

COURSE OBJECTIVES

To enable the students to

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

UNIT I CONCEPTS OF AGRICULTURAL BUSINESS**9**

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

UNIT II AGRI- BUSINESS ORGANIZATION**9**

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

UNIT III AGRICULTURAL MARKETING**9**

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

UNIT IV AGRICULTURAL BUSINESS FINANCE**9**

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

UNIT V MARKET PROMOTION AND HUMAN RESOURCES**9**

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- know the importance of Agri-business management, its characteristics and principles.
- understand the methods of managing employees, quality control and SWOT Analysis.
- familiar with the functions of Production and Operations management and marketing Techniques.
- have knowledge on various aspects of financial management in agribusiness, branding and promotion.
- understand the methods of pricing, retailing, distribution and training in agricultural business.

TEXT BOOKS

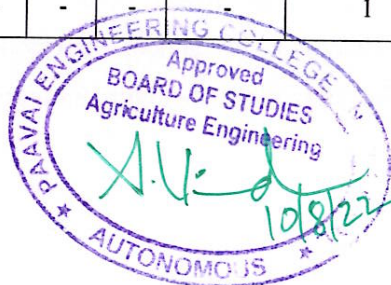
1. Himanshu, "AgriBusinessManagement-Problemsandprospects", Ritu Publications, Jaipur, 2005.
2. Smita Diwase, "Indian Agriculture and Agri business Management". resource Management.

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

CO PO MAPPING:

*CO-PO & PSO Matrix Correlation:: Put if, Strong:3, Moderate:2, Weak:1, Nil:-														
COs	Programmes Outcomes(POs)													
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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



COURSE OBJECTIVES

To enable the students to

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

UNIT I CONCEPTS OF REMOTE SENSING AND SATELLITES

9

Remote sensing - Definition, importance, components, types of remote sensing; Energy source-electromagnetic spectrum; EMR interaction with Atmosphere; Spectral Reflectance Characters - Spectral signatures for water, soil and vegetation; Sensors - Active and passive Sensor; Platforms- Types of Platform; Satellite – Sun synchronous and Geostationary satellite; Remote sensing satellites - LANDSAT, SPOT, IRS, Future Remote sensing Mission.

UNIT II DATA PRODUCTS AND IMAGE PROCESSING

9

Satellite Data products- Pictorial data, Digital data; Image interpretation - Visual interpretation, Digital Interpretation; Interpretation key elements; Digital image processing – Preprocessing, Image enhancement techniques, image classification; Normalized differential vegetation Indices.

UNIT III CONCEPTS OF GIS AND GPS

9

GIS – Definition, Components, functions of GIS; Map and their characteristics; Map projections - Types of Map Projection; Coordinate systems – Geographic and projected coordinate systems; Map element and map scale; Global Positioning System(GPS) Concepts, Segments, errors and working principle.

UNIT IV DATA INPUT AND ANALYSIS

9

Data - Spatial, Non-Spatial data; Spatial data - Raster data, Vector data; Methods of Data input; Data Editing- Files formats; Map algebra; Topological analysis; Queries; Reclassification; Spatial interpolation Techniques – Network analysis; Modeling in GIS - Digital Elevation Modeling; Data Base Management System .

UNIT V AGRICULTURAL APPLICATIONS

9

Modeling soil erosion; Land degradation mapping; Land use /land cover mapping; SWAT models; Ground water prospecting zone mapping; Farm asset management; Spatial variability mapping; Application of Remote Sensing and GIS in Precision Agriculture; Remote Sensing for Weather & Meteorological Application.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- understand the remote sensing principles and systems.
- gain sufficient knowledge on satellite data processing and available data products.
- know the concept of GIS and its tools.
- have knowledge on data input and analysis techniques.
- utilize these advanced techniques in addressing the real world problems.

TEXT BOOKS

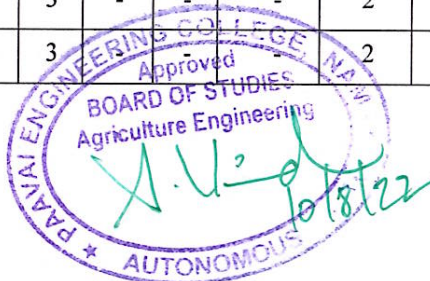
1. Anji Reddy. M, "Remote Sensing and Geographical Information Systems", BS Publications, Hyderabad, 2012
2. Lilles and, T. M., and Kiefer, R.W., "Remote Sensing and Image Interpretation", John Wiley and Sons, New York, 2000.

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

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I PROTECTED CULTIVATION AND ITS TYPES

12

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

UNIT II PROTECTED CULTIVATION OF VEGETABLE CROPS

7

Protected cultivation technology for vegetable crops - various varieties; need of fertilizer; types of fertilizers; tomato, capsicum, cucumber, gherkins, strawberry and melons; integrated pest and disease management; post harvest handling.

UNIT III PROTECTED CULTIVATION OF FLOWER CROPS

6

Protected cultivation technology for flower crops - roses , chrysanthemum, carnation, gerbera, anthurium, orchids, foliage and fillers, various varieties - need of fertilizer, types of fertilizers; post harvest Handling; Advanced technology in protected cultivation; Automation Ventilation system.

UNIT IV PRECISION FARMING TECHNIQUES

12

Precision farming - introduction, concept and importance; Mobile mapping system and its application in precision farming; Design - layout and installation of drip and fertigation; Site specific management (SSM) - geo-referencing and photometric correction; Sensors - information gathering and application; Crop simulation models - role in precision farming ; integrated pest and disease management.

UNIT V PRECISION FARMING OF CROPS

8

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

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- understand different types of protected cultivation system.
- know protected cultivation techniques used in vegetable crops.
- gain sufficient knowledge on protected cultivation of flower crops.
- familiar with precision farming techniques.
- apply precision farming techniques in various crops.

TEXT BOOKS

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

REFERENCES

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

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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



COURSE OBJECTIVES

To enable the students to

- understand the use of ICT in agriculture engineering.
- know the automation of Irrigation for crops.
- get an idea about data gathering using sensors for automation.
- use computers for simulations in agriculture engineering.

LIST OF EXPERIMENTS

1. Configuring timers for automatics switching "on and off" of irrigation systems (With the available timing devices students should experience on how to configure and switch the small pumps or Other devices. Requirements—timing devices and small pumps for simulations)
2. Experience with solenoid valves for pressurized irrigation (For distributing irrigation to different parts of the field in drip or sprinkler irrigation system solenoid valves need to be used for maintaining uniform pressure for better distribution of water. Student should be exposed how to use solenoid valves for this purpose. Requirements—Solenoid valves and layout of drip or Sprinkler system)
3. Using sensors for Agro meteorological measurements (Mainly soil moisture and air temperature measurements. The Time Domain Reflectometer (TDR) can be used to measure soil moisture and any digital thermometer can be used to measure temperature. Making connections and Measurements are important.)
4. Employing Printed Circuit Board (PCB) or Bread board for controlling or triggering an agricultural system (Taken the measurements of temperature or soil moisture in the experiment No. 3 using a circuit board an event can be trigger the soil moisture is below certain level the motor should be switched on. Similarly in a green house if the temperature exceeds say 40°C Then fogger should be switched on. Requirements -Breadboards, relays etc.)
5. Use of mobile apps for controlling or triggering an agricultural system (An existing application may be used to demonstrate this exercise. For example already applications are Available for remotely switching motor or solenoid valves for irrigation.)
6. Construction of crop growth functions (best fit) for crop yields simulations (Data sets of sandy Can be given to the students so that students can fit a best growth functions either using spreadsheet application or MATLAB and draw graphs)
7. Image processing as tool for biotic and a biotic stress identification (Using the facilities available In MATLAB leaf images can be processed to identify degree of damage include in area calculation nor to understand whether it is biotic or abiotic)
8. Experience with existing open source crop simulation models (Any one of the crop simulation available as open source like DSSAT, Info Crop, APSIM, EPIC may be demonstrated to The students to expose them crop growth simulation)

9. Exposing cloud resources for agricultural applications (The students should be demonstrated with use of clouds for exchanging information. For example the measured data like Temperature or soil moisture can be automatically send to clouds (a local cloud can be build for this purpose or existing cloud service can be used) for access and take decisions whether to irrigate or pay attention.
10. Developing automated agro advisory systems (Based on observed and forecasted weather information agro-advisories can be developed automatically and advisory send to the farmers as SMS or by IVR. This exercise can be demonstrated based on the exercises already completed by the students in this lab).

TOTAL PERIODS: 30

COURSE OUT COMES

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

- understand the use of ICT in agriculture engineering.
- learn automation of Irrigation to crops.
- gather data using sensors for automation.
- employ computers for simulations in agriculture engineering.

CO/PO MAPPING:

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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



COURSE OBJECTIVES

To enable the students to

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

LIST OF EXPERIMENTS

1. Introduction to GIS software
2. satellite images interpretation(Visual, Digital)
3. Geo-referencing of Satellite images
4. Spatial data input and editing-digitization
5. Calculate geometry of polygon and line and Symbology and Map composition
6. Raster analysis-Data base query
7. Normalized Vegetation Indices (NDVI) analysis
8. Supervised and unsupervised classification of digital image
9. GIS applications in DEM and its analysis
10. GIS application in erosion/runoff modeling

TOTAL PERIODS: 30

COURSE OUT COMES

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

- understand the remote sensing principles and systems
- gain sufficient knowledge on satellite data processing and available data products.
- know the concept of GIS and its tools.
- have knowledge on data input and analysis techniques.



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

COURSE OBJECTIVES

To enable the students to

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

GUIDELINES

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

TOTAL PERIODS: 90

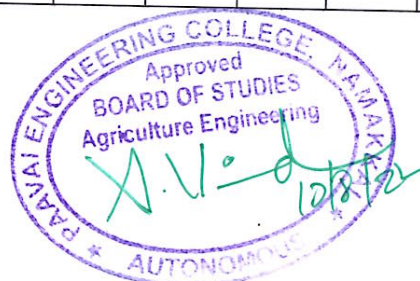
COURSE OUTCOME

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

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

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



COURSE OBJECTIVES

To enable the students

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

UNIT I LAWS OF ECONOMICS

9

Agricultural Economics - Definition and scope; Basic laws of economics - Demand and supply concepts, law of increasing, Diminishing and constant returns, Equi-marginal returns; Factor-Product relationship - Production function, Definition and types, Optimum level of input and optimum level of output; Scale of Economics External and internal economics and diseconomies; Cost concepts - types, opportunity cost comparison of costs, cost curves.

UNIT II PRODUCT RELATIONSHIP

9

Factor-factor relationship and concepts, Principle of substitution, Isoquant, Isocline, Expansion path, Ridge line and least cost combination of inputs; Product-Product relationship - Production possibility curve, Iso-revenue line and optimum combination of outputs; Estimation of cost of cultivation and production of crops - Annual and perennial crops; Preparation of interview schedule and farm visit for data collection.

UNIT III MANAGEMENT OF RESOURCES AND FINANCIAL ANALYSIS

9

Risk and uncertainty - concept, Causes for uncertainty, Managerial decisions to reduce risks in production process; Management of resources - Types of resources - Land, Labour, Capital and measurement of their efficiencies; Mobilization of farm resources; Cost of machinery and maintenance; Break even analysis; Farm Investment analysis; Time comparison principles - Compounding & Discounting techniques; Farm financial analysis - Balance sheet, Income statement, Cash flow analysis; Farm planning - Elements of farm planning, Farm level management system; Farm budgeting - whole farm budgeting and partial budgeting - Examples of farm planning and budgeting.

UNIT IV EXTENSION CONCEPT

9

Extension - Definition and meaning, Education, Types of Education, Difference between Formal and Extension Education, Function and scope of Extension, Principles of Extension, Steps in Extension Teaching; Communication - Basic functions of Communication, Models of Communication, Barriers of Communication.

UNIT V EXTENSION TEACHING METHODS

9

Extension teaching methods - Audio-Visual aids, definition, classification, purpose, planning and selection, combination and use - individual, group and mass contact methods - merits and demerits; Modern communication methods - internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), Village kiosks, Kisan Call Centre (KCC), mobile phone applications Capacity building of extension personnel and farmers, meaning, definition, types of training, training to farmers, farm women and rural youth - FTC - KVK

COURSE OUTCOMES

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

- apply basics of agricultural economics.
- plan the financial aspects in a cost effective manner.
- know the different farm management techniques.
- familiar with various extension methods, communication gadgets.
- give ideas in capacity building techniques.

TEXT BOOKS

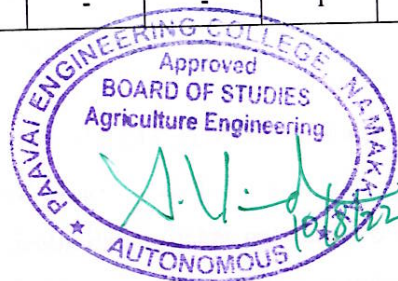
1. Johl, S.S., and Kapur, T.R., "Fundamentals of Farm Business Management", Kalyani publishers, Ludhiana, 2007.
2. Subba Reddy, S., Raghu Ram, P., Neelakanta Sastry T.V and Bhavani Devi, I., "Agricultural Economics" Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

REFERENCES

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

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



COURSE OBJECTIVES

To enable the students to

- develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- improve the skills to formulate a technical project.
- explain the various tasks of the project and standard procedures
- train the students in preparing project reports and to face reviews and viva voce examination.

GUIDELINES

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

TOTAL PERIODS: 180

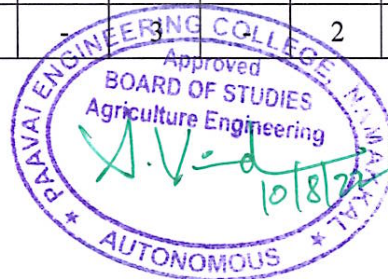
COURSE OUTCOME

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

- identify and formulate an agriculture engineering related solution for an engineering problem.
- analyze and review existing system
- be in a position to take up any challenging practical problem and find solution by formulating proper methodology.
- communicate, demonstrate and document the work as a member and leader in a team.

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



PROFESSIONAL ELECTIVE (PE)

ELECTIVE – I

AI20151

STORAGE AND PACKAGING 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- 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.

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; 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; 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; Flexible packaging materials and their properties; Aluminum 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 oven able and restorable packages & pouches, types; 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

- 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

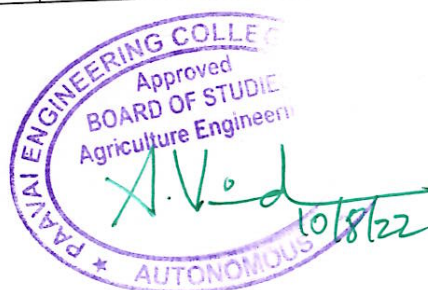
1. Hall CW. 1970. "Handling and Storage of Food Grains in Tropical and Sub-tropical Areas", FAO Publ.Oxford & IBH.
2. Gordon L. Robertson, "Food Packaging - Principles and Practice", Marcel Dekker Inc, USA, 1993.
3. J. R.D.David, R. H Graves and V.R.Carlson, "Aseptic Processing and Packaging of Foods",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

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



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 safety records, 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

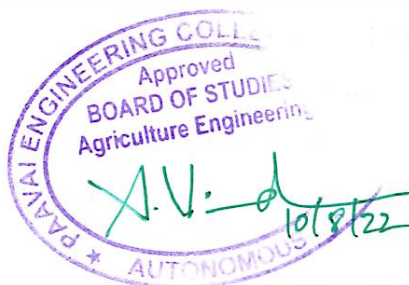
1. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.
2. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.

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

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



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 for future 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**8**

Role of mechanization in Indian Agriculture- Farm Power Availability and Productivity in India; Design and development of farm power- Modern trends, principles, procedures, fundamentals and economic considerations, reliability criteria in design and its application.

UNIT II MACHINERY MANAGEMENT**10**

Importance of farm machinery management-Field Performance and power requirements, 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**

Farm planning and control - Elements of planning, objectives, steps and formulation of farm plans, farm level management information systems, 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, estimating farm power & machinery costs, fixed cost and variable costs, effect of inflation on cost; Selection of optimum machinery and replacement criteria - 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", VanNostrand Reinhold, 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

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



COURSE OBJECTIVES

To enable students to

- understand the management principles.
- build the entrepreneurial competencies and analyse the support rendered by government and other agencies in entrepreneurship development.
- understand the business opportunities and to prepare a feasibility report.
- propose a business plan.
- appraise and comprehend the various factors to be considered for launching a small business.

UNIT I Basics of Management:

9

Management: Meaning, Definition, Nature and Importance; Roles of management, Functions of Management, Levels of Management, Functional areas of Management: Marketing, Finance, Production, HRM, IT, Research and Development.

The Evolution and Development of Management Thought: Classical, Neo-classical, System and Contingency Approaches, An Overview.

UNIT II Entrepreneurial Competence and Environment

9

Entrepreneurial Competence: Entrepreneurship, Definition, Role and expectations, Entrepreneurial styles and types, Characteristics of the Entrepreneur, Entrepreneurial Competencies, Functions of an Entrepreneur.

Entrepreneurial Environment: Role of Socio-Cultural, Economic and Political Environment, Institutional Support for small entrepreneurs, Assistance Programme for Small Scale Units, Institutional Framework, Central and State Government Industrial Policies and Regulations.

UNIT III Entrepreneurial Development

9

Ownership Structures, Proprietorship, Partnership, Company, Co-operative, Franchise.

Identification of Business Opportunity, Preparation of Feasibility Report, Financial and Technical Evaluation, Project Formulation, Common Errors in Project Formulation, Specimen Project Report, Entrepreneurial Development Programs, Role of SSI Sector in the Economy, IAS Units, Failure, Causes and Preventive Measures, Turnaround Strategies.

UNIT IV Business Plan Preparation, Financing Ventures

9

Business Plan: Business opportunities-SWOT, Business plan process, Feasibility Study, Functional plan, Marketing plan, Operational plan, Organizational plan, financial plan, Evaluation Criteria.

Financing ventures: sources of raising capital, seed funding, venture capital funding, funding opportunities for start-ups in India.



UNIT V Women Entrepreneurship & Entrepreneurship in various sectors

9

Women Entrepreneurship: Growth of women Entrepreneurship, Problems faced by Women Entrepreneurs, Development of women Entrepreneurship.

Entrepreneurship in Informal Sector: Rural Entrepreneurship, Entrepreneurship in Sectors like Agriculture, Tourism, Health care, Transport and allied services.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- implement the necessary managerial skills to become an entrepreneur.
- take up self-employment having been exposed to entrepreneurial environment.
- select a best business idea by using appropriate methods to assess its viability.
- formulate a business plan and deploy the resources for sustainable growth.
- analyse channels and means of launching a small business in any sector.

TEXT BOOKS

1. Khanka S.S, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, 2013.
2. Saravanavel. P, "Entrepreneurial Development", Ess Pee Kay Publishing House, Chennai, 2013.

REFERENCES

1. Donald L. Sexton and Raymond W. Smilor, "The Art and Science of Entrepreneurship", Gulfinger Publishing Company, 2008.
2. Clifford M. Baumback & Joseph R. Mancuso, "Entrepreneurship and Venture Management", Prentice Hall, 1975.
3. Gifford Pinchot, "Intrapreneuring" Harper & Row Publishers, New York, 1985.
4. Mathew Manimala, "Entrepreneurship Theory at the Crossroads", Paradigms and Precedents, BIZ/BA/BAE 2nd Edition, 2015.

CO – PO Mapping:

Mapping of Course Outcomes with Programme Outcomes: (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	2	-	1	-	-	2
CO3	-	-	2	-	-	-	-	-	-	-	-	-	1	2
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	1
CO5	-	-	-	-	-	-	-	2	-	-	3	-	-	-



PROFESSIONAL ELECTIVE (PE)

ELECTIVE – II

AI20251

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 PROPERTIES AND THERMAL PROCESSING

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.

UNIT II ADVANCED PRESERVATION METHODS

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, storage tanks, receiving and handling & testing of milk, method of raw milk procurement and preservation; Processing- Staining, filtering and clarification, cream separation, pasteurization, principles & methods- homogenization, principles & methods, UHT processing, applications and aseptic packaging, emulsification, fortification.

UNIT IV DAIRY PRODUCTS

9

Milk powder -Manufacture, processing of milk products, condensed milk, skim milk, butter milk, flavored 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, International Standard, 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 Gopala Rao, "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.

REFERENCES

1. Subbulakshmi.G., and Shobha A. Udipti, "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", Kitab Mahal Publishers, Allahabad, 1997.

CO PO MAPPING

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



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 - Flail mowers, lawn 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, tree pruners.

UNIT V ADVANCED FARM EQUIPMENT 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 equipment's.

TEXT BOOKS

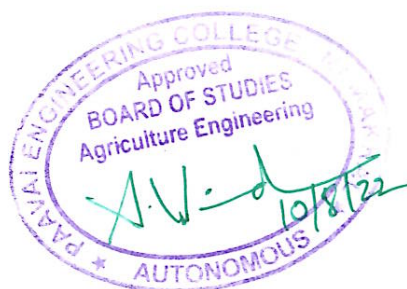
1. Jagdishwar Sahay., "Elements of Agricultural Engineering", Standard Publishers Distributors, 2010.
2. Michael and Ojha, "Principles of Agricultural Engineering", Jain brothers, 2005.

REFERENCES

1. Kepner, R.A., et al., "Principles of farm machinery", CBS Publishers and Distributors, Delhi, 1997.
2. Harris Pearson Smith et al., "Farm machinery and equipments", Tata McGraw-Hillpub, 1996.
3. Srivastava, A.C., "Elements of Farm Machinery", Oxford and IBH Pub. Co., NewDelhi, 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	2	1	2	2	1	-	1	-	-	-	2	-	2	-
CO2	1	-	-	2	1	-	-	-	-	-	2	1	1	-
CO3	2	1	2	2	-	1	-	-	-	2	3	1	1	3
CO4	2	1	2	2	1	-	-	-	2	1	2	-	1	2
CO5	1	2	-	2	2	-	-	-	-	1	2	-	2	1



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", CommonWealth 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.

CO PO MAPPING

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



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 Bliesner D. 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", Standard Book House, New Delhi, 2002.
4. Suresh, R., "Land and water management principles", Standard Publishers & Distributors, New Delhi, 2008.

CO PO MAPPING

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I SEED CHARACTERS

9

Seed – Definition, characteristics, difference between seed & grain , good quality features; Importance of seed in successful crop production; Floral biology - self and cross pollination; Seed dormancy- methods of Dormancy breaking; Methods of genetic improvement of crop plants , selection, hybridization, mutation, polyploidy; Seed Act and rules- new policy and importance.

UNIT II SEED PRODUCTION AND CERTIFICATION

9

Seed Multiplication – systems, classes of seed, multiplication ratio, field selection, planting ratio, isolation needs and rouging; Harvest and extraction of seed; Methods of hybrid seed production; Genetic deterioration during crop production cycles; Seed certification process – Phases of seed certification, legal basis, prerequisites for applicability, description of the specific steps of the certification process.

UNIT III SEED PROCESSING AND TESTING

9

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

UNIT IV DEVELOPING SEED PROGRAMMES

9

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

UNIT V SEED PRODUCTION IN SPECIFIC CROPS

9

Seed production techniques for selected crops - Rice, Maize, Black gram, Groundnut, Sunflower, Cotton, Tomato, Brinjal and Onion

TOTAL PERIODS: 45

COURSE OUT COMES

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

- acquire basic knowledge of seed production technologies.
- know the different methods of seed production.
- gain knowledge in processing and testing of seed.
- have knowledge on planning and management of different seed programmes.
- earn seed production technologies of important crops.

TEXT BOOKS

1. Singh, S.P., "Commercial Vegetable Seed Production", Kalyani Publishers, Chennai, 2001.
2. Agarwal, R.L., "Seed Technology", Oxford IBH Publishing Co., New Delhi, 1995.

REFERENCES

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

CO/PO MAPPING:

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



COURSE OBJECTIVES

To enable the students to

- impart basic knowledge of insect pest and diseases and their losses caused to crops.
- study various methods of plant protection to get more yield in Agricultural and Horticultural crops
- gain knowledge on pest & diseases management in horticultural crops
- learn about Plant Protection Appliances using different machineries
- expose the pesticide hazards and management

UNIT I GROUPS OF INSECT AND DISEASE

9

Sucking pests, borer pests, soil pests, Vectors, Rodent pests and their symptoms of damage. Fungal bacterial and viral pathogens causing crop diseases.

UNIT II AGRICULTURE AND HORTICULTURE CROP PESTS

9

Agricultural crops: Rice, pulses cotton, sugarcane. Horticultural crops: Coconut, fruits, vegetables and flower crops affected by various pests and diseases.

UNIT III METHODS OF CROP PROTECTION

9

Cultural, physical, mechanical, legal, biological, chemical and biotechnological methods of crop protection and IPM.

UNIT IV PLANT PROTECTION APPLIANCES

9

Different machineries available for spraying / soil application on annual and perennial crops and maintenance of machineries

UNIT V PESTICIDE HAZARDS AND MANAGEMENT

9

Pesticide residues in consumable crop parts by way of application of pesticides / fungicides, methods of decontamination of toxic chemicals, organic healthy way of crop protection.

TOTAL PERIODS: 45**COURSE OUTCOMES**

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

- possess knowledge on various groups of insect pests and diseases of crops and their symptoms.
- acquire knowledge on different crops damaged by insects and diseases.
- possess knowledge on various methods of pest management to increase crop yield.
- have knowledge on plant protection machineries.
- understand pesticide residues and health hazards; pest and disease management in organic farming.

TEXTBOOKS

1. Dhandapani, N and S.Uthamasamy 2000. Integrated pest Management. Tnau Publications, Coimbatore.p.181.
2. Ragupathy. A and R. Ayyasamy 2003. A Guide on crop pests. Namrutha publications, Madananadapuram, Porur, Chennai-16.p.368.

REFERENCES

1. Justin. K.2004. Crop protection. TNAU, Petchipaarai, kanyakumari Dt.p.379.
2. IanHeywood.,“An Introduction to Plant Protection”, Pearson Education, New Delhi,2001.
3. K.Justin. Crop Protection. TNAU, Petchipaarai, Kanyakumari Dt.2004..
4. David, B.V. and T. kumaraswami 1975. Elements of Economic Entomology. Popular Book Depot, Chennai-600034.p.507. 16. 2003.

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I MICRO IRRIGATION CONCEPT AND APPLICATIONS**10**

Micro irrigation - comparison between traditional and micro irrigation methods, Merits and demerits of micro irrigation system, Types and components of micro irrigation system, scope and potential problem of micro irrigation; Low cost micro irrigation technologies-gravity fed micro irrigation, Care and maintenance of micro irrigation System, Economics of micro irrigation system; Automation in Micro irrigation- Surge irrigation and cablegation, Greenhouse irrigation system.

UNIT II COMPONENTS OF MICROIRRIGATION SYSTEMS**8**

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

UNIT III DRIP IRRIGATION DESIGN**10**

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

UNIT IV SPRINKLER IRRIGATION DESIGN**10**

Sprinkler irrigation - Components and accessories, Hydraulic design, Distribution pattern, Application rate; Droplet size - Sprinkler selection and spacing, Capacity of sprinkler system, Types, Sprinkler performance, Sprinkler discharge; Water distribution pattern - Droplet size, Filtering unit and system maintenance.

UNIT V SPECIAL PRESSURISED IRRIGATION SYSTEM**7**

Principles, construction and operations of Mini sprinkler, Butterfly sprinkler - Pop-up sprinkler, Under tree sprinkler & Rain gun; Pressurized irrigation techniques - Green House, Poly house, Poly Tunnel Net house, Aeroponics; Spray Heads- Jets & Foggers and Venturi system, Surge and cablegation system.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- have a thorough knowledge on micro irrigation and its concepts.
- get an idea about the use of various types of pumps in irrigation.
- know the design, operation and maintenance of Drip irrigation systems.
- gain knowledge on design, operation and maintenance of Sprinkler irrigation systems.
- learn pressurized and automated irrigation systems.

TEXT BOOKS

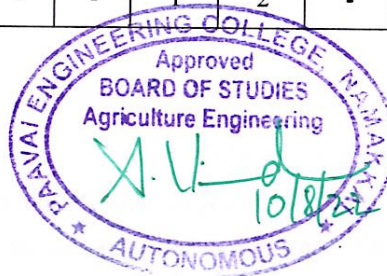
1. Suresh,R.,“Principles of Micro-Irrigation Engineering”, Standard Publishers Distributors, New Delhi,2010.
2. Michael,A.M.,“Irrigation Theory and Practice”, Vikas Publishers,NewDelhi,2002.

REFERENCES

1. Modi,P.N., and Seth,S.M., “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi,1991.
2. Jack Keller and Rond Belisher.,“Sprinkler and Trickle Irrigation”, Vannistr and Reinhold, New York,1990.
3. Sivanappan R.K.,“Sprinkler Irrigation”, OxfordandIBHPublishingCo.,NewDelhi,1987.
4. Keller J and D. Karmeli,“Trickle Irrigation Design”, Rain bird Sprinkler Irrigation Manufacturing Corporation, Glendora, California, USA.

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I MECHANICS OF TILLAGE

9

Tillage - history - Soil, machine, crop system; Mechanics of tillage tools; Engineering properties of soil – physical and mechanical; Principles and concepts - stress straight relationship.

UNIT II DYNAMICS OF TILLAGE

9

Design of tillage tools - principles of soil cutting; Design equation - force analysis, application of dimensional analysis in soil; Dynamics performance of tillage tools.

UNIT III TRACTION

9

Traction – Introduction, Mechanics, Parameters; Off road traction and mobility - Traction model, Traction testing, Traction improvement, Traction performance, Traction prediction.

UNIT IV TYRES

9

Tyres - Tyre size and its effects, effects of tyre pressure; Tyre geometry and their effects - balla sting forty relief - tyre testing.

UNIT V APPLICATION

9

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

TOTAL PERIODS: 45

COURSE OUT COMES

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

- understand the concepts of mechanics.
- know the principles of dynamics and traction.
- understand about traction implements and its mechanism.
- acquire knowledge on tyres and its testing.
- apply the tillage and traction for soil compaction and plant growth optimization

TEXT BOOKS

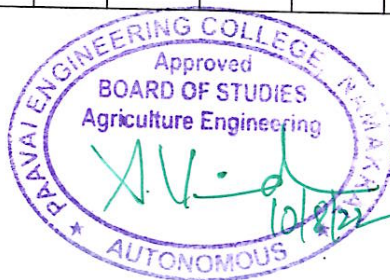
1. Klenin, N.L. Popov, I.F. and V.A. Sakum, "Agricultural machines", Amerind Pub. Co. New York, 1985.
2. B. Liljedahl, P.K. Turnquist, D.W. Smith, & M. Hoki, "Tractors and their power units", Fourth American Society of Agricultural Engineers, ASAE, 1996.
3. Kepner, R. A., Roy Bainer and E. L. Barger,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

REFERENCES

1. Ralph Alcock, "Tractor Implements System.", AVI Publications, 1986.

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



PROFESSIONAL ELECTIVES -IV

AI20451

WATERSHED PLANNING AND MANAGEMENT

3 0 0 3

COURSE OBJECTIVES

To enable students to,

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

UNIT I INTRODUCTION

9

Watershed – Definition , concept, Objectives , classification ; Priority watersheds ; Watershed Characteristics, Watershed Based Land Use Planning - Land capability classification - Land resource regions in India - watershed atlas.

UNIT II WATERSHED PLANNING

9

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

UNIT III WATERSHED MANAGEMENT

9

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

UNIT IV WATER CONSERVATION PRACTICES

9

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

UNIT V WATERSHED DEVELOPMENT PROGRAMME

9

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- know the characteristics of watershed
- prepare plan for water shed development
- utilize the engineering practices in watershed management.
- adopt conservation practices in irrigated and dry lands.
- implement watershed development programmes.

TEXT BOOKS

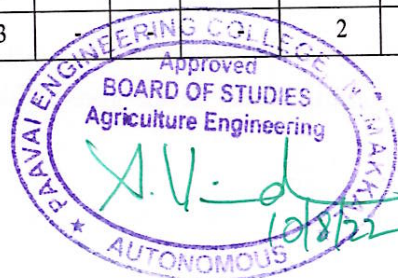
1. Suresh, R. "Soil and Water Conservation Engineering", Standard Publishers & Distributors, New Delhi, 2005.
2. Ghanashyam Das, "Hydrology and Soil Conservation Engineering", Prentice Hall of India Private Limited, New Delhi, 2000.

REFERENCES

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

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



COURSE OBJECTIVES

To enable the students to,

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

UNIT I IMPORTANCE AND PROCESSING OF HORTICULTURAL CROPS 9

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

UNIT II PACKAGING, GRADING AND QUALITY ANALYSIS OF SPICES 9

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

UNIT III PROCESSING OF COFFEE, TEA AND COCOA 9

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

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

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

UNIT V PROCESSING OF MEDICINAL CROPS 9

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

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- learn all the Horticultural crop processing techniques.
- get knowledge on cleaning, grading and packaging of processed horticultural by products.
- familiar with processing of tea, coffee and cocoa.
- understand the processing of plantation crops.
- gain knowledge on processing of medicinal crops.

TEXT BOOKS

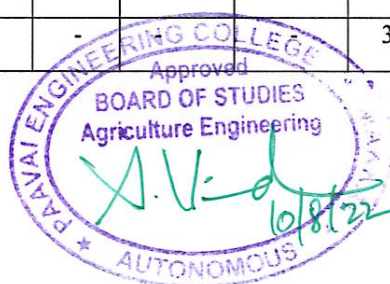
1. Pandey, P. H., "Post-Harvest Engineering of Horticultural Crops through Objectives", Saroj Prakasam, Allahabad, 2002.
2. Pruthi, J.S., "Major Spices of India - Crop Management and Post-Harvest Technology", Indian Council of Agricultural Research, Krishi Anusandhan Bhavan , Pusa, New Delhi. PP. 514, 1998.

REFERENCES

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

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



COURSE OBJECTIVES

To enable the students to

- understand the underlying principles of operations in different Refrigeration systems.
- provide knowledge on design aspects of refrigeration & air conditioning systems.
- know the concept of vapour compression refrigeration system.
- acquire knowledge on psychrometry.
- 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; chloroflouro carbon (CFC) Refrigerants - effect on environmental pollution, Alternate refrigerants; Vapour absorption cycle – Theoretical, deviation in practice; Electrolux refrigerator- Lithium bromide refrigeration, Construction and principles.

UNIT IV PSYCHROMETRY**9**

Properties of moist air- Psychrometric properties and measurement , Psychrometric chart; saturation line - relative humidity line, Constant specific volume lines , constant thermodynamic wet bulb temperature lines, Constant enthalpy lines; Psychrometric process - Air mixing process and simple air conditioning process; solving problems using Psychrometric chart.

UNIT V AIR CONDITIONING SYSTEM**9**

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

TOTAL PERIODS: 45**COURSE OUTCOMES**

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

- gain knowledge on refrigeration principles.
- acquire knowledge on vapour compression system and its components.
- understand the concepts of refrigerants and vapour absorption cycle.
- know the psychrometric properties and processes.
- attain in-depth knowledge of air conditioning system.

TEXT BOOKS

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

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

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



COURSE OBJECTIVES

To enable the students to,

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

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

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

UNIT II WIND ENERGY ENGINEERING 9

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

UNIT III BIO-CHEMICAL CONVERSION TECHNOLOGY 9

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

UNIT IV THERMO-CHEMICAL CONVERSION TECHNOLOGY 9

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

UNIT V ENERGY AUDITING AND MANAGEMENT 9

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- understand renewable energy resources & solar energy, its conversions and applications.
- know the fundamentals of wind energy and its applications.
- understand about bio-chemical conversion of biomass.
- understand thermo-chemical conversion of biomass
- have knowledge in energy auditing and management

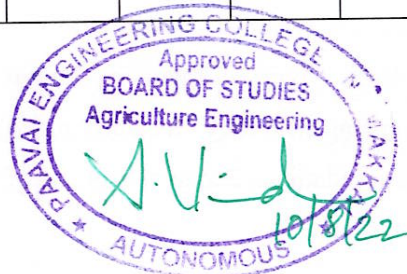
TEXT BOOKS

1. Chawla, O.P. "Advances in Biogas Technology". ICAR Publication, New Delhi, 1986.
2. More, H.S and R.C. Maheshwari, "Wind Energy Utilization in India" CIAE Publication – Bhopal, 1982.

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2. Rai. G.D. "Non-Conventional Sources of Energy", Khanna Publishers, New Delhi, 2002.
3. Rao, S. and B.B. Parulekar, "Energy technology - Non conventional, renewable and conventional" Khanna Publishers, New Delhi, 2002.
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CO2	3	1	-	1	3	-	2	-	1	1	3	1	2	3
CO3	3	2	3	-	-	1	1	-	-	-	1	2	3	1
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	2
CO5	3	2	3	-	1	-	-	-	-	-	-	1	1	2



COURSE OBJECTIVES

To enable the students to

- study the importance of land resources for sustainability.
- know the importance of water resources for sustainability
- understand organic farming for sustainable agriculture.
- study the importance of food security and ecological balance.
- know the policies and programmes for sustainable agriculture and food security

UNIT I LAND RESOURCE

9

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

UNIT II WATER RESOURCE

9

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

UNIT III SUSTAINABLE AGRICULTURE AND ORGANIC FARMING

9

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

UNIT IV FOOD PRODUCTION AND FOOD SECURITY

9

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

UNIT V POLICIES AND PROGRAMMES

9

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

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- gain knowledge on the need for sustainable agriculture.
- understand the importance of land and water resources for sustainability.
- know the relationship between organic farming and sustainable agriculture.
- comprehend the need for food security on global level.
- get awareness on the policies and programmes for sustainable agriculture and food security.

TEXT BOOKS

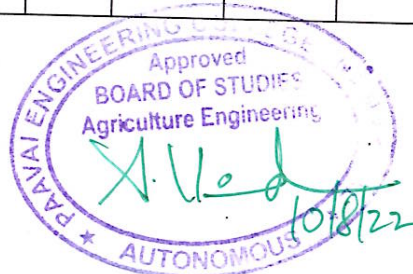
1. M.S.Swaminathan, "Science and sustainable food security", World Scientific Publishing Co.,Singapore, 2010.
2. B.K.Desai and Pujari, B.T. "Sustainable Agriculture: A vision for future", New India PublishingAgency, New Delhi, 2007.

REFERENCES

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

CO PO MAPPING:

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



COURSE OBJECTIVES

To enable the students to

- expose the concept of Irrigation Automation
- introduce the concepts of Automatic Systems
- get an idea about IOT and its applications in Irrigation
- gain knowledge on automation in surface Irrigation
- explore and use new technologies in Irrigation

UNIT I INTRODUCTION TO AUTOMATION

9

Automatic Irrigation - Traditional methods of Irrigation ,Need for Automation , Comparison between Traditional and Automated Irrigation , Advantages , Disadvantages ; Economic Impacts of Automation on Agricultural Firms - Future of Automation.

UNIT II SYSTEMS OF AUTOMATION

9

Pneumatic System - Portable timer system, principles, components- Timer/Sensor Hybrid/SCADA; Methods of automating - Irrigation layout, Machine Learning in Tank Monitoring System.

UNIT III ASSESSMENT OF PARAMETERS IN IRRIGATION

10

Crop water estimate using Satellite data ; Automation of Lysimeter for PET Measurements and Energy based Remote Sensing model - Remote Monitoring design of Automatic Irrigation system ,Cost and Benefits of Automation.

UNIT I SURFACE AND MICRO-IRRIGATION AUTOMATION

8

Automation and control in Surface Irrigation Systems - Equipment , benefits ,barriers ;Automation Design in Bay, Basin and Furrow Irrigation ; Automation in Micro Irrigation - Design ,Cost ,Operation and maintenance.

UNIT V IOT IN IRRIGATION

9

IOT based Automated Irrigation System; IOT based Smart Irrigation; Sensor based Automation - types - operation; Solar based Automatic Irrigation System - components, operation; Automation by sensing soil moisture; Automation using ANN based controller - operation.

TOTAL PERIODS 45**COURSE OUTCOMES**

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

- understand the technologies available for automation
- design automated systems for irrigation
- know various IOT applications
- gain knowledge on automated surface irrigation
- analyse the various parameters involved in design of automated system.

TEXT BOOKS

1. H.R.Haise, E.G.Kruse. et al., 1981. "Automation of Surface Irrigation: 15 years of USDA Research and Development at Fort Collins, Colorado"
2. Brian Wahlin and Darell Zimbelman, Canal Automation for Irrigation Systems, American Society of Civil Engineers, 2014

REFERENCES

1. Darell D.Zimbelman, Planning, Operation, Rehabilitation and Automation of Irrigation water delivery system, American Society of Agricultural Engineers, 1987

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



COURSE OBJECTIVES

To enable the students to

- ability to manage Intellectual Property portfolio to enhance the value of the firm.
- understand the registration of IPRs
- identify the laws and agreements
- know about the food indicators
- identify the emerging issues

UNIT I INTRODUCTION

9

Introduction to IPRs- Basic concepts ,design thinking and need for Intellectual Property ; Patents, Copyrights, Geographical Indications; PR in India and Abroad – Genesis and Development , the way from WTO to WIPO –TRIPS; Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations; Important examples of IPR.

UNIT II REGISTRATION OF IPRs

9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS

9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW

9

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

UNIT V ENFORCEMENT OF IPRs

9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL PERIODS : 45**COURSE OUTCOME:**

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

- ability to manage Intellectual Property portfolio to enhance the value of the firm.
- possess knowledge about registration of IPRs.
- gain knowledge about the laws and legislations
- predict the performance of food indicators.
- acquire knowledge about the enforcement of IPRs.

TEXT BOOKS:

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India Pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Publications, NewDelhi, 2002.

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Gangulli "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of IntellectualProperty, Edward Elgar Publishing Ltd., 2013.

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



AI20554 HEAT AND MASS TRANSFER FOR AGRICULTURE ENGINEERING 3 0 0 3

COURSE OBJECTIVES:

To enable the students to

- understand the physical behavior of the various modes of heat transfer, like, conduction, convection and radiation.
- understand the application of various experimental heat transfer correlations in engineering calculations.
- learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.
- understand various concepts of radiation.
- develop knowledge about mass transfer.

UNIT I CONDUCTION

9

Basic concepts – Mechanism of heat transfer – Conduction, convection and radiation ;General differential equation of heat conduction – Fourier law of conduction ,Cartesian and cylindrical coordinates , one dimensional steady state heat conduction – Conduction through plane walls, cylinders and spherical systems – Composite systems; Conduction with internal heat generation– Extended surfaces ,Unsteady heat conduction; Lumped analysis; Use of Heislers chart.

UNIT II CONVECTION

9

Basic concepts – Convective heat transfer coefficients ; Boundary Layer concept ; Types of convection Forced convection ,Dimensional analysis, External flow, Flow over plates, Cylinders and spheres, Internal flow, Laminar and turbulent flow, Combined Laminar and turbulent flow, Flow over bank of tubes; Free convection - Dimensional analysis , Flow over vertical plates, horizontal plate, inclined plate, cylinders and spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

9

Nusselts theory of condensation – Pool boiling, flow boiling, correlations in boiling and condensation, types of heat exchangers – LMTD method of heat exchanger analysis; Overall heat transfer coefficient – Fouling Factors.

UNIT IV RADIATION

9

Basic concepts, law of radiation – Stefan Boltzmann law, Kirchhoff law, Black body radiation, Grey body radiation; shape factor algebra – Electrical analogy; Radiation shields; introduction to gas radiation.

UNIT V MASS TRANSFER

9

Basic concepts – Diffusion mass transfer, Fick's Law of diffusion, Steady state molecular diffusion, Convective mass transfer; Momentum, heat and mass transfer analogy; Convective mass transfer correlations.

TOTAL PERIODS: 45

COURSE OUTCOME:

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

- ability to know about convection, conduction.
- apply various heat transfer correlations in engineering calculations.
- understand the various phase changes in heat transfer and heat exchangers.
- have knowledge about various laws.
- possess knowledge about mass transfer.

TEXT BOOKS:

1. Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International, New Delhi, 1995.
2. Yadav, R., "Heat and Mass Transfer", Central Publishing House, New Delhi, 1995.

REFERENCES:

1. Ozisik, M.H., "Heat Transfer", McGraw Hill Book Co., New York, 1994.
2. Nag, P.K., "Heat Transfer", Tata McGraw Hill Book Co., New Delhi, 2002.
3. Holman, J.P., Heat and Mass transfer, Tata McGraw Hill Book Co., New York, 2002.
4. Kothandaraman, C.P., "Fundamentals of Engineering Heat and Mass Transfer", New age International, New Delhi, 1998.

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



COURSE OBJECTIVES

To enable the students to

- study about ergonomics principles.
- impart knowledge on various physical work load in farm operations.
- acquire knowledge on energy requirement in farm operations.
- get an idea about anthropometry principles.
- know about equipment/work place design, safety in farm operations

UNIT I ERGONOMICS**7**

Ergonomics - introduction, Role of ergonomics in Agriculture; Human metabolism- energy liberation in human body, Types of human metabolism, energy requirements at work, acceptable work load.

UNIT II PHYSIOLOGICAL FUNCTIONS**10**

Human Skeletal system - muscle, structure and function ;Physiological stress - Efficiency of work ,Physical functions ,Age and individual differences in physical functions; Physiological and operational criteria of physical activity.

UNIT III ENERGY EXPENDITURE**10**

Energy expenditure of activities - keeping energy expenditure within bounds; Energy expenditure of Spraying- Weeding operations , Movements of body members; Strength and endurance of movements- Movement of bodymembers related to Agricultural activities , Speed and accuracy of movements ,Time and distance of movements, Reaction time.

UNIT IV ANTHROPOMETRY**8**

Anthropometry – introduction - Types of data, Principles of applied anthropometry - concept of percentile, Normal distribution; Estimating the range - Minimum and Maximum dimensions, Cost benefit analysis; applications of anthropometric data - Anthropometric consideration in tool and equipment design.

UNIT V HUMAN ENGINEERING IN TRACTOR DESIGN**10**

The operator - Machine Interface, Operator exposure to environmental factors; Thermal comfort for tractor operator - Spatial, Visual and Control requirement of the operator -; Occupational health hazards- Noise, Dust -Vibration in Tractor.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- know various principles of ergonomics.
- gain knowledge on physical activities related to farm operations.
- understand the energy requirements in farm operations.
- acquire knowledge on cost benefit analysis.
- gain knowledge to improve the performance of the farm systems

TEXT BOOKS

1. Bridger, R.S. Introduction to ergonomics, McGraw Hill, INC, New York. 1995.
2. Sharma, D.N and Mukesh, S. Design of Agricultural Tractor- Principles and Problems, Jain Brothers, New Delhi. 2012.

REFERENCES

1. Hand Book of Agricultural Engineering, Indian Council of Agricultural Research, New Delhi. 2013. (ISBN : 978-81-7164-134-5)
2. Wesley E. Woodson, Human Factors design Hand Book. McGraw Hill Book Co., New York. 1981.

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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	-	-	-



COURSE OBJECTIVES

To enable the students to

- learn the different aspects of energy auditing in the Food Industry.
- understand the facility in food processing industry.
- know about the energy saving opportunities in existing food processing facilities.
- understand the energy saving opportunity.
- update in the field of waste recovery.

UNIT I ENERGY AUDITING, SUSTAINABILITY IN THE FOOD INDUSTRY 12

Fundamentals of Energy Auditing,-Sustainability in the Food Industry -Energy Conservation Technologies Applied to Food Processing Facilities- Energy Conservation in Steam Generation and Consumption System. Energy Conservation in Compressed Air System- Energy Conservation in Power and Electrical Systems. Energy Conservation in Heat Exchanger.

UNIT II WASTE HEAT RECOVERY 6

Waste Heat Recovery and Thermal Energy Storage in Food Processing Facilities- novel Thermodynamic Cycles Applied to the Food Industry for Improved Energy Efficiency

UNIT III ENERGY SAVING OPPORTUNITIES IN EXISTING FOOD PROCESSING 12

Facilities Energy Consumption pattern, Energy Conservation in Grains and Oilseeds Milling Facilities, in Sugar and Confectionary Processing Facilities, in Fruit and Vegetable Processing Facilities, in Dairy Processing Facilities, in Meat Processing Facilities, in Bakery Processing Facilities.

UNIT IV ENERGY CONSERVATION IN EMERGING FOOD PROCESSING SYSTEMS 9

Membrane Processing of Foods, Energy Efficiency and Conservation in Food Irradiation, in Pulsed Electric Fields Treatment, in High-Pressure Food Processing, in Microwave Heating, in Supercritical Fluid Processing Conversion of Food Processing Wastes into Energy.

UNIT V FOOD PROCESSING WASTES AND UTILIZATIONS 6

Concepts of Anaerobic Digestion of Food Processing Wastes, Fermentation of Food Processing Wastes into Transportation Alcohols, Bio-diesel Production from Waste Oils and Fats, Thermo- chemical Conversion of Food Processing Wastes for Energy Utilization.

TOTAL PERIODS: 45

COURSE OUTCOMES (COS)

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

- classify the energy resources based on sources and purposes
- identify the types of energy audits in production agriculture for rural living and scope of energy conservation
- identify the energy efficient machinery systems and analyse the technologies and methods for conservation of energy resources
- identify the factors affecting energy conservation and analyse the energy economics, pricing and incentives for energy conservation
- make use of a case study on energy audit in agricultural fields for comparative studies

TEXT BOOKS

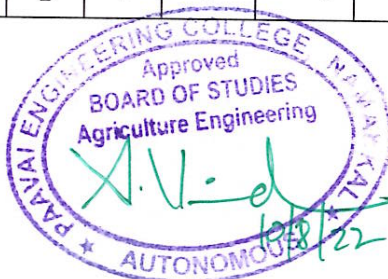
1. Spiewak Scott A, Cogeneration and Small Power Production Manual, The Fairment Press, 1987
2. Khartchenko N.V. Green Power: Eco-Friendly Energy Engineering, Tech Books, New Delhi, 2004

REFERENCE(S)

1. L.Wang, Energy Efficiency and Management in Food Processing Facilities, CRC Press, 2009
2. R. P. Singh, Energy in Food Processing, Elsevier Publishing Co., 1986
3. B. Mattsson, and U. Sonesson, Environmentally Friendly Food Processing, CRC Press, 2003
4. Sydney Reiter, Industrial and Commercial Heat Recovery Systems, Van Nostrand Reinhold, 1985.

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I INTRODUCTION TO DISASTER 9

Definition, Disaster, Hazard, Vulnerability, Resilience, Risks; Disasters, Types, Classification; Causes; Impact-differential impacts; Global trends in disasters; urban disaster; pandemics; complex emergencies; Dos and Dont's during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

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

UNIT III INTER - RELATIONSHIP BETWEEN DISASTER AND DEVELOPMENT 9

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

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

UNIT V APPLICATIONS, CASE STUDIES AND FIELD WORK 9

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

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- differentiate the types of disasters, causes and their impact on environment and society.
- assess vulnerability, damage assessment and various methods of risk reduction measures as well as mitigation.
- get an ideas about Climate change adaptation, IPCC Scenario and Scenarios in the context of India
- know the various disaster risk management practices in India.
- acquire knowledge on applications of disaster management.

TEXT BOOKS

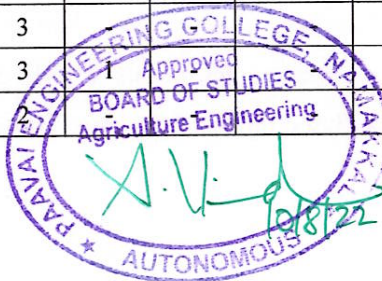
1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13:978-9380386423.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt.Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

REFERENCES

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.
3. Gupta Anil K, Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.
4. Kapur Anu, "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I INTRODUCTION TO ORGANIC FARMING**9**

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

UNIT II SOIL MANAGEMENT IN ORGANIC FARMING**9**

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

UNIT III PRODUCTION TECHNOLOGIES FOR ORGANIC FARMING**9**

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

UNIT IV CROP PROTECTION**9**

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

UNIT V POST HARVEST AND CERTIFICATION**9**

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

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- learn principles and practices of organic farming for sustainable crop production.
- acquire knowledge on soil management practices in organic production technology.
- gain knowledge on organic production technology.
- know about the post harvest technologies used in organic farming.
- understand the organic certification procedures for export.

TEXT BOOKS

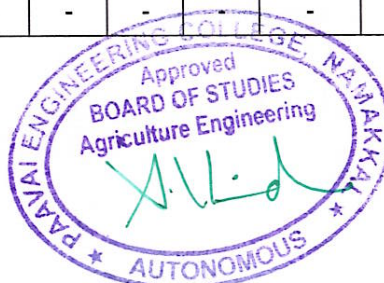
1. Dahama, A.K., "Organic Farming for Sustainable Agriculture", Agrobios (India), Jodhpur pp.301,2002.
2. Palaniappan, SP. and K. Annadurai, "Organic farming: Theory and Practice", Scientific Publishers, Jodhpur,1999.

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1. Sharma, Arun K., "A Hand book of Organic Farming", Agrobios (India), Jodhpur pp. 627,2002.
2. Vyas, S.C., Smriti Vyas, Sameer Vyas and H.A. Modi., "Biofertilizers and Organic farming", Akta Prakashan, Nadiad, pp.252,1998.
3. Anantha krishnan, T. N. (ed.), "Emerging Trends in Biological Control of Phytophagous Insects", Oxford & IBH, 1992.

CO/PO Mapping:

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I BASICS OF LANDSCAPING

9

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

UNIT II SITE SELECTION AND PLANTING PRINCIPLES

9

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

UNIT III PLANTING PRACTICES

9

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

UNIT IV LANDSCAPE APPLICATIONS

9

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

UNIT V SURFACE TREATMENTS IN LANDSCAPING

9

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

TOTAL PERIODS: 45**COURSE OUTCOMES**

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

- understand the basic concept of landscape design.
- select the suitable site and plants for designing landscape.
- analyse the different gardening requirement.
- design the landscape for different type of gardening.
- apply the different treatments and maintenance procedure.

TEXT BOOKS

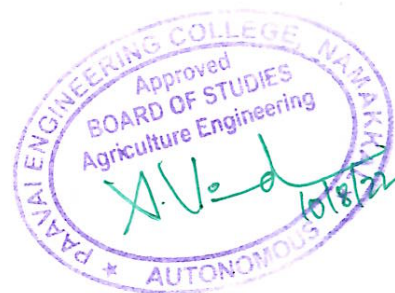
1. Rita Buchanan, "Taylor's Master Guide to Landscaping, Houghton Mifflin Gardening", ISBN: No. 0618055908, 2000.
2. Jack E Ingels, "Landscaping", Thomson Delmar Learning, ISBN No.: 082736735X, 1997.

REFERENCES

1. Steven Angle et.al., "Landscape Estimating and Contract Administration", Thomson Delmar Learning, ISBN: No. 0618055908, 2001.

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



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 APPING

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



COURSE OBJECTIVES

To enable the students to

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

UNIT I ATMOSPHERE COMPONENTS AND GLOBAL PHENOMENA 9

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

UNIT II CLIMATE CHANGE AND CAUSES 9

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

UNIT III OBSERVED AND PROJECTED CHANGES IN CLIMATE 9

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

UNIT IV IMPACTS OF CLIMATE CHANGE 9

Impacts of Climate Change on various sectors - Agriculture - Forestry - Coastal Ecosystem - Water Resources - Human Health - Industry - Settlement and Society; Crop yield impacts - temperature - precipitation - CO₂ - Assessment of impacts in agriculture - use of crop simulation models.

UNIT V CLIMATE CHANGE ADAPTATION AND MITIGATION 9

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

COURSE OUTCOMES

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

- know the characteristics of atmosphere and its components.
- understand the importance of global warming and climate change.
- get exposure on the observed climate changes and its causes.
- gain sufficient knowledge about the impacts of climate change on various sectors.
- learn about mitigation and adaptation measures (including vulnerability assessments) in different sectors

TEXT BOOKS

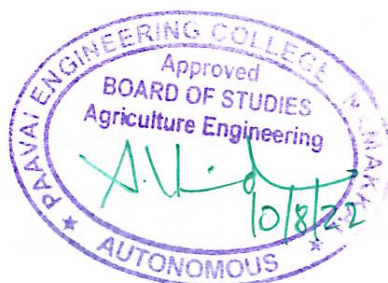
1. Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
2. "Adaptation and mitigation of climate change - Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.

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1. "Atmospheric Science", J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
2. Jan C. van Dam, "Impacts of Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

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



COURSE OBJECTIVES

To enable the 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 Biochar production and its applications.
- utilize agricultural waste for eco-friendly energy and manure production.

UNIT I INTRODUCTION

7

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

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 ligno 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 biogas digestion - types of digesters - factors affecting - nutrient value and utilization of biogas slurry. Ethanol production from ligno cellulosic wastes - Processing of Biomass to Ethanol - pre-treatment-fermentation - distillation.

TOTAL PERIODS :45

COURSE OUTCOMES

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

- know various eco-friendly methods for agricultural waste management.
- gain 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

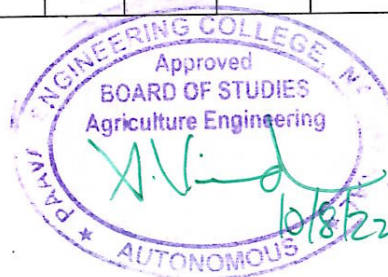
1. Raymond C Loehr, "Agricultural Waste Management- problems, processes and approaches". First edition, Academic press, 1974.
2. Diaz, I.F., M. de Bertoldi and W. Bidlingmaier. 2007. Compost science and technology, Elsevier pub., PP.1-380.

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1. Uta Krogmann, Ina Körne and Luis F. Diaz. 2010. Solid waste technology and management (Vol 1 and 2). Black well 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

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



COURSE OBJECTIVES

To enable students to

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

UNIT I UNDERSTANDING SELF**6**

Introduction - Self Exploration: Who am I, Know yourself, Johari Window Model ; Basics of English Grammar ; Improving Vocabulary; Communication –Definition – Process of Communication – Importance of Communication – Types & Barriers of Communication - Communicating effectively in the workplace

Activities

Spotting of Errors , Writing Caption for the Given Picture , SWOT Analysis , Johari Window Model: A Self Analysis

UNIT II PERSONALITY ENHANCEMENT SKILLS**6**

Leadership- Leadership Styles – Empathy - Decision Making – Problem Solving – Goal Setting – Motivation – Positive Attitude – Critical, Strategic & Lateral Thinking; Team Building – Importance – Stages of Team Building – Team Communication – Styles & Analysis

Activities:

Real Life Situations and Case Studies related to Leadership – “What Sort of a Leader You Are”: An Analysis – Personality Profile Analysis: Session 1 – Company Profile Analysis: Session 1 - Team Building: Two Truths & a Lie

UNIT III VERBAL ABILITY**6**

Introduction to Verbal Ability – Para Jumbles – Para Completion – Critical Reading - Sentence Construction – Reading Comprehension

UNIT IV QUANTITATIVE APTITUDE**6**

Introduction – Number System – LCM & HCF – Average – Percentage – Profit & Loss

UNIT V LOGICAL REASONING**6**

Character Puzzles – Logical Sequence – Classification – Coding & Decoding

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- enhance their verbal ability.
- demonstrate the Leadership Skills.
- practice soft skills to excel in their jobs.
- resolve problems based on quantitative aptitude.
- upgrade the logical reasoning Skills

TEXTBOOKS

1. Agarwal, R.S.” a modern approach to Verbal & Non Verbal Reasoning”, S.Chand& Co Ltd, new delhi.2015.
2. Agarwal, R.S. “ Objective General English”, S.Chand &Co.2016.

REFERENCES

1. Abhijit Guha, “Quantitative Aptitude “, Tata-Mcgraw Hill.2015.
2. Word Power Made Easy By Norman Lewis ,Wr.Goyal Publications.2016.
3. Johnson, D.W. Reaching out – Interpersonal Effectiveness and self actualization. Boston: Allyn And Bacon.2019.
4. Infosys Campus Connect Program – students’ guide for soft skills.2015.

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



COURSE OBJECTIVES

To enable students to

- enhance their own Behavioral Skills to survive in corporate world.
- evaluate their Listening and Speaking 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 BEHAVIORAL SKILLS**6**

Behavioral Skills – Time Management – Conflict Resolution – Emotional Intelligence – Feedback- Delegation – Productivity – Resilience – Resourcefulness- Analytical Thinking

Activities:

Puzzles, finding the Ace of Spade – Colored Blocks

UNIT II LISTENING & SPEAKING SKILLS**6**

Listening – Listening & Hearing - Types of Listening – Barriers to effective Listening – Ineffective Listening ;Public Speaking – Introduction & Types – Principles of Public Speaking - Improving the Skill – Techniques of Public Speaking

Activities:

Listening & Sequencing of Sentences - Story Telling Session I- Reading Comprehension– Cloze Exercise - Personality Profile Session 2 – Company Profile Session 2

UNIT III VERBAL ABILITY**6**

Elements of Verbal ability–English Grammar, vocabulary - Inductive & Deductive Reasoning – Paragraph Formation

UNIT IV QUANTITATIVE APTITUDE**6**

Time & Work - Time, Speed & Distance – Simple Interest & Compound Interest- Area

UNIT V LOGICAL REASONING**6**

Inputs & Outputs – Order & Ranking - Data Sufficiency – Statements & Conclusion – Arithmetic Reasoning

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- demonstrate the Behavioral skills through various activities.
- Speaking and Listening Skills to excel in their jobs
- enhance their verbal and Logical ability
- exhibit an quantitative skills along with logical and analytical skills
- excel in reasoning abilities by scoring exceeded percentage to get placed in reputed companies

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

