

REFERENCES

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

CO/PO Mapping:

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

AI19506 IRRIGATION AND DRAINAGE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

- inculcate water resources development and various parameters required for irrigation scheduling and its requirement
- understand different kinds of irrigation system and choose appropriate system for a given environment.
- introduce different types of water control and diversion structures for planning the irrigation system.
- understand canal, tank irrigation and command area development.
- understand the basic concepts for planning, design and management of land drainage works in field areas

UNIT I WATER RESOURCES AND IRRIGATION REQUIREMENT 9

Water Resources - River basins, Development and Utilisation in India; Irrigation - Definition, Advantage and Disadvantages; Duty, Delta and Crop Water requirement; Evaporation and Evapotranspiration (ET); Effective Rainfall, Factors Affecting Effective Rainfall; Scheduling – Irrigation water Requirement and Irrigation Efficiencies.

UNIT II METHODS OF IRRIGATION 9

Methods of Irrigation - Surface, Subsurface and Pressurised methods; Surface Methods - flooding, border, basin, Hydraulics and Designs of Furrow Irrigation; Subsurface - Underground pipeline irrigation system; Pressurised – Designing of Drip and Sprinkler systems, Greenhouse and its irrigation system; Automation irrigation system-Surge and Cablegation methods.

UNIT III DIVERSION AND CONTROL STRUCTURES 9

Water control and diversion structure – Head works, Weirs and Barrage, Dams - Factors affecting the location of dams, Forces acting on a dam, Earth dams, Arch dams; Spillways and Energy dissipaters.

UNIT IV CANAL, TANK IRRIGATION AND COMMAND AREA DEVELOPMENT 9

Classification of canals, Alignment of canals, Design of irrigation canals, Regime theories, Kennedy's and Lacey's theory, Canal head works and regulators, Canal drops, Cross drainage works, 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; Warabandi and rotational irrigation system.

UNIT V AGRICULTURAL DRAINAGE SYSTEM 9

Agricultural drainage - Drainage coefficient, principles of flow through soils, Darcy's law, infiltration theory; Surface drainage methods- design of open drain; Subsurface drainage - mole drains, drainage wells, Pipe and envelope materials; Land reclamation - methods of Reclamation, Leaching Requirements.

TOTALPERIODS 45

COURSE OUTCOMES

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

- estimate the irrigation efficiency and water requirements of the irrigation system.
- design the advance automation irrigation system
- identify the suitable diversion and water control structures for agricultural land
- design the canal irrigation system and command area development
- construct the advanced drainage system with components.

TEXTBOOKS

1. Michael, A.M., "Irrigation- Theory and practices", Vikas Publishers, New Delhi, 2010.
2. 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. Ritzema, H.P., "Drainage Principles and Applications", Publication No. 16, International Institute of Land Reclamation and Improvement, Netherlands, 1994.
3. Dilip Kumar Majumdar., "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
4. Bhattacharya, A.K., and Michael, A.M., "Land Drainage – Principles, Methods and Applications", Konark Publishers Pvt. Ltd., New Delhi, 2003.

CO/PO Mapping

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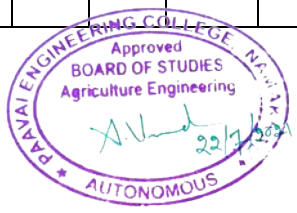
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	2	2	1	1	-	-	-	-	-	1	-	2
CO2	2	3	2	2	1	1	-	-	-	-	-	1	-	1
CO3	1	2	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	2	3	1	-	-	-	-	-	-	-	2	-	1
CO5	2	1	3	2	-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



AI19508 CAD LABORATORY FOR AGRICULTURAL ENGINEERING 0 0 4 2

COURSE OBJECTIVES

To enable students to

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

LIST OF EXPERIMENTS

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

TOTALPERIODS 60

COURSE OUTCOMES

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

- draft the farm machinery and structures by using computers.
- get an idea about design of post harvesting units and check dams.
- draw the components of irrigation systems using CAD.
- get trained on 3D modelingsoftwares.

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

AI19507 OPERATION OF FARM MACHINERY AND EQUIPMENT LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable students to

- practice different operations in tractor, power tiller and studying various components of them.
- study field operations of primary and secondary tillage implements and their adjustments.
- have knowledge on field operation of land farming, sowing, plant protection equipments and theiradjustments.
- learn operation of various types of sprayers, dusters, weeders and trailers in field level.
- 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 powertiller.
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 30

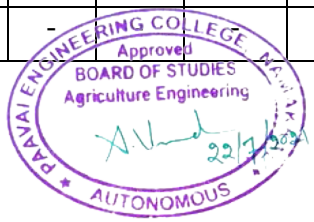
COURSE OUTCOMES

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 equipment’s.
- depict the requirement of repair, maintenance and off-season storage of farm equipment.

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



EN 19501 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 BASICS - SELF ANALYSIS 6

Introduction - Self Explorations-Who Am I; Know yourself; SWOT Analysis – Corporate resume building – Group Discussion: Level – 0 – Role Play: Team

UNIT II PERSONALITY DEVELOPMENT 6

Just A Minute (JAM): Level 0-Extempore – Johari Window Model – Goal Setting – Achievement worksheet – Group Discussion: Leve-1 - Mock Interview Practice: Level 0

UNIT III QUANTITATIVE APTITUDE I 6

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

UNIT IV QUANTITATIVE APTITUDE II 6

Trains - Boats & Streams – Average – Ages - Area

UNIT V LOGICAL AND VERBAL REASONING 6

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

Upon completion of the 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

TEXTBOOKS

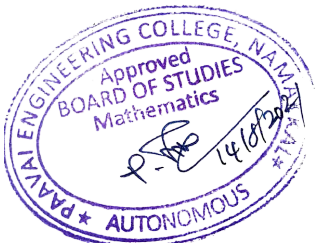
- Agarwal, R.S.” a modern approach to Verbal & Non Verbal Reasoning”, S.Chand& Co Ltd, new delhi
- Agarwal, R.S. “ Objective General English”, S.Chand&Co

REFERENCES

- Abhijit Guha, “Quantitative Aptitude “, Tata-Mcgraw Hill.
- Word Power Made Easy By Norman Lewis ,Wr.Goyal Publications
- Johnson, D.W. Reaching out – Interpersonal Effectiveness and self actualization. Boston: Allyn And Bacon.
- Infosys Campus Connect Program – students’ guide for soft skill

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



AI19601 DESIGN OF FARM MACHINERY AND EQUIPMENTS 3 1 0 4

COURSE OBJECTIVES

To enable students to

- provide knowledge on fundamentals of machine design in various aspects.
- furnish the details about design of joints and gears.
- acquire knowledge on couplings and shafts for various equipment's.
- understand the underlying design of energy storing elements and bearings.
- 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 12

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 12

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 bevel 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 12

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 hallowshafts based on strength and rigidity - shafts subjected to torsion, bending and combined stresses.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS & BEARINGS 12

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 -calculation of bearing dimensions.

UNIT V DESIGN OF POWER TRANSMISSION SYSTEM 12

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

TOTAL PERIODS 60

COURSE OUTCOMES

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

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

TEXT BOOKS

1. Khurmi R.S and Gupta J.K, "A Textbook of Machine Design", Euarsia publication house,2005.
2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.

REFERENCES

1. Norton R.L, "Machine Design - An Integrated Approach", Pearson Publications, 3rd Edition,2006.
2. Srivastava A.K., Goering.C.E. andRohrbach R.P. "Engineering Principles of 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.

CO/PO Mapping

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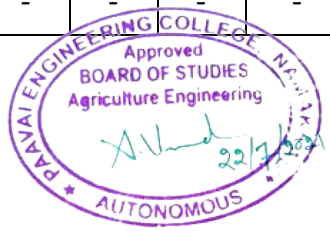
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	-	3	2	3	-	-	-	-	-	-	2	-	3
CO3	-	-	3	2	3	-	-	-	-	-	-	-	-	3
CO4	-	-	3	2	3	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-



AI19602 SOIL AND WATER CONSERVATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I SOIL EROSION PRINCIPLES 7

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 9

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

UNIT III EROSION CONTROL MEASURES 11

Soil management practices - Agronomic practices - contour cultivation - strip cropping - tillage practices; Mechanical measures for plains - contour and graded Bunding - Types and design specifications; Mechanical measures for hill slopes - Terracing - Classification and design specification of bench terrace - contour stone wall - gabbions; Grassed waterways - Location - design, construction and maintenance; Types of temporaryand 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

- analyse the various types of soil erosion and suggest the suitable preventive measures
- estimate the quantity of soil erosion.
- design the various erosion control measures.
- implement advanced water conservation techniques.
- estimate the sediment load and suggest the suitable 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.

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.
4. "Sedimentation Engineering", ASCE manual and Report on Engineering Practice No. 54, Edited by Vito A. Vanoni. ASCE publishing, 2006.

CO/PO Mapping

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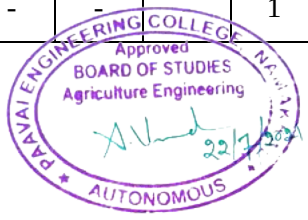
Cos	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	-	-	-	2	-	1	-	-	-	-	-	2
CO2	3	1	-	-	-	-	1	-	-	2	1	-	3	2
CO3	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	-	-	-	-	-	-	-	-	-	3	2	-	3
CO5	3	2	-	-	-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



AI19603 POST HARVEST TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

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 10

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, MATERIAL HANDLING 10

Cleaning - Principles - air screen cleaners - adjustments; Separators - cylinder - spiral - magnetic - colour sorter- inclined belt - disk - effectiveness of separation and performance index- Material handling equipments - belt conveyor - screw conveyor - chain conveyor - bucket elevators - pneumatic conveyor - principles and operation

UNIT IV POST HARVEST PROCESSING 7

Post-harvest Processing of Wheat milling - pulse milling methods - oil seed processing – Flower crops processing-extraction methods, refining and hydrogenation.

UNIT V PADDY 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.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- possess knowledge in engineering properties of agricultural produces
- apply expertise in drying process of harvested crops
- understand the cleaning and grading operation in agricultural produces
- use the different types of material handling techniques
- identify on latest trends in food grains and oil seed processing

TEXT BOOKS

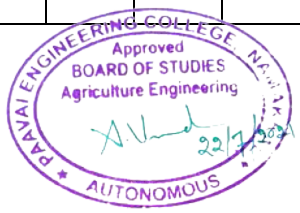
1. Chakraverty, A. "Post harvest technology for Cereals, Pulses and oilseeds" Oxford & IBH Publication Pvt Ltd, New Delhi, Third Edition, 2000.
2. Sahay, K.M., and Singh, K.K. "Unit operations of Agricultural Processing"Vikas Publishing House Pvt.Ltd., New Delhi, 1994.

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.

CO/PO Mapping

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



AI19604 SOIL MECHANICS AND WATER QUALITY LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- assess physical and engineering behaviour of soils through laboratory testing procedures.
- determine the in-situ field density of soil by various methods.
- gain knowledge on classification of soils.
- 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 Permeability by constant & variable head test
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 Ammonia 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

- analyse the engineering properties of soil through advanced tests.
- apply on various soil reclamation techniques.
- estimate the gypsum requirement for agricultural productivity
- analysis the various parameters of irrigation water and suggest the remedial measure.

CO/PO Mapping

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

EN19601 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

Writing Skills: EmailWriting - Paragraph writing -Time Management – Stress Management – JAM: Level 1 - Self Introduction – JAM: Level 2 – Buddy Presentation - Role Play: Individual

UNIT II INTERVIEW SKILLS 6

Group Discussion: Level II – Group Discussion: Level III – General – Interview Techniques - Selection process - Grooming - Dress code - Body Language – Mock Interview Practice: Level 1

UNIT III QUANTITATIVE APTITUDE I 6

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

UNIT IV QUANTITATIVE APTITUDE II 6

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

UNIT V LOGICAL AND VERBAL REASONING 6

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

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the 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

TEXTBOOKS

1. Agarwal, R.S.” a modern approach to Verbal & Non Verbal Reasoning”, S.Chand& Co Ltd, new delhi
2. Agarwal, R.S. “ Objective General English”, S.Chand&Co

REFERENCES

1. Abhijit Guha, “Quantitative Aptitude “, Tata-McGraw Hill.
2. Word Power Made Easy By Norman Lewis ,Wr.Goyal Publications
3. Johnson, D.W. Reaching out – Interpersonal Effectiveness and self actualization. Boston: Allyn and Bacon.
4. Infosys Campus Connect Program – students’ guide for soft skills

CO/PO Mapping

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programmes Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
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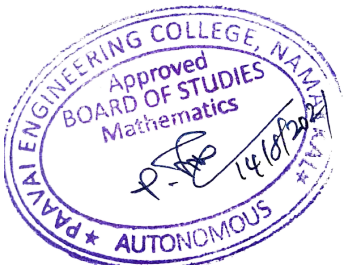
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	3
CO4	3	2	2	-	-	1	-	-	-	-	2	-	2	3
CO5	2	3	3	2	1	3	3	1	-	1	2	-	2	3



AI19605 **INTERNSHIP TRAINING** **0 0 2 1**
(Two weeks during V semester -Winter)

COURSE OBJECTIVE

To enable students to

- give training in field work by attaching to any industry / organization
- have a firsthand knowledge and practical problems in Agricultural Engineering.
- develop skills in worth ethics in communication , management and others
- gain the knowledge through hands on observation job execution

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

COURSE OUTCOME

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

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

TOTAL PERIODS 30

CO/PO Mapping

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

COs	Programmes Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	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

OPEN ELECTIVE I

AI19901 AGRICULTURAL WASTE MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- impart knowledge on various characteristics of agricultural wastes.
- know about composting techniques.
- acquire knowledge on briquetting techniques in biomass production.
- get an idea about Bio-char production and its applications.
- utilize agricultural waste for eco-friendly energy and manure production.

UNIT I CHARACTERSTICS OF AGRICULTURAL WASTE 7

Availability of different types of agriculture wastes - characteristics - classification of agrowastes based on their characteristics - its recycling and utilization potential - current constraints in collection and handling of agricultural wastes - its environmental impact.- equilibrium moisture content.

UNIT II COMPOSTING 10

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

UNIT III BIOMASS BRIQUETTING 10

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

UNIT IV BIOCHAR PRODUCTION 8

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

UNIT V BIOGAS AND BIO ETHANOL PRODUCTION 10

Screening of suitable lingo cellulosic substrate for biogas production - determination of bio-energy potential of agro-waste by estimating total solids - volatile solids - Calorific value - per cent total carbohydrates, moisture, lignin and cellulosic contents - preparation of feed stocks for anaerobic bio-digestion - types of digesters - factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from lingo cellulosic wastes - Processing of Biomass to Ethanol - pre-treatment-fermentation – distillation-Poultry waste Production.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand various eco-friendly methods for agricultural waste management.
- apply knowledge on composting methods and its uses.
- understand the biomass briquettes production technique.
- acquire knowledge on Biochar production.
- calculate nutritive value and energy production potential of agro wastes.

TEXT BOOKS

1. Raymond C Loehr, "Agricultural Waste Management- problems, processes and approaches". First edition, Academic press, 1974.
2. Diaz,l.F.,M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1-380.

REFERENCES

1. Uta Krogmann, Ina Körne and Luis F. Diaz.2010. Solid waste technology and management (Vol 1 and2). Black wel Pub Ltd., Wiley Online library.
2. P.D. Grover & S.K. Mishra, "Biomass Briquetting: Technology and Practices". Published by FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand, 1996.
3. Yong Sik Ok, Sophie M. Uchimiya, Scott X. Chang, Nanthi Bolan.," Biochar-production characterization and applications". 2015. CRC press

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

AI19902 ENERGY MANAGEMENT IN AGRICULTURE 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

- improve 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.
- use knowledge on the concept of energy audit and case studies

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.

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.
4. Barun Kumar De.,"Energy Management, Audit and Conservation",(Kindle eBook),2015.

CO/PO Mapping

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

PROFESSIONAL ELECTIVE I

AI19151 STORAGE AND PACKAGE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

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COURSE OUTCOMES

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

- possess the knowledge on store g various grain in different storage structures.
- adhere BIS standards to store in controlled atmosphere storage
- apply the knowledge on food packaging and methods to enhance shelf life of food items.
- evaluate the packaging material and package performance commodities.
- 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.

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

AI19152 INDUSTRIAL SAFETY MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- know the concepts and techniques of industrial safety management.
- acquire knowledge in safety audit and performance monitoring.
- acquaint about accident investigation and reporting
- learn principles and practices of safety management in industries.
- gain knowledge about the safety education and training systems.

UNIT I CONCEPTS AND TECHNIQUES 10

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

UNIT II SAFETY AUDIT 10

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

UNIT III ACCIDENT INVESTIGATION AND REPORTING 10

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

UNIT IV SAFETY PERFORMANCE MONITORING 8

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

UNIT V SAFETY EDUCATION AND TRAINING 7

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the principles and practices of safety management in industries.
- implement the safety audit and performance monitoring.
- analysis and report various accident.
- display the safety performance.
- creates consciousness and develops alertness to safety

TEXT BOOKS

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

REFERENCES

1. Dan Petersen, "Techniques of Safety Management", McGraw-Hill Company, Tokyo, 1981.
2. Relevant India Acts and Rules, Government of India.
3. Relevant Indian Standards and Specifications, BIS, New Delhi.
4. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973.
5. "Safety and Good House Keeping", N.P.C., New Delhi, 1985.

CO/PO Mapping

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

AI19153 FARM POWER AND MACHINERY MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I INTRODUCTION TO FARM POWER AND DESIGN CRITERIA 8

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

UNIT II MACHINERY MANAGEMENT 10

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

UNIT III SYSTEMS APPROACH 9

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

UNIT IV PLANNING OF MACHINERY 9

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

UNIT V ECONOMIC ANALYSIS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design criteria in farm power and machinery system.
- evaluate management techniques in farm power operations and plan for the future.
- apply various systems in the farm power and machinery management.
- describe planning of optimum utilization of machineries in farm.
- analysis performance evaluation of different farm machineries

TEXT BOOKS

1. Bainer, R. Kepner, R.A. and Barger, E.L.,"Principles of farm machinery", John Wiley and Sons. New York,1978.

2. Liljedahl, B: Tumquist, PK: Smith, DW; and Hoki, M, "Tractor and its Power Units",VanNostrandReinhold,1989.

REFERENCES

1. Kepner, R.A., Bainer, R. and Barger, E.L,"Principles of Farm Machinery", C.S.B. Publishers and distributors, New Delhi,1987.

2. Smith, H.P. and Wilkes, L.H,"Farm Machinery and Equipment", Tata McGraw-Hill Publishing Co. Ltd., New Delhi,1979.

3 Culpin, C. "Farm Machinery",Granada Publishing Ltd., London,1978.

CO/PO Mapping

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

BA19154 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

- acquire the knowledge about competencies required for an entrepreneur.
- impart knowledge in motivation techniques in entrepreneurship
- discuss the various factors that has to be considered while preparing a business plan.
- understand the various sources of finance and accounting for business.
- describe the role of government and other agencies in promoting entrepreneurship.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur ,Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need,Objectives.

UNIT III BUSINESS 9

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

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire skills necessary to become an entrepreneur
- exhibit the skills required to manage small business
- analyze and develop a business plan.. .
- identify the various factors to be considered for launching a small business.
- comprehend the support rendered by government and other agencies in entrepreneurship development

TEXT BOOKS

1. Khanka. S.S., “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi,2013.
2. Donald F Kuratko, “Entreprenuership – Theory, Process and Practice”, 9th Edition, Cengage Learning,2014.

REFERENCES

1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis” 2nd Edition Dream tech, 2005.
3. Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

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

PROFESSIONAL ELECTIVE II

AI19251 FOOD AND DAIRY PROCESS ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

- have thorough knowledge about Food, its properties reaction and kinetics.
- identify recent trends in Food processing and preservation.
- obtain sufficient knowledge about Dairy industries and milk processing techniques.
- apply knowledge on Manufacturing, processing and treatment of dairy products.
- grasp 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	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	3	-	-	-	-	-	-	-	3

AI19252 SPECIAL FARM MACHINERY AND EQUIPMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I WEEDING EQUIPMENT 9

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

UNIT II SPRAYERS AND DUSTERS 9

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

UNIT III MOWERS AND HARVESTERS 9

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

UNIT IV THRESHERS AND OTHER MACHINERY 9

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

UNIT V ADVANCED FARM EQUIPMENTS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- have a thorough knowledge on various types of weeders.
- identify the different types of sprayers and dusters.
- construct and use various types of mowers and harvesters.
- work on threshers and other farm machinery.
- acquire complete knowledge on special farm equipments.

TEXT BOOKS

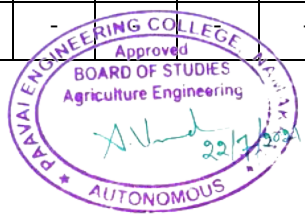
1. JagdishwarSahay., "Elements of Agricultural Engineering", Standard Publishers Distributors,2010.
2. Michael and Ojha, " Principles of Agricultural Engineering", Jain brothers,2005.

REFERENCES

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

CO/PO Mapping

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



AI19253 ENERGY AND ENVIRONMENTAL AUDITING AND ITS MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

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

UNIT I INTRODUCTION TO ENERGY AUDIT 9

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

UNIT II ENERGY MANAGEMENT SYSTEM 9

Energy management approach - understanding energy costs - Bench marking - Energy performance - Matching energy use to requirement - Maximizing system efficiencies - Optimizing the input energy requirements - Energy savings without suffering - Fuel and energy substitution; Case study examples - Energy saving calculations-Industrial Environmental Management.

UNIT III INTRODUCTION TO ENVIRONMENT AUDIT 9

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

UNIT IV ENVIRONMENT IMPACT ASSESSMENT (EIA) 9

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

UNIT V ENVIRONMENT MANAGEMENT SYSTEMS (EMS) 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- attain knowledge on energy auditing and its management.
- understand the concepts of environmental auditing, impact assessment and environment management systems.
- carryout projects regarding environmental auditing in various sectors.
- manage and assess projects administrative at level
- expertise in environmental management system.

TEXT BOOKS

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

REFERENCES

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

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

AI19254 ON-FARM WATER MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable students to

understand the fundamental design of irrigation channels and diversion structures.

- study about Command area development.
- know about availability and utilization of water resources.
- impart knowledge on water use efficiency.
- get an idea about automation of irrigation systems and water policies.

UNIT I DESIGN OF IRRIGATION CHANNELS 9

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

UNIT II COMMAND AREA 9

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

UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER 9

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

UNIT IV WATER BALANCE 9

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

UNIT V AUTOMATIZATION IN IRRIGATION 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design irrigation channels and diversion structures.
- organize the different CADA programmes and involved farmers to participate
- inspect the conjunctive use of water resources by farmers
- identify water balance between productivity and water use efficiency in agricultural land.
- adhere latest technologies and national water policy.

TEXT BOOKS

1. Michael, A.M. 2006. "Irrigation Theory and practice", Vikas publishing house, New Delhi
2. Michael, A.M. and Ojha, T.P. "Principles of Agricultural Engineering -Vol II ",Jain Brothers, New Delhi,2002.

REFERENCES

1. Keller, .J. and BliesnerD.Ron, "Sprinkler and Trickle irrigation", Anari book, Published by Van No strand Rein hold New York, 2001.
2. Israelson,"Irrigation principles and practices", John Wiley & sons, New York, 2002.
3. Modi, P.N., "Irrigation and water resources and water power engineering", StandardBook House, New Delhi,2002.
4. Suresh, R., "Land and water management principles", Standard Publishers & Distributors, New Delhi,2008.

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