

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

IV Year B.Tech. Ag. Engg.-I Sem

L T/P/D C

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**(A73021) MICRO IRRIGATION ENGINEERING**

**Objective:** To impart knowledge and skills to students to design sprinkler and drip irrigation systems to improve water productivity of different crops and to perform economic analysis and to prepare project proposals and cost estimates of Micro – Irrigation Systems.

[www.universityupdates.in](http://www.universityupdates.in)**Unit – I:**

Sprinkler Irrigation Historical development, Scenario in the World, Country and State, adoptability and limitations, Components of the sprinkler system, pump set, (Centrifugal, turbines and Submersible), Main lines, Lateral lines, Sprinkler heads, Debris screens, Desilting basins, booster pumps, Take-off valves, Flow control valves (individual sprinkler). Sprinkler heads, fertigation Equipment, Types of sprinkler Irrigation systems: A. Based on mechanism: i) Rotating head system, ii) Perforated pipe system, B. Based on portability: i) Portable systems, ii) Semi-portable systems, iii) Semi-permanent systems, iv) Permanent systems and v) Solid set systems.

**Unit-II:**

Precipitation profiles and Moisture distribution patterns, Recommended sprinkler spacings, Effects of wind speed on working of the system, Importance of distribution uniformity, Christiansen Uniformity coefficient, Design of Sprinkler system, layout, laterals and mains: (i) Inventory of Resources and Conditions, ii) Types of system and Layout, iii) Sprinkler Selection and Spacing, iv) Capacity of Sprinkler Systems, v) Hydraulic Design of Sprinkler Systems, vi) Selection of pump, Operation and maintenance of system, Field evaluation of the system, Cost analysis.

**Unit – III:**

Drip Irrigation, Historical development, Scenario in the World, Country and State, Advantages and Limitations, Components of drip irrigation: A. Head Control- Non return valve, Air release & Vacuum breaker, Filter, Fertigation Tank, Throttle valve, Pressure gauge, other fittings, B. Wayer carrier systems- PVC pipeline, Control valve, Flush valve, other fittings, C. Water distribution systems- Drip lateral, Drippers, Emitting pie, Grommet, Start connector, Nipple, End cap, Micro tube, Barbed connector, Drip Hydraulics, Pipe section, Water flow in pipes, Velocity recommended pressure, Pressure and Hydrostatic, Pressure due to gravity, Friction and pressure losses, Coefficient of friction.

**Unit-IV:**[www.universityupdates.in](http://www.universityupdates.in)

Types of Emitters: A) Based on Floe regime (Reynolds number): i) Laminar

Flow, ii) Partially turbulent flow, iii) Fully turbulent flow and B) Based on Lateral connection: i) in-line and ii) on-line, Emitter flow equation, Emitter constants, Pressure variations (%) for different emitter flow variations and x-values, Emission uniformity (EU), Distribution Uniformity and Irrigation efficiency. Planning and design of drip system- Collection of primary data, Layout, crop water requirements, hydraulic design, selection of components, Economic pipe size selection, Pressure variation Along drip Irrigation and design criteria of lateral, sub-main and main lines, Pai-wu I design charts.

#### **Unit – V:**

Installation, operation and Maintenance of drip irrigation systems, testing and field evaluation of the system, Computer Software programs for design of drip irrigation systems. Automation of drip irrigation systems – i) Volume based, ii) time based and iii) Soil moisture bases systems.

#### **TEXT BOOKS:**

1. Drip Irrigation & Sprinkler Irrigation, Sivanappan R K Padam Kumari O and Kumar V 1997, Keerthi Publishing House Pvt. Ltd., Coimbatore.

#### **REFERENCES:**

1. Micro-Irrigation for Crop Production, Design, Operation and Management, Freddie R. Lamm, James E. Ayars and Francis S. Nalayama, 2006, Elsveir Publications, Singapore.
2. Land and Water Management Principles, R. Suresh, 2008, Standard Publishers Distributors, Delhi.

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**(A73018) FARM MACHINERY AND EQUIPMENT – II**

**Objective:** To enable the students to understand the basic principles of cutting mechanisms and to know the various available harvesting machines. To know the working principle and functions of various machine parts of mowers, reapers, windrowers, forage harvesters, threshers, combine harvesters, cotton strippers, cotton pickers, groundnut and potato and sugarcane harvesters. Students can also understand the importance of testing and evaluation of agricultural machines and different standard codes (BIS codes) available in India for testing of machinery..

**Unit – I:**

Harvesting – Crop harvesting machinery, history of development, manual harvesting and its classification. Principles and types of cutting mechanisms – principle of cutting mechanism, impact cutting, types of impact cutting, shear cutting Construction and adjustments of shear and impact type cutting mechanisms. Mowers – history and development, tractor mounted mowers, Trail behind tractor mower, integral Rear mounted mowers, side or central mounted tractor mower, semi-mounted mowers, safety precautions in operation and adjustments of mowers, Knife drives, cutter bar and its parts – inside and outside shoes. Cutter Bar – Guards, Ledger plates, wearing plates, knife clips, grass board and various parts of cutter bar assembly, alignment and registration of cutter bar. Windrowing – Methods of windrowing, Self propelled windrows, effects on yields and quality of Reapers, Animal drawn reaper, Tractor mounted Vertical conveyer reaper Repairs & maintenance of Harvesting equipment.

**Unit-II:**

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Power operated vertical conveyer reapers – Reaper binders – Care and maintenance, types Forage harvesting equipment – row forage harvesting equipment, field forage harvesters, types of field forage harvesters. Field chopper harvesters, forage wagons and boxes, field flail forage harvesters, the self propelled forage harvester, silo forage blowers, silo un loaders.

**Unit – III:**

Threshing – Principal of threshing, threshing methods, threshing by manual, threshing by animals, threshing by machines, oldpad threshers, Power thresher – types of power threshers, hammer mill type, rasp bar, spike tooth, syndicator,

Classification threshers based on feeding type, components of power thresher. Cleaning unit- Aspirator, blower, winnower, winnowing fan, cylinder adjustment, wheat thresher, groundnut thresher, terminology connected with power thresher. development of the binder, development of the combine, Harvester, advantages and disadvantages of combines, types of combines – Tractor drawn and self propelled combines. Functions performed by a combine, cutting mechanism, threshing mechanism, separating mechanism, cleaning mechanism, attachments for combine.

#### Unit – IV:

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Corn harvesting equipment- types of corn pickers, snappers, picker husker, Picker Sheller, power transmission, gathering and snapping mechanism, conveying and elevating mechanism. Husking mechanism, shelling mechanism, factors affecting performance of corn pickers, safety rules for operating corn pickers. Root crop harvesting equipment – groundnut harvester, groundnut diggers, digger operation and adjustments – groundnut shakers, groundnut threshers and pickers, groundnut combines, different units and its operation. Potato harvesters – harvesting methods and equipment, one row harvester, two row harvester, digging and soil separation, vine removal by harvesters, separation of stones and clods.

#### Unit V:

Cotton harvesting equipment – cotton stripper, types of cotton strippers, factors affecting the performance of the cotton strippers, plant characteristics – thickness of plants – conveying system. Cotton pickers – types of pickers, drum type and chain belt spindle arrangements in cotton pickers, methods of mounting spindles, doffing of the cotton, conveying systems, working, factors affecting performance of cotton pickers. Sugar cane harvesters – self propelled sugar cane harvester, cleaning and special sugar cane wagon. Sugar cane harvesters – Self propelled sugar cane harvester, conveying and special sugar cane wagon. Principles of fruit harvesting tools and machines – Harvesting methods – manual harvesters – hold on and twist type – Horticultural tools and gadgets. Testing of farm machine- Introduction, Standardization efforts, Testing programme and Procedure, Type of testing systems, national testing, prototype testing, testing for quality marketing.

#### TEXT BOOKS:

1. Principals of Farm Machinery. Kepner R.A., Bainer R and Barger E.L, 1987. CBS Publishers and Distributors, Delhi.

[www.universityupdates.in](http://www.universityupdates.in)

2. **ASA** Engineering principles of Agricultural machines, Ajith k Srivatsava, Carrol E. Goering, Roger P. Rohrbach, 1993, ASAE Publishers.

**REFERENCE BOOKS:**

1. Farm Machinery and Equipment. Smith H.P. 1971. Tata McGraw-Hills Publishing Co., Ltd., New Delhi.
2. Testing and Evaluation of Agricultural Machinery. Mehta M.L., Verma S.R. Misra S.K. and Sharma V.K. Daya Publishing House, New Delhi.

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**(A73022) POST HARVEST ENGINEERING AND HORTICULTURAL PRODUCE**[www.universityupdates.in](http://www.universityupdates.in)**Unit – I:**

Factors affecting fruit and vegetable quality, pre-harvest factors, Environmental Factors, Cultural factors, Post Harvest Factors, Engineering properties of Fruits and vegetables, Physical properties, Shape, Size, density, porosity, surface area, colour, serilynamie properties, dry coefficient terminal velocity Rheological properties, screen stain, Mechanical Properties, comprehension strength, tensile strength, shear resistance, Electrical properties, conductive, resistance dielectric properties, Optical properties, dielectric properties-optical properties, light transmittance, light reflectance, Handling and transportation of fruits and vegetables.

**Unit-II:**

Harvesting indices of different fruits and vegetables, determination of Maturity standards for fruits and Vegetable- Size shapes, aroma, Fruit ripening, leaf charges, firmness, Juice content, sugar content, skin colour, total soluble solid, modern techniques for determination of harvesting indices/ and grading of fruits, Electrical property, Near Infrared Reflectance (NIR), Radiation, Optical method, Light reflectance, Machine vision. Cleaning of fruits & Vegetables, soaking, rinsing, Cleaning & Washing- by agitator, by spraying water, wet and dry brushing, chemical washing, factors affecting effectiveness of a sprayer, Peeling of fruits and vegetables, Hand peeling, Mechanical peeling, peeling by heat treatment, Lye peeling, Grading of fruits & vegetables, Factors affecting grading, Types of graders, screen grader, roller grader, rope and cable type grader and weight grader

**Unit-III:**

Canning of fruits & Vegetables, Grading, washing, peeling, cutting, Blanching, cooling, filling, Syruping or brining, Exhausting, sealing, Heat processing, cooling to room temp, Storage, Labeling, Making of cans for canning, causes of spoilage of canned foods, Hydrogen swell, Flipper, Springer, soft swell, hard swell, Buckling, Principles of preservation of Fruits & Vegetables, Asepsis packaging, preservation by high temperature. Pasteurization, Flash Pasteurization, Sterilization, Chemical preservation with sulphur dioxide,

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advantages, disadvantages, Preservation with Benzoic acid, Concentration and reverse osmosis technique applied to fruits & vegetables, Drying and dehydration of fruits & vegetables (Flow chart), types of dryers, cabinet dryer, tray dryers, tunnel dryer, Reconstitution test and rehydration, Ratio of Rehydration coefficient, Freeze drying, methods of freezing, slow freezing, quick freezing method, advantages and disadvantages, direct immersion, indirect contact with refrigerant, Air blast freezing, cryogenic freezing, Dehydro freezing, Freeze-Drying (Flow chart).

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#### Unit – IV:

Post harvest management of Fruits and vegetables, procurement centers, Washing & grading, pre-cooling, room cooling, hydro cooling, Transportation by refrigerated trucks, Centralized cold storage centers etc, Controlled atmospheric storage, effects of CA, additional benefits, Limitations, Maintaining CA system, modified atmosphere storage/Packaging, Maintenance of MAP, active modification, passive modification, Requirements of fresh fruits package under CAS or MAS. Packaging of fruits and vegetables, packaging of fresh fruits, advantages of fresh packaging, Packaging materials, Cello pave, Poly vinyl chloride, polyethylene, Ethyl vinyl alcohol, Packaging of apples, Oranges, Mangoes, Bananas etc, Preparation of preservation of unfermented fruit beverages, selection of fruit, sorting and washing, Juice extraction, Deaeration, Filtration, Clarification, addition of sugar, fortification, preservation, Baffling, Unfermented beverages, Apple juice, grape juice, Pineapple juice, Citrus juice, Mango juice, with all flow sheets.

#### Unit-V:

Fermented beverages, Wine, Flow sheet for processing of grape wine, Selection of fruit, crushing, Addition of sugar, adjustment of PH, addition of preservative addition of wine yeast, Fermentation, Firing & filtration, aging, packaging, Preparation of Vinegar, Alcoholic fermentation, Acetic acid fermentation, quality characteristics of fruits and vegetable for processing, Sensory, Hidden and quantitative characteristics, Oleoresin and essential oil extraction, turmeric oleoresin, extraction of chilli oleoresin, factors responsible, Solvents used for oleoresin extraction, advantages and disadvantages, Extraction of essential oil from spices by steam distillation, flow chart.

#### TEXT BOOKS:

[www.universityupdates.in](http://www.universityupdates.in)

1. Food Science by Potter, N. CBS Publishers.

2. Fruits and Vegetable Preservation. Principles and practices by srivastava R P & Kumar S International book distributes .

### REFERENCE BOOK:

1. Fruits: Tropical and subtropical by Bose T,K & Mitre, SK Naya Prakash.
2. Fruits and Vegetable processing by Bhatti, S and varma U CBS Publishers.
3. Technology of food preservation by Defroshier and Defrossier CBS Publications.

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**(A73016) AGRO INDUSTRIES AND BI-PRODUCT UTILIZATION**

**Objective:** Processes to convert low value byproducts from agricultural and food processing industries will be explained in detail to produce economically viable value added products. Knowledge on treatment techniques of waste water from agricultural/food industry and animal sheds for safe disposal will be imparted to the students.

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**Unit –I**

Agro-industries-Definition, classification, factors responsible for establishment. By-products utilization-Rice husk-Introduction, characteristics, uses, production of pure silica and silicon, uses of amorphous silica, grades of silicon, structure of rice husk silica. Burning of rice husk for production of white ash, production of high purity silicon (calcium reduction process). Ceramic materials from rice husk – Classification of ceramics, advantages of rice husk white ash, raw materials for ceramics, production process, merits of process. Rice husk combustion – Furnace design calculation, efficiency of furnace, problems on rice hush combustion, design of cyclone furnace and inclined grate furnace. Rice husk – Alcoholic fermentation – Introduction, processes for manufacture of alcohol, production of ethyl alcohol by SSF process. Rice husk – Furfural – Chemistry, products properties of furfural, synthesis, production of furfural and xylitol from corn cobs, furfural through RRL process.

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**Unit-II:**

Rice bran – Oil extraction, food and chemical products processing. Coconut coir and shell utilization – Introduction. Commercial products – Edible copra, milling copra, oil milling, quality of copra and oil. Fresh kernel based products and product diversification – Desiccated coconut, canned coconut cream, coconut water. Coconut toddy production. Coir – Brown fiber milling, manufacture of white fiber. Coconut shell products. Mango stone and peel utilization – Mango vinegar, mango leather, mango flour-Cashew nut-Harvesting, processing. Cashew products – Nuts, testa, apple, cashew nut shell liquid, extraction of CNSL. Banana pseudo stem – Pseudo stem, banana stem candy, banana starch from pseudo stem, banana cheese from peel, banana pectin from peel, banana vinegar from pulp and peel, banana peel

as cattle feed. Sugarcane bagasse – Molasses, bagasse, filter mud, sugarcane wax. Paper making from agricultural wastes – paper processing – Manufacture of pulp and paper. Raw materials for paper production, paper board production from agricultural wastes.

#### Unit –III:

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Feed processing plants – Introduction, feedstuffs from cereals, classification of feeds, specialized feeding requirements, feed manufacturing processes, forms of feed. Equipment for unit operations in feed processing – Liquid feed blenders, flaking, milling, mixing, pelleting and extruding. Formulating feeds, layout of feed mills for commercial production. Agricultural waste management – Planning waste management systems – System selection, system principles, waste utilization opportunities, waste management alternative systems. Properties of agricultural waste – characteristics of solid and liquid wastes, parameter importance, determination of DO, COD, total organic carbon, BOD. BOD analysis of industrial waste waters, determination of BOD with seed material, problems on BOD. Waste collection, storage and handling – Collection, components of waste collection systems, storage of manures and slurries, factors affecting choice of storage facility. Waste handling and transport, pumping liquid manure, sumps and mixing, mixing and agitation.

#### Unit-IV:

Industrial waste treatment – Physical treatment of waste – Solid-liquid separation – Settling, problems on solid-liquid separation, screening, drying, incineration, and pyrolysis. Biological treatment – Introduction. Anaerobic decomposition, lagoon systems, anaerobic lagoons, advantages and disadvantages of anaerobic lagoons. Design of anaerobic lagoons, problems on design of anaerobic lagoons, anaerobic lagoon sludge. Aerobic treatment – Introduction, reactions and processes for anaerobic treatment, advantages and disadvantages of anaerobic treatment.

#### Unit –V:

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Types of aeration systems - Natural aeration - Introduction, planning and design, Mechanical aeration – Film reactors – Tricking filters, rotating biological contactors, problems on tricking filters. Floc reactors – Mechanically aerated lagoons, diffused air systems, Waste for reuse. Briquetting – Introduction, principle, briquetting machines. Processing – Direct compaction, carbonization and extrusion. Establishment of agro Processing industries in rural areas, factors affecting for establishing of agro

processing plants, cost benefit ratio for agro processing industries, employment generation.

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#### REFERENCES:

1. Agricultural Waste Manual, Vandersholm D H 1984. New Zealand Agricultural, Engineering Institute, Lincoln College, New Zealand.
2. Principles of Food Sanitation, Marriott N G 1985. AVI Publishing Co. Inc., Westport, Connecticut.

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### (A70352) OPERATIONS RESEARCH

(Elective-I)

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#### UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

**Allocation:** Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method.

#### UNIT – II

**Transportation Problem** – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

**Assignment problem** – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.

#### UNIT – III

**Sequencing**– Introduction – Flow – Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines

**Replacement:** Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

#### UNIT – IV

**Theory of Games:** Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

**Inventory:** Introduction – Single item, Deterministic models – Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand may be discrete variable or continuous variable – Single Period model and no setup cost.

#### UNIT – V

**Waiting Lines:** Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

**Dynamic Programming:**

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Introduction – Terminology- Bellman's Principle of Optimality – Applications

of dynamic programming- shortest path problem – linear programming problem.

**Simulation:** Introduction, Definition, types of simulation models, Steps involved in the simulation process- Advantages and disadvantages-applications of simulation to queuing and inventory.

**TEXT BOOK :**

1. Operations Research /J.K.Sharma 4e. /MacMilan
2. Introduction to O.R/Hillier & Libermann/TMH

**REFERENCE BOOKS :**

1. Introduction to O.R /Taha/PHI
2. Operations Research/ NVS Raju/ SMS Education/3<sup>rd</sup> Revised Edition
3. Operations Research /A. M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
4. Operations Research / Wagner/ PHI Publications.
5. Operations Research/M. V. Durga Prasad, K, Vijaya Kumar Reddy, J. Suresh Kumar/ Cengage Learning.

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**(A73017) DRYING AND STORAGE ENGINEERING****(Elective-I)**

**Objective:** To enable the students to understand the principles and acquire the knowledge on moisture content determination methods, EMC models, principles and methods of drying and their analysis, study of different driers, dehydration and functional requirements, storage of grains, CAP storage, MAP storage, and study the conveying equipment.

**Unit-I:**[www.universityupdates.in](http://www.universityupdates.in)

Moisture contents and methods for determination: Moisture content representation, wet basis, dry basis, direct and indirect methods of moisture content determination, problems. Importance of EMC and methods of its determination: static method, dynamic methods: desorption method and isothermographic method. EMC curve and EMC model: Kelvin equation, Harkins-Jura equation, Chung-Pfost equation and Henderson equation, hysteresis effect, bound moisture, unbound moisture, free moisture. Principle of drying: Theory of diffusion, mechanism of drying - falling rate, constant rate, thin layer: determination of drying constants, remarks, effects of different factors on the drying process.

**Unit-II:**

Deep bed drying and their analysis, time of advance of drying front, decreasing rate period - remarks on the deep bed, problems on drying. Critical moisture content, drying models, rate of drying curves for constant drying conditions, calculation methods for falling rate drying period. Calculation of drying air temperature and air flow rate, air pressure within the grain bed, Shred's and Hukill's curve. Different methods of drying: convective drying, radiation drying, dielectric drying, chemical drying, sack drying, puff drying, foam mat drying, freeze drying etc. Study of different types of driers: unheated air driers: air distribution systems, heated air driers: flat bed type batch driers, reciprocating batch drier. Study of LSU dryer, baffle dryer, rotary dryer, performance, energy utilization pattern and efficiency.

**Unit-III:**[www.universityupdates.in](http://www.universityupdates.in)

Types and causes of spoilage in storage, conditions for storage of perishable products. Functional requirements of storage, control of temperature and

relative humidity inside storage. Calculation of refrigeration load, control of its environment, air movement inside the storage. Storage of grains: destructive agents, respiration of grains, moisture and temperature changes in stored grains. Conditioning of environment inside storage through natural ventilation. Conditioning of environment inside storage through mechanical ventilation, artificial drying.

#### Unit – IV:

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CAP Storage, warehouse – design and control of environment. Storage of cereal grains and their products. Storage of seeds – terminology and treatments. Principles of grain storage – parameters – effecting the grain storage. Changes occurring during storage, nutritive changes, minerals, carbohydrates, proteins and vitamins. Moisture migration, storage insects, pests and their control.

#### Unit-V:

Grain storage structures – bag storage of grains: different types of storage, classification planning for a bag storage complex, constructional features and basic specifications of typical bag storage structures, design aspects of bag storage structures. Bulk storage of grains: advantages of bulk handling system, types of bulk storage traditional storage structures, morla, bhukari, kothar type storage structures. Bulk storage of grains, pusa bin, brick and cement bin, bunker storage, vertical silos. Grain handling equipment-bucket elevator: types of bucket elevators, components of bucket elevators, head section, boot section, elevator legs, elevator belt, buckets, drive mechanism and power requirement problems. Belt conveyors: Salient features, design considerations, belt tension, power, design problems. Screw Conveyors: Salient features, Conveyor elements, selection of screw conveyors and power requirements–problems. Pneumatic conveyor, essential components, description of typical plant, limitations of pneumatic conveyor. Hermetically sealed and air cooled storage. Controlled Atmosphere storage of grains. Modified Atmosphere storage of grains. Tutorial problems on drying.

#### TEXT BOOKS:

1. Unit Operations of Agricultural Processing, Sahay K M and Singh K K 1994 Vikas Publishing House Pvt. Ltd., New Delhi.
2. Grain Storage Engineering and Technology, Vijaya Raghavan, S. 1993. Batre Bale Service New Delhi.
3. Drying and Storage of Grains and Oilseeds, CBS Publishers & distributions, New Delhi.

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## REFERENCES:

1. Transport Processes and Unit Operations, Geankoplis C J 1978. Aliyn and Bacon Inc., Newton, Massachusetts.
2. Unit operations in Food Processing, Earle R L 1983. Pergamon Press, New York.
3. Post Harvest Technology of Cereals, Pulses and Oil seeds, Chakravarthy A and De D S 1988 Oxford and IBH Publishing Co. Ltd., Calcutta.
4. Unit Operations of Chemical Engineering, McCabe W L and Smith J C 1993 McGraw Hill Book Co., New Delhi.



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### (A70010) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Elective-I)

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#### Objectives:

To enable the student to understand and appreciate, with a practical insight, the importance of certain basic issues governing the business operations namely: demand and supply, production function, cost analysis, markets, forms of business organisations, capital budgeting and financial accounting and financial analysis.

#### Unit I

**Introduction & Demand Analysis:** Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. *Elasticity of Demand:* Definition, Types, Measurement and Significance of Elasticity of Demand. *Demand Forecasting,* Factors governing demand forecasting, methods of demand forecasting.

#### Unit II

**Production & Cost Analysis:** *Production Function* – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. *Cost Analysis:* Cost concepts. Break-even Analysis (BEA) – Determination of Break-Even Point (simple problems) - Managerial Significance.

#### Unit III

**Markets & New Economic Environment:** Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. *Pricing:* Objectives and Policies of Pricing. Methods of Pricing. *Business:* Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, *New Economic Environment:* Changing Business Environment in Post-liberalization scenario.

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#### Unit IV

**Capital Budgeting:** Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

**Unit V**

**Introduction to Financial Accounting & Financial Analysis:** Accounting concepts and Conventions - Introduction IFRS - Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis:* Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

**TEXT BOOKS:**

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

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**REFERENCES:**

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012
4. Domnick Salvatore: Managerial Economics in a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting - A Managerial Perspective, Pearson, 2012.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha : MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J. V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

**Outcomes:**

At the end of the course, the student will

- Understand the market dynamics namely, demand and supply, demand forecasting , elasticity of demand and supply, pricing methods and pricing in different market structures.

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- Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis
- Develop an understanding of
- Analyse how capital budgeting decisions are carried out
- Understand the framework for both manual and computerised accounting process
- Know how to analyse and interpret the financial statements through ratio analysis.

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**(A73019) FOOD PROCESSING PLANT DESIGN AND LAYOUT****(Elective-I)**

**Objective:** Students will be trained in organization of food and agricultural processing plant machinery as per process flow. Also, site selection, layout procedures, project design concepts, etc. Will be explained for bringing the talent to establish an engineering industry.

**Unit -I:**[www.universityupdates.in](http://www.universityupdates.in)

Plant layout – Definition, meaning, objectives, principles. Plant layout – Factors in planning layouts. Methods of layout planning – Unit areas concept, two – dimensional layouts, scale models. Principles of plant layout – Storage layout, equipment layout, safety, plant expansion, floor space, utilities servicing, building, materials handling equipment, rail roads and roads. Types of plant layout – fruit processing plant. Salient features of rice processing plant. Salient features of maize processing plant. Salient features of pulses – processing plants. Salient features of oilseeds processing plants. Salient features of horticulture processing plants. ★

**Unit-II:**

Salient features of processing plants of vegetable crops. Salient features of processing of poultry plants. Salient features of processing of fish processing plant. Salient features of processing of meat processing plant. Salient features of milk and milk products processing plants. Salient features of milk and milk products processing plants.

**Unit-III:**

Location selection criteria – Plant location, factors in selecting a plant, selection of the plant site, preparation of the layout. Selection of processes – Comparison of different processes, batch versus continuous operation. Plant capacity – Equipment design and specifications, scale – up in design, safety factors, specifications, materials of construction. Project design – Process design development, general overall design considerations, cost estimation, factors affecting profitability of investments, optimum design (economic and operation). Project design – Practical considerations in design, approach. Project design – Types of designs, feasibility survey, process development, design, construction and operation, design information from the literature.

**Unit -IV:**[www.universityupdates.in](http://www.universityupdates.in)

Flow diagrams-Qualitative and quantitative flow diagrams. Selection of equipments - Preliminary design, problem statement, literature survey, material

and energy balance, equipment design and selection, problems, economics. Process and controls-Control systems, instrumentation control, maintenance, computer aided design. Handling equipments - Selection, factors, pumps, piping, fittings, solid feeders, plant layout. Plant elevation -Requirement of plant building and its components, foundation for equipment and dynamic loading, flooring, walls, roof, illumination, air-conditioning. Labor requirement for processing plant - Labor costs, maintenance and repairs, common denominator, Plant installation, Power and power transmission - Systems.

#### Unit-V:

[www.universityupdates.in](http://www.universityupdates.in)

Food plant sanitation-Environmental protection, regulations, pollution control, air pollution abatement, particulate removal, noxious gas removal, thermal pollution control, recycling, CIP. Cost analysis - Cash flow for industrial operations, factors affecting investment and production costs, capital investment, estimation of capital investment. Cost analysis - Cost indexes, cost factors in capital investment, estimation of total product cost. Preparation of feasibility report -Types of reports, organization of reports, organization of a design report, preparing the report, rhetoric, checklist for the final report.

#### TEXT BOOK:

Dairy and Food Engineering, Farall F W 1992. John Wiley & Sons, New York.

#### REFERENCES:

1. Plant Layout and Design, James M Moor, Macmillan, New York.
2. Milk Plant Layout, Hall H S and Y. Rosen, FAO publications, Rome.
3. Principles of Food Sanitation, Marriott N G 1985. Van Nostrand Reinhold Company, New York.
4. Food Technology Processing and Aylward F 2001. Allied Scientific Publishers, Bikaner. Laboratory Control.

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**(A70145) WATERSHED MANAGEMENT****(Elective-II)**[www.universityupdates.in](http://www.universityupdates.in)**UNIT-I**

**Introduction:** Concept of watershed development, objectives of watershed development, need for watershed development in India, Integrated and multidisciplinary approach for watershed management.

**Characteristics of Watershed:** size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

**UNIT-II**

Watershed delineation – Runoff Computations from a watershed – Flood Frequency Analysis – Gumbell, Log Pearson and Weibull Methods of Analysis.

Planning of watershed management activities, peoples participation, preparation of action plan, administrative requirements

**UNIT-III**

**Principles of Erosion:** Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, Universal soil loss equation.

**Measures to Control Erosion:** Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rockfill dams, brushwood dam, Gabion.

**UNIT-IV**

**Water Harvesting:** Rainwater Harvesting, catchment harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds, percolation tanks.

[www.universityupdates.in](http://www.universityupdates.in)**UNIT-V**

**Forest and Grass Land Management:** Interpretation of Satellite Imageries-Land use and Land Cover. Land capability classification, management of forest, agricultural, grassland and wild land. Reclamation of saline and alkaline soils.

**Ecosystem Management:** Role of Ecosystem, crop husbandry, soil enrichment, inter, mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, Silvi pasture, horticulture, social forestry and afforestation.

**TEXT BOOKS:**

1. Watershed Management by JVS Murthy, - New Age International Publishers.
2. Water Resource Engineering by R.Awurbs and WP James, - Prentice Hall Publishers.

[www.universityupdates.in](http://www.universityupdates.in)

**REFERENCE:**

1. Land and Water Management by VVN Murthy, - Kalyani Publications.
2. Irrigation and Water Management by D.K.Majumdar, Printice Hall of India.

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**(A73020) MECHANICAL MEASUREMENTS AND INSTRUMENTATION****(Elective-II)**[www.universityupdates.in](http://www.universityupdates.in)

**Objective** To enable the students to understand the principles and to acquire the knowledge on measuring systems, different types of instruments used for measuring the parameters like pressure, force, strain, temperature, sound, acceleration and displacement etc. and also to study practically using instruments for carrying out the experiments related to the concerned fields.

**Unit- I:**

Measurement and its significance, methods of measurement – direct methods and indirect methods and classification of measurements – primary measurements, secondary measurements and tertiary measurements. Instruments and measuring systems, their classification – according to history of instruments, according to mode of measurement and according to the functional requirement and principles of operation. Their principles of operation. Functional elements of a generalized measurement system – basic functional elements – transducer element, signal conditioning element and data precision elements and auxiliary elements. Examples of instruments for identification of basic and auxiliary elements – bourdon tube pressure gauge with out and with electrical read out, spring balance and proving ring etc. Inaccuracy in measurement and its analysis – types of errors or limiting errors – propagation of error or uncertainty.

Detector transducer elements – introduction, classification and their principles – primary and secondary transducers, mechanical transducer, pressure transducers and active, passive transducers, analogue transducers and digital transducers. Signal conditioning elements and their principles of operation, data presentation elements and types – visual display type, graphical recording type, magnetic type and digital type. Static performance characteristics of instruments: static sensitivity, independent and proportional linearity, hysteresis, threshold, resolution and drift – zero and sensitivity drifts.

**Unit-II:**[www.universityupdates.in](http://www.universityupdates.in)

Measurement of pressure: Introduction, types of pressure – atmospheric pressure, gauge pressure and absolute pressure, units of measurement and conversion of units from one system or another system. Types of pressure measuring devices with examples – mechanical devices, electromechanical devices. Manometers – types: simple U tube manometer. Well type manometer and inclined well manometer – ranges and their application – fluids used in manometer – desirable properties of manometric fluids – micro



manometer for measuring very low pressures. Low pressure measurement devices – basic methods of measuring low pressures – study of McLeod pressure gauge used for measuring vacuum pressures: principles, construction, range and limitations. Electrical methods of measuring pressure – pressure sensitivity of resistance gauge – study of Bridgman pressure gauge used for measuring very high pressures: construction, principle, range and applications.

#### Unit- III:

[www.universityupdates.in](http://www.universityupdates.in)

Measurement of strain – introduction, strain gauge principle, metals used for manufacturing strain gauges – strain gauge theory and gauge factor. Strain gauge circuits – Wheatstone bridge circuit and unbalanced bridge. Measurement of change of resistance. Cross sensitivity and temperature compensation using dummy gauge and more than one active gauge – advantages and applications of strain gauges. Strain gauge arrangements – measurement of axial force applied to simple beams by the arrangement of one active gauge, using two active gauges and using of active gauges. Measurement of force applied to a cantilever by using four active gauges – simple arrangement method and Poisson arrangement method. Measurement of pressure using strain gauges – diaphragm type strain gauge pressure transducer.

#### Unit- IV:

Measurement of temperature – introduction and classification of temperature measuring gases along with examples – bimetallic thermometer, mercury thermometer and vapor pressure thermometer. Bimetallic thermometers – principles – types: strip type and cantilever type – materials of construction – types based on shape – advantages, ranges of measurement and applications. Liquid in glass thermometers – type of liquids used – desirable properties of liquids used in thermometer – complete immersion type measurement and partial immersion type measurement – ranges – disadvantages. Liquid in metal thermometer. Thermometers based on expansion of gases – vapor pressure thermometer; construction, principles, gases used, range, merits and limitations. Electrical methods of measuring pressure – electrical resistance thermometers – conductor type and semiconductors type – metals used – platinum resistance thermometer. Thermistor – principle – metals used – types based on shape – range of measurement – advantages – limitations. Comparison between thermometer and thermistor. Thermometer – principle – thermocouple laws – base metal type and rear metal type thermocouples – thermocouple materials and characteristics. Comparison between resistance thermometer and thermocouple. Thermopile – principle.

#### Unit- V:

[www.universityupdates.in](http://www.universityupdates.in)

Measurement of sound – introduction – noise and loudness, sound pressure

level, sound power level, variation of intensity of sound with distance and combination of sounds. Sound measuring system. Microphone – principle, types: capacitor type, carbon granule type, piezo electrical crystal type and electro-dynamics type-fields of application. Study of speed measuring instruments-stroboscope and tachometer-principles-construction-range. Study of proving ring for force measurement and study of linear variable differentiation transformer (LVDT) for displacement measurement-principles and construction.

**TEXT BOOKS:**

[www.universityupdates.in](http://www.universityupdates.in)

- 1 Mechanical Measurements, Sirohi RS and Radhakrishna HC 1983, Wiley Eastern Ltd., 4835/24 Ansari Road, New Delhi
- 2 Instrumentation, Measurement and Analysis Nakra BC and choudhary KK 1987, Tata McGraw Hill publishing Co Ltd., 12/ 4 Asaf Ali Road, New Delhi
- 3 A course in Mechanical Measurements and Instrumentation, Shawhney A K, 1989, Dhanpat Rai and Sons, 1682, Nai Sarak, New Delhi.

**REFERENCES:**

1. Engineering Measurements and Instrumentation, Adams L F, 1981, The English Language Book Society and Hodder and Stoughton, London.
2. Mechanical Measurements, Thomas G B and Buck N L, 1969, Oxford and IBH Publishing Co. Ltd., 66, Janpath, New Delhi.

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**(A70338) COMPUTATIONAL FLUID DYNAMICS****(Elective-II)**[www.universityupdates.in](http://www.universityupdates.in)**UNIT-I**

Elementary details in numerical techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition for instability, computational methods for error estimation, convergence of sequences.

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

**UNIT - II**

Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

**UNIT - III**

Introduction to first order wave equation; Stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

**UNIT - IV**

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

**UNIT-V**

Finite volume method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

**TEXT BOOKS:**[www.universityupdates.in](http://www.universityupdates.in)

1. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
2. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa

Publications

[www.universityupdates.in](http://www.universityupdates.in)

**REFERENCES:**

1. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
3. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis/Oxford University Press/2<sup>nd</sup> Edition

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**(A73087) FIELD OPERATION AND MAINTENANCE OF TRACTORS AND FARM MACHINERY LAB**

**Objectives:** To enable the students for acquiring the knowledge pertaining to maintenance of tractors like periodical maintenance (50 to 100 hours, 200 to 250 hours, 480 to 500 engine working hours, 960 to 1000 hours) and trouble shooting of all systems like fuel system, lubrication system, cooling system and ignition system and remedial measures for above system.

1. Tractor Systems - Maintenance of air fuel system – cleaning of air cleaners – Frequent troubles and Remedies – Process to remove air lock in the diesel engine – Precautions in handling diesel fuels in diesel engine.
2. Maintenance of lubrication system – Frequent troubles and Remedies – Troubles in Lubrication system – Excessive oil consumption – Care and maintenance of lubrication system.
3. Maintenance of transmission system – General maintenance – Differential trouble shooting – Frequent troubles and Remedies.
4. Maintenance of cooling system and cleaning of radiators - Frequent troubles and Remedies – Cooling system troubles – Over heating – slow warm up of the engine – care and maintenance of cooling system.
5. Maintenance of Ignition system – Care and Maintenance of batteries – Frequent troubles and Remedies – causes of ignition failure in battery system.
6. Maintenance of hydraulic system – Working principle – Basic components of hydraulic system – Types of hydraulic system – Frequent troubles and Remedies – Repairs and maintenance of hydraulic system – Precautions of hydraulic system.
7. Periodical maintenance of tractors – at 8 – 10 engine working hours – At 50 – 60 engine working hours at 100-120 engine working hours – at 200-250 engine working hours – at 480-500 engine working hours – at 960 – 1000 engine working hours.
8. Emission of smoke – Over heating of engines - maintenance of clutch brakes hydraulic problems..
9. Maintenance of Agricultural machinery before and after use like primary tillage implements M.B. plough, Disc plough and secondary tillage implements like harrows, seed drills, weeders cultivators.
10. Driving in forward and reverse gears, Driving safety sales and study

bean trepanned.

- 11 Hitching and field operation of M.B. plough, disc plough and harrows.
- 12 Field operation and adjustments of seed drill, Trans planers.
- 13 Adjustment and maintenance of threshers.

**REFERENCES:**

[www.universityupdates.in](http://www.universityupdates.in)

1. Elements of Agricultural Engineering. Jasgishwara Sahay 1992. Agro Book Agency, Patna.
2. Farm Tractor Maintenance and Repair. Jain S.C. and Roy C.R. 1984. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3. Tractors and their Power units. Liledahi J.B. Carleton W.M. Turnquist P.K. and Smith D.W. 1984. AVI Publishing Co., Inc., Westport, Connecticut.
4. Farm Machines and their Equipment. Nakra C.P. 1986 Dhanpet Rai and Sons. New Delhi.

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**(A73088) DAIRY AND FOOD ENGINEERING LAB**

1. To study composite pilot milk processing plant & equipments
2. To study various parts of Pasteurizer and its working
3. To study various parts of Sterilizer and its working
4. To study various parts of Homogenizer and its working
5. To study various parts of Cream Separator and its working
6. To study various parts of Butter Churner and its working
7. To study various parts of Evaporator and its working
8. To study various parts of milk drier and its working
9. To study various parts of freezer and its working
10. Design and layout of dairy plant
11. To determine various physical properties of Food Products
12. To estimate steam requirement for various operations in dairy plant
13. Visit to food industry/dairy plant.

**REFERENCES:**

1. Food Engineering and Dairy Technology, Kessler H G 1981. Verlag A. Kessler, Freising
2. Outlines of Dairy Technology, Sukumar D C 2005. Oxford University Press, New Delhi
3. Principles of Food Science, Fennema O R 2006. The Bangalore Printing & Publishing Co., Ltd., Bangalore