R16 SYLLABUS
FOR
AGRICULTURAL ENGINEERING

for

THIRD YEAR

(Applicable for batches admitted from 2016-2017)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA - 533 003, Andhra Pradesh, India

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
4	-/-	3

THERMODYNAMICS AND REFRIGERATION SYSTEMS

Objective: To enable the students to know about the thermodynamic laws and principles, gas laws and different cycles and their efficiencies for efficient designs of heat engines, Refrigerator systems in general and Farm engines and cold storages in particular.

Unit – I:

Introduction to Thermodynamic system, boundary, surroundings, Classification of Thermodynamic system, Closed system-open system-isolated system, Laws of conservation of energy, heat, work, Definition of thermodynamic work and example of work, Thermodynamic properties, classification of thermodynamic systems.

Laws of thermodynamic – first law, second law and zeroth law, Gas laws-Boyless' law Charles law Guy–Iussac law, Thermodynamic properties of perfect gases. Application of first law in heating and expansion of gases, Cycles-introduction-Applications, Carnot theorem-Carnot cycle,

Unit – II:

Entropy-introduction-physical concept of entropy, Change of entropy of gases in thermodynamics.

Heat engines, Classification, Components, Working principles- Working cycle of 4-stoke and 2-stroke diesel and Petrol Engines, Comparison between 4 stroke and 2-stroke Diesel and Petrol Engines, Air standard cycle-efficiencies, Explanation of other engine efficiencies and terms, Explanation of Otto cycle-thermal efficiency equations, Explanation of diesel cycle and dual cycle, Calculation of efficiencies, Mean effective pressure and their comparison, Measurement of indicated horse power, brake horse power, Heat balance calculations, Problems on IP, BP, Engine efficiencies and performances

Unit-III:

Principles of refrigeration- Definition of refrigeration, second law of thermodynamics, background, major uses and applications, Principles of refrigeration – Room air conditioner, domestic refrigerator, working substances in refrigeration machines, unit of refrigerating capacity, coefficient of performance, problems on refrigeration capacity, Production low temperatures- Expansion of a liquid with flashing, reversible adiabatic expansion of a gas, irreversible adiabatic expansion (throttling) of a real gas, thermoelectric cooling, adiabatic demagnetization.

Unit – IV:

Refrigeration machine, heat engines, Air refrigerators working on reverse Carnot cycle-Carnot cycle, reversed Carnot cycle, selection of operating temperatures, Problems on reverse Carnot cycle and selection of operating temperatures, Air refrigerators working on Bell Coleman cycle- Reversed Brayton or joule or Bell Coleman Cycle, Analysis of gas cycle, polytropic and multistage compression, Problems on Bell Coleman cycle, Vapour refrigeration – Vapor as a refrigerant in reversed Carnot cycle with P-V. and T-s diagrams, problems on reversed Carnot cycle with vapour, gas as a refrigerant in reversed Carnot cycle, limitations of reversed Carnot cycle.

Unit –V:

Vapour compression systems –Modifications in reverse Carnot cycle with vapour as refrigerant (dry vs. wet compression, throttling Vs isentropic expansion), Vapor compression cycle, vapor compression system calculations, Vapor compression cycle – Representation of vapor compression cycle on pressure- enthalpy diagram, super heating, sub cooling, problems on vapour compression cycle, Liquid-vapour regenerative heat exchanger for vapour compression system, effect of suction vapour super heating, sub cooling, problems on vapour

compression cycle, Vapour-absorption refrigeration system – Process, calculation, maximum coefficient of performance of a heat operated refrigerating machine, problems on vapour absorption refrigerating system, common, refrigerant-absorbent systems.

Unit-VI:

Common refrigeration and their properties, Cold storage- Cold storage, controlled atmosphere storage, factor affecting refrigerated cold storage, hypobaric storage, Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, ideal gas law, Amagat's law, Dalton's law, Psychometric chart – Saturation pressure, absolute humidity, percentage humidity, humid volume, total heat, enthalpy, adiabatic processes, wet bulb temperature and its measurement, psychometric chart and its use. Psychometric processes- state factor, cooling, heating, mixtures, dehumidifying, drying, air conditioning.

TEXT BOOKS:

1. Engineering Thermodynamics, Nag PK 1995, Tata Mc Graw Hill Publishing Co., Ltd., 12/4 Asaf Ali Road, New Delhi.
2. Refrigeration and Air conditioning, C P Arora.

REFERENCES:

1. A Course in Thermodynamics and Heat Engines, Kothandaraman C.P Khajuria PR and Arora SC 1992.Dhanpat Rai and Sons, 1682 Nai Sarak, New Delhi
2. Engineering Thermodynamics, Khurmi R S 1992 S Chand and Co. Ltd Ram Nagar, New Delhi.
3. Thermodynamics and Heat Power Engineering, Mathur ML and Mehata fs 1992 Dhanpat Rai and Sons 1682 Nai Sarak, New Delhi
4. Thermal Engineering, Ballaney PL 1994, Khanna Publishers, New Delhi
5. A text book of Refrigeration and Air Conditioning, R. S. Khurmi and J.K. Gupta – 2008, S. Chand & Company Ltd, New Delhi

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
4	-/-	3

SOIL AND WATER CONSERVATION ENGINEERING

Objective: To enable the students to acquire knowledge on different soil laws estimation models, run off estimation by rational, curve number, cook's etc. Land use, capability classification, Land treatment works like contour bunding, terracing, bench terraces, contour trenches and their types and complete design calculations. Also to enrich the students and familiarize the students in the design of various gully control structures, temporary and permanent, their designs with a due importance to hydrologic, hydraulic and structural phases of design.

Unit- I:

Introduction – Soil and Water conservation research centre–Its sub-centers in India–Soil Erosion–Geologic, Accelerated types. Causes and agents of erosion – Factors affecting erosion – Different stages of erosion – Rill – Sheet – Gully and Ravines-Water Erosion– Forms of water erosion–Mechanics of Erosion – Gullies and their classification, stages of gully development. Soil Loss estimation–Universal Soil Loss equation and modified soil loss equation, expansion of various terms – Estimation of their various parameters.

Unit–II:

Wind Erosion – Factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, Wind erosion control measures – Vegetative, mechanical measures, wind blades and shelter belts, sand dunes stabilization – Wind erosion and its control.

Unit – III

Runoff – Factors affecting runoff – Runoff – Peak Runoff and design peak runoff – its estimation - Rational method – Time of concentration estimation – Curve number method – Cook's method. Land use capability classification based on different criteria with a special reference to slope – Erosion control measures – Agronomic and mechanical or engineering measures.

Unit-IV:

Contour bunds – Design of contour bunds – Horizontal interval – Vertical interval – Cross Section of the contour bunds – Seepage line consideration. Determination Height of Bund – Loss of Area due to bunding. Design of waste weir – Construction of contour bunds in fields. Graded bunds – Design of graded bunds. Introduction to Conservation Ditching. Terraces – Classification of Terraces-Design of narrow based and broad based terraces. Bench Terraces – Types of Bench Terraces – Derivation for an equation for finding of vertical interval – Design of bench terraces.

Contour trenching – Staggered and continuous trenche – Adaptability and types.

Unit V: Vegetated water ways – Types of water ways based on shapes – Expression for wetted perimeters – Areas – Hydraulic radii – types of vegetation – roughness of different grasses – Design of vegetated water ways. Sedimentation – Sedimentation in reservoirs in streams, estimation and measurement, sediment delivery ratio, trap efficiency – Estimation of useful life of reservoir based on sedimentation. Characteristics of contours and preparation of contour maps – Analysis of toposheets.

Unit –VI: Introduction to water harvesting techniques – Estimation of Earth work Design of farm ponds – Introduction to Stream water quality and pollution. Temporary gully control structures – Design – Types like Brush wood dams – Wire Mesh – Dams etc. – Introduction to permanent gully control structures – Design phases – Components of permanent structures.

TEXT BOOKS:

1. Soil and Water Conservation Engineering. Scwab G.O. Frevert R.K. Edminster T.W. and Barnes K.K. 1981 John Wiley and Sons New York.
2. Manual of Soil and Water Conservation Practicals. Gurmel Singh. Venkataramanam C. Sastry G and Joshi BP. 1994.Oxford and IBH Publishing Co. Ltd., New Delhi.

REFERENCES:

1. Land and Water Management Engineering. Murthy VVN 2004. Kalyani Publishers, New Delhi.
2. Introduction to Soil and Water Conservation Engineering. Mal B.S. 1995 Kalyani Publishers, Rajinder Nagar, Ludhiana.

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
4	-/-	3

AGRICULTURAL PROCESS ENGINEERING

Objective: To train students on unit operations of agricultural process engineering to acquaint with preliminary operations such as clearing, size reduction, mixing, separation, filtration and materials handling equipment.

Unit-I:

Scope and importance crop processing – principles and methods of food processing cleaning and grading of cereals. pulses & oilseeds – Principles. Size reduction –principle of comminution/ size reduction, mechanisms of comminution of food, particle shape, average particle size, Characteristics of comminuted products, crushing efficiency. determination and designation of the fineness of ground material, screen analysis,

Empirical relationships (Rittinger's Kick's and Bond's equations), Work index, energy utilization, methods of operating crushers, classification based on particle size, nature of the material to be crushed, Size reduction equipment – Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, burr mill, tumbling mills, action in tumbling mills, Size reduction equipment –Ultra fine grinders (classification hammer mills, colloid mill), cutting machines (slicing, dicing, shredding, pulping), energy requirement of size deduction.

Unit –II:

Mixing –Introduction, theory of solids mixing, criteria of mixer effectiveness and mixing index for granular solids, mixing indices, criteria of mixer effectiveness and mixing index for pastes and semi solid masses, mixing index at zero time, rate of mixing, theory of liquid mixing, power requirement for liquids mixing. Mixing equipment – Mixers for low or medium viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.

Unit-III:

Aerodynamics of agricultural products – drag coefficient – frictional drag and profile drag or pressure drag – and terminal velocity. Theory of separation, types of separators, cyclone separators, size of screens applications, Separator based on length, width, and shape of the grains, specific gravity, density. Air-screen grain cleaner-principle and types, Design considerations of air-screen grain cleaners, Sieve analysis-particle size determination, Ideal screen and actual screen–effectiveness of separation and related problems, Pneumatic separator, Threshing, Winnowing, cleaning and separation equipment,

Unit –IV:

Moisture content and methods for determination, moisture content representation, wet basis, dry basis, direct and indirect methods of moisture content determination, problems, Importance of EMC and method of determination, static-dynamic methods, EMC curve and EMC models, hysteresis effect, bound, unbound and free moisture. Principles of drying, theory of diffusion, mechanism of drying, falling rate, constant rate period, Thin layer, deep bed dying methods, Effect of different factors on the drying process, different types of dryers, LSU dryer, flat bed batch dryer, fluidized bed dryer, rotary dryer..

Unit –V:

Rice milling, principles and equipments, paddy parboiling methods and equipment, wheat milling, milling of pulses and oilseeds. Theory of filtration, rate of filtration, pressure drop during filtration, applications, Constant-rate filtration and constant–pressure filtration derivation of equation, Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters

Unit-VI:

Scope and importance of material handling devices, study of different material handling systems–Classification, principles of operation, conveyor systems selection/design. Belt Conveyor–Inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper, Chain conveyor–Principle of operation, advantages, disadvantages, capacity and speed, conveying chain, Screw conveyor – Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors.

Bucket elevator–Principle, classification, operation, advantages, disadvantages, capacity, speed, Bucket discharge, relationship between belt speed, pickup and bucket discharge, bucket types, Pneumatic conveying system- capacity and power requirement, types, selection of pneumatic conveying system, Gravity conveyor design considerations – capacity and power requirement.

REFERENCES:

1 Transport Processes and separation Process Principle, Geankoplis C J 2003 Prentice-Hall Inc., New Jersey.

2 Unit operations in Food processing, Earle R L 1983. Pergamon Press, New York

3 Post Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A 1988. Oxford and IBH Publishing Co. Ltd., Calcutta.

4 Unit Operations of Chemical Engineering, McCabe WL, Smith JC and Harriott P 1993 Mc Graw-Hill Book Co., Boston.

5 Unit Operations of Agricultural Processing, Sahay KM and Singh KK 1994, Vikas Publishing House Pvt. Ltd., New Delhi.

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
4	-/-	3

ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS AND FOOD QUALITY

Objective: To enable the students to understand the principles and concepts of various properties of biological materials to design various processing equipment to insure food quality and safety. They are the basis for measuring instruments and sensors.

Unit –I:
Physical characteristics of different food grains, fruits and vegetables – importance. Shape and size – criteria for describing shape and size. Roundness and sphericity – Volume and density – Specific gravity – Bulk density. Porosity – surface area – measurement of the same. Rheology – basic concepts – ASTM standard definition of terms. Rheological Properties – Force deformation behavior, stress and strain behavior. Visco – elasticity – time effects –

Unit –II:
Rheological models. Kelvin and Maxwell models – electrical equivalence of mechanical models.
Rheological equations – Maxwell model and generalized Maxwell model. Kelvin model – generalized Kelvin model creep – stress relaxation. Friction – basic concepts – effect of load sliding velocity. Friction in agricultural materials – measurement – rolling resistance – angle of internal friction and angle of repose.

Unit-III:
Aerodynamics of agricultural products – drag coefficient – frictional drag and profit drag or pressure drag -and terminal velocity. Electrical properties – Di electrical properties. Thermal Properties – specific heat – thermal conductivity-thermal diffusivity. Application of engineering properties in handling and processing equipment and also storage structures.

Unit-IV:
Food quality – Concept, objectives and importance. Food quality, control – methods of quality control sampling – purpose. Quality control – sampling techniques. Sampling procedures for liquid, powdered and granular materials. Sensory evaluation or organoleptic evaluation of food quality, methods. Interpretation of sensory results in statistical quality control.

Unit-V:
Total quality management (TQM – parameters of quality management. The evolution of total quality management – total quality management (TQM). Total quality control principles of quality control – consumer preference and acceptance.

Unit –VI:
Food laws and regulations in India. Food grade and standards – BIS, AGMARK, PFA, FPO, CAC (Codex alimantarious Commission). Sanitation in food industry – GMP. ISO 9000 series of standards. Hazard analysis and critical control point (HACCP) – objectives – principles – Steps involved in implementation of HACCP. Application of HACCP concept to milk and milk products – problems in implementing HACCP.

TEXT BOOKS:
Physical properties of plant and animal materials, Mohsenin N N 1986. Gordon and Breach Science Publishers, New York.

REFERENCES:

1 Food and Process Engineering Technology, Wilhelm LR, Suler W A and Brusewitz, G H 2004. American Society of Agricultural Engineers (ASAE), St. Joseph, Ml.

2 Engineering Properties of Foods, Rao M A, Syed S H Rizvi and Ashim K Datta 2005. CRC Press – Taylor & Francis Group, Boca Raton, FL.

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
4	-/-	3

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Unit I Introduction to Managerial Economics:
Definition, Nature and Scope of Managerial Economics–Demand Analysis: Demand Determinants, Law of Demand and its exceptions.

Unit II Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

Unit III Theory of Production and 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, Opportunity cost, Fixed vs. Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)- Determination of Break-Even Point (simple problems)- Managerial Significance and limitations of BEA.

Unit IV Introduction to Markets & Pricing Policies:
Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.
Objectives and Policies of Pricing- Methods of Pricing: Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two-Part Pricing, Block Pricing, Bundling Pricing, Peak Load Pricing, Cross Subsidization.

Unit V Business & New Economic Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario.

Unit VI Capital and Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance.
Nature and scope of 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 VII Introduction to Financial Accounting: Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

Unit VIII Financial Analysis through ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Profit Ratio, P/E Ratio and EPS).

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.

REFERENCES:

1. Raghunatha Reddy & Narasimhachary: Managerial Economics& Financial Analysis, Scitech, 2009.
2. V.Rajasekarn & R.Lalitha, Financial Accounting, Pearson Education, New Delhi, 2010.
3. Suma Damodaran, Managerial Economics, Oxford University Press, 2009.
4. Domnick Salvatore: Managerial Economics in a Global Economy, 4th Edition, Cengage, 2009.
5. Subhash Sharma & M P Vittal, Financial Accounting for Management, Text & Cases, Machmillan, 2008.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2008.
7. Truet and Truet: Managerial Economics:Analysis, Problems and Cases, Wiley, 2009.
8. Dwivedi:Managerial Economics, Vikas, 2009.
9. M.Kasi Reddy, S.Saraswathi: Managerial Economics and Financial Accounting, PHI, 2007.
10. Erich A. Helfert: Techniques of Financial Analysis, Jaico, 2007.

Prerequisites: Nil

Objective: To explain the basic principles of managerial economics, accounting and current business environment underlying business decision making.

Codes/Tables: Present Value Tables need to be permitted into the examinations Hall.

Question Paper Pattern: 5 Questions to be answered out of 8 questions .Out of eight questions 4 questions will be theory questions and 4 questions should be problems. Each question should not have more than 3 bits.

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
-	-/3	2

AGRICULTURAL PROCESS ENGINEERING LAB

Practical:

1 Preparation of flow charts and layout of a food processing plant
2 Determination of fineness modulus and uniformity index
3 Determination of mixing index of a feed mixer
4 Determination of the efficiency of cyclone separator
5 Tutorial on extraction by McCabe and Thiele plot
6 Tutorial on use of psychrometry chart
7 Tutorial Problems on distillation
8 Tutorial on power requirement in size reduction of grain using Rittinger's law, Kick's law and Bond's law
9 Performance evaluation of hammer mill and attribution mill.
10 Separation behavior in pneumatic separation
11 Evaluation of performance of indented cylinder and screen pre cleaner
12 Mixing index and study of mixers

III Year B.Tech. Ag. Engg I Sem. **L T/P C**
- -/3 2

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

1. Introduction

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

Gather ideas and information, to organize ideas relevantly and coherently.
Engage in debates.
Participate in group discussions.

- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

2. Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

- **Functional English** - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- **Vocabulary Building** – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.
- **Reading Comprehension** – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, Critical reading.
- **Writing Skills** – structure and presentation of different types of writing – *Resume writing /*
  e-correspondence/Technical report writing/Portfolio writing – planning for writing – *research abilities/data collection/organizing data/tools/analysis* – improving one's writing.
- **Group Discussion** – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- **Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars and written presentations through posters/projects/reports/PPTs/e-mails/assignments etc.
- **Interview Skills** – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.

4. Minimum Requirement:

The English Language Lab shall have two parts:

The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

P – IV Processor
Speed – 2.8 GHZ
RAM – 512 MB Minimum
Hard Disk – 80 GB

Headphones of High quality

5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

Suggested Software:

- **Clarity Pronunciation Power** – part II
- **Oxford Advanced Learner's Compass**, 7th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed,**
  - **Positive Thinking,**
  - **Interviewing Skills,**
  - **Telephone Skills,**
  - **Time Management**
  - **Team Building,**
  - **Decision making**

- **English in Mind**, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

6. Books Recommended:

Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.

Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.

English Language Communication : A Reader cum Lab Manual Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.

English Vocabulary in Use series, Cambridge University Press 2008.

Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.

Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.

Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.

Job Hunting by Colm Downes, Cambridge University Press 2008.

Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.

English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.

Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron's/DELTA/Cambridge University Press.

International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

Advanced Communication Skills Lab Practicals*:*

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
-	-/3	2

FIELD OPERATION AND MAINTENANCE OF TRACTORS LAB I

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
8 Periodical maintenance of tractors – at 200-250 engine working hours – at 480-500 engine working hours – at 960 – 1000 engine working hours.
9. Emission of smoke – Over heating of engines - maintenance of clutch brakes hydraulic problems..
10. 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.
11. Starting and stopping practice of the tractor and familiarization with instrumentation panel and controls
12. Driving in forward and reverse gears, Driving safety sales and study bean trepanned.

REFERENCES:

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.

III Year B.Tech. Ag. Engg I Sem.

L	T/P	C
-	2/-	-

INTELLECTUAL PROPERTY RIGHTS AND PATENTS

Unit I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement - Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

Unit II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

Unit III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

Unit IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law

Unit V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

Unit VI

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime.

REFERENCE BOOKS:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning , New Delhi
2. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw –

Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights",
Excel Books. New Delhi.
7. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
4	-/-	3

IRRIGATION AND DRAINAGE ENGINEERING

Unit –I:

Introduction Irrigation Engineering, advantages of irrigation, necessity and development of irrigation in India and AP and classification if irrigation projects, Irrigation terminology-GCA,CCA, Base period, crop period, Delta, Duty, Relationship between Duty and Delta (Delta= (864B) / Duty cm), Introduction soil-water plant relationships, soil physical properties such as soil texture, soil structure, capillary conductivity, soil consistency-volume-mass relationships of soil constituents, Water relations of soil, kinds of soil water-Hygroscopic, Capillary and Gravitational movement of water into soils, Infiltration, factors affecting infiltration, procedure for measurement of infiltration rate and development of infiltration equations (Kostia-Kov equations-curve fitting) $Ic=KT^n+b$), Soil moisture characteristic curves, difference between soil moisture stress and soil moisture tension, soil moisture constants such as saturation capacity, field capacity moisture equivalent and permanent wilting point. Terminology related with movement of water within soils-water intake, percolation, interflow, seepage, permeability, hydraulic conductivity and hydraulic gradient- Measurement soil moisture by different methods, Evaporation, transpiration and evapo-transpiration-Estimation by Blaney-Criddle, Thornthwaite, penman and modified Penman equations only-Potential ET. Water requirements of crops-Importance of water in plant growth, procedures of working out the net irrigation requirement (depth of irrigation) gross irrigation requirement, irrigation frequency and Irrigation efficiency (conveyance, application, storage, distribution, water use efficiency) with few numerical examples,

Unit-II:

Water application methods-classification, border irrigation, components of border irrigation-Width, Length and Slope for different soils for different soils, Hydraulics of border irrigation (Advance curve, Recession Curve and Opportunity time through Time and Distance Curve) design of border irrigation. Derivation of Israelson's equation for the width of the border (X= (Q/W.I) (1-eity), Furrow irrigation system-advantages and disadvantages, determination of infiltration depth in furrows by inflow-outflow method (Steam size, Distance Advance time, CS area and Wetted Perimeter data problem on computation of infiltration depth), Check basin irrigation–advantages and disadvantages, estimation of infiltration under check basin conditions, adaptability and design considerations.

Unit-III:

Methods of conveyance of irrigation water-assessment of design capacity of irrigation channels. Design of irrigation canals using Lacey's and Kennedy's theories and problems, Measurement of irrigation water-units of measurements, methods of measurement, direct and indirect methods, measurement of velocity using current meter-indirect methods such as area velocity method and coordinate method for measuring discharges form pipes-dethridge meter, tracer method, Direct methods of measurement of discharges-different devices such as weirs flumes and notches and their installation procedures – Equations for Rectangular Triangular and Trapezoidal notches, Explanation on RBC flumes (critical flow flumes). Underground pipe lines for irrigation water distribution-types of pipes used for underground pipe lines, testing of pipes for its water absorption and pressure requirements, estimating the discharge capacity of pipe lines, Installation procedures of underground pipe lines and study of different structures associated with underground pipe lines.

Unit-IV:

Drainage-definition, objective and types, familiarization with the drainage problems (twin problems of water logging and salinity) and extent of areas in irrigated areas in the state,

Surface drainage, effects of poor drainage, areas requiring drainage, factors affecting drainage requirement, drainage coefficient, determination of drainage coefficient based on different criteria, Types of surface drainage-random field drain system, bedding system, parallel field drain, parallel lateral open ditch, cross slope drain system interception system, design of open drainage channels using Manning's equation and alignment of open ditches (radius of curvature), Investigations on design parameters, hydraulic conductivity, drainable porosity fluctuations of depts. To water table in the areas, methods of determining hydraulic conductivity-single auger hole method and derivation of Hooghoudt's equation for 'K' with assumptions and inverse auger hole, Sub-surface drainage systems purpose and benefits, types of sub surface systems tile drains, mole drains, drainage wells, deep open drains and combinations and their suitability for different conditions and limitations.

Unit-V:

Components of Sub-surface drainage system Layouts and types –Random type herring bone, grid iron cutoff or interceptor drains, depth and spacing of drains, size of the pipe drains using Manning's equation, drain materials of burnt clay. Perforated corrugated and solid PVC and cement concrete, slope/grade for the drains, Envelope materials for sub-surface drains and selection criteria for uniform soils and graded soils, geo-textile and nylon mesh, outlets for sub surface drainage, gravity, gravity and pumped outlets.

Unit-VI:

Design of sub surface drains under steady state (equilibrium) conditions and derivation of Hooghoudt's equation for spacing, The Ernst's derivation for drain spacing, The Ernst's derivation for drain spacing. Glover-Dumm equation (only) for spacing under non-steady state conditions of water table to drop from 'm0' to 'm' in time 't', Drainage structures, Loads on conduits, ditch conduit conditions and projecting conduit conditions, construction and installation of drains, Bio-drainage, vertical drainage and drainage of irrigated and humid areas, Salt balance, classification and reclamation of saline and alkaline soils, soil amendments, leaching requirement-leaching ratio, Economic aspects of drainage with a typical example for total cost estimation SSD system and benefit – cost ratio.

TEXT BOOKS:

1. Irrigation Engineering, Muzumdar S K, 1983, Tat-McGraw Hill Publishing's. Co. Ltd., New Delhi.
2. Irrigation Theory & Practice, Michael A M, 2008, Vikas Publishing House, New Delhi.
3. Drainage Engineering, Luthin J M, 1970, Wiley Eastern Ltd., New Delhi.
4. Soil and Water Conservation Engineering, Schwab G O, Frevert R K, Edminister T w and Barner K K, 1981, John-Wiley and Sons, New Delhi.

REFERENCES:

1. Land & Water management Engineering, Murthy V V N, 2004, Kalyani Publishers, New Delhi.

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
4	-/-	3

FARM MACHINERY AND EQUIPMENT -I

Objective: Primary and Secondary tillage implements along with earth moving machinery, seeding and plant protection equipment will be discussed to get awareness on the mechanical area of the agricultural engineering.

Unit – I:
Objectives of Farm Mechanization, sources of farm power, classification of farm machines. Materials of construction and heat treatment. Principles of operation and selection of machines used for production of crops - Field capacities of different implements and their economics. Problems on field capacities and cost of cultivation.

Unit – II
Classification and types of tillage, Primary tillage implements-Mould board plough and its parts, Disc plough, and other ploughs, Secondary tillage equipments- Disc harrows, implements-Cultivators, and intercultural implements.

Unit – III:
Forces acting on tillage tools, Problems on forces analysis, Draft measurement of tillage equipments, Draft and unit draft related problems.

Unit - IV
Earth moving equipment-terminology, Earth moving equipments, construction and their working principles, Earth moving equipment- shovels, Bulldozers, Earth moving equipments-Trenches and elevators.

Unit-V:
Seeding methods, Different types of seed metering mechanism, different types of furrow openers. Calibration of Seed drills. Adjustment of Seed Drills - Objectives and uses of plant protection equipment. Types of sprayers and dusters. Sprayers calibration and selection. Constructional features of different components of sprayers and dusters and their adjustments.

Unit-VI:
Transplanting methods, different types of Transplanting machinery and their working principle, adjustments in Transplanting equipment. Fertilizer application equipment – fertilizer meeting mechanism calibration of fertilizer equipment.

REFERENCES:

1. Farm Machinery, Stone A A 1958. John wiley and sons, New York.
2. Farm Machinery and Equipment, Smith H P 1971. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Principals of Agricultural Engineering, Michael A M and OJha T P 1985 Vol.I, Jain Brothers, New Delhi.
4. Principals of Farm Machinery, Kepner R A, Bainer R and Barger E L 1987. CBS Publishers and Distributors, Delhi.
5. Elements of Agricultural Engineering, Jagadeshwar Sahay 1992. Agro Book Agency, Patna.
6. Land Reclamation Machinery, Borshahov Mansurov Sergecv 1988. Mir Publishers, Moscow.

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
4	-/-	3

DESIGN OF SOIL, WATER CONSERVATION AND FARM STRUCTURES

Objective: To enable the students to design and execute the structures for controlling soil erosion, water erosion and irrigation in fields and prepare cost estimates for the structures.

Unit-I:
Introduction, Classification of structures, land treatment structures, gully control structures, functions of soil erosion control structures. Flow in open channels – types of flow, state of flow, regimes of flow, energy and momentum – principles, specific energy and specific force – critical depth concept–stage discharge relationship–sequent depths. Hydraulic jump and its application, type of hydraulic jump, energy dissipation due to jump, jump efficiency, relative loss of energy – Froude number and its significance in the design of hydraulic structures.

Unit-II:
Runoff measuring structures–Parshall flume, H-Flume and weirs, Water stage recorders. Straight drop spill way-general description, functional use, advantages and disadvantages, structural parts and functions, components of spillway. Three design phases – hydrologic and hydraulic design, free board and wave free board, aeration of weirs, concept of free and submerged flow. Structural design of a drop spillway–loads on headwall, variables affecting equivalent fluid pressure. Determination of saturation line for different flow conditions, seepage under the structure, equivalent fluid pressure of triangular load diagram for various flow conditions. Creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension.

Unit III :
Chute spillway- general description and its components, hydraulic design, energy dissipaters – uplift pressure diagram – analysis of various forces etc. Design criteria of a SAF stilling basic and its limitations. Drop inlet spillway – General description, types of possible flow conditions, pipe flow, orifice flow, functional use, design criteria.
Design of diversions, small earth embankments – their types and design principles, farm ponds and reservoirs. Estimation of volume of earthwork of farm ponds by various methods. Irrigation Engineering structures – Various types and their purposes. Differences between soil conservation and irrigation structures.

Unit-IV:
Canal Falls – types of canal falls with line diagrams (elevations). Design of trapezoidal notch fall. Design of syphon well drop type of canal falls. Cross drainage works – Locations needing cross drainage works – aqueduct – super passage – inverted siphon aqueduct – inlets and outlets – different types of cross drainage works with line diagrams. Design principles of various cross drainage works – Design of an aqueduct.

Unit–V:
Irrigation outlets – non modular, semi modular rigid modular outlets battle sluice irrigation modules. Diversion head works – Different components of diversions head works – head regulator and cross regulator. Different types of weirs and barrages – Difference between a weir and barrage with example locations. Operation of gates in controlling water in irrigation structures.

Unit-VI:
Planning and layout of farmstead-location – Design and construction of farm fences, type of farm fences – Requirements of farm work shop and implement shed. Problems and layout - Design and construction of threshing and drying yards. Design of different barns – Barn for

cows, Buffalo, poultry - Design and construction of rural grain storage structures such as Bhukari, Morai, Kothari – requirements of good storage structures. Design and construction of Silo – Types of Silos- Good silo requirements – Problems on size and capacity of Silos

TEXT BOOKS:

1. Soil and Water Conservation Engineering. Schwab G.O., Frevert R.K. Edminister T.W. and Barnes K.K. 1981. John Wiley and Sons, New York.
2. Irrigation Engineering and Hydraulic Structures. Garg S.K. 1986. Khanna Publications. New Delhi.

REFERENCES:

1. Irrigation Engineering. Mazumdar. S.K. 1983. TMH Publishing Co. Ltd., New Delhi.
2. Irrigation Water Resources. Modi P.N. 1990. Standard Book House. Post Box No. 1074. New Delhi.
3. Hydrology and Soil Conservation Engineering. Ghanshyam Das 2009 PHI Learning Private Limited, New Delhi.

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
4	-/-	3

DAIRY AND FOOD ENGINEERING

Objective Knowledge on milk and food processing unit operations offer strength to students to handle pasteurization, sterilization, packaging, etc. of dairy products and control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.,

Unit – I:

Dairy development in India and dairy technology- Indian dairy industry products Concentrated whole mile products, – Composition of milk, physic-chemical properties of milk, water content, acidity, pH, developed acidity, natural acidity, total acidity, density, specific gravity, freezing point of milk colour of milk, flavor, Unit operations of various diary and food processing systems- Centrifugation, separation, separation by cyclone (Application of separation in the dairy industry, velocity of particles in a gravitational field, distribution of fat globule diameters in milk, velocity of particles in a centrifugal field, strength of centrifugal bowl, disc bowl centrifuge, design of centrifuges and methods of application, decanting centrifuge for lactose and casein, cyclones for separation from gas phase).

Unit – II:

Milk receiving – Quantity determination, quality evaluation, clearing and disinfection of transport facilities, milk returns, procedures for reception and returns, Process flow charts for product manufacture – Pasteurized milk, flow chart, process steps, person method and mass balance method for making balances of cream and fat in making whole milk, butter, cheese, ice cream manufacture, process steps, over run. Pasteurization- Purpose, microorganisms and enzymes and their reaction to temperature and other influences, bacteria in milk, effect of temperature, Pasteurization – Methods of heating, design and mode of operation heating equipment (Vat, tubular heat exchanger, plate heat exchanger), Sterilization – UHT method (Direct and indirect heating), sterilization in the package (temperature and pressure patterns), equipment for sterilizing goods in the package (Batch autoclaves, continuously operating sterilizers).

Unit – III:

Homogenization – Emulsifying, types of emulsions, emulsifiers, homogenizing (Application, mode of operation, technical execution, effect of the product), Filling and packaging – Packaging of milk, cultured milk, cheese, butter, concentrated milk, products, dried milk products, and packaging materials of them, filling and metering, packaging methods, Butter manufacture – Principle, treatment of cream, churning, overrun, factors affecting churn ability, methods (Butter churn, continuous butter making), butter oil and special butter products (Composition, methods of manufacturing ,direct evaporation method, decantation, centrifugal separation, vacuum method).

Dairy plant design and layout – factors in planning, importance of site selection. Location of building, size and type of dairy building, advantages of good plant layout, functional design, Dairy plant design and layout – Operating schedule and layout, process selection, floor space, walls and ceiling ventilation, doors, windows and lighting, flooring, drainage.

Unit-IV:

Composition and proximate analysis of food products- Carbohydrates, protein, lipids, minerals, vitamins, Deterioration in products and their controls – Food as a substitute to microorganisms, food preservation methods, principles of food preservation, causes of food spoilage and classification of food with respect to spoilage and consumption, Principles of food preservation, effects of pH and water content on growth of microorganisms, methods of controlling water content, effect of water activity, methods of measuring a oxidation-

reduction potential effect on microorganisms, effect of nutrient content and effect of inhibitory substances, biological structures, Physical, chemical, and biological methods of food preservation, Change undergone by food components during processing –Changes during heating, evaporation, drying, freezing, juice extraction, filtration and separation.

Unit – V:

Evaporation – Applications, functions, factors affecting rate of evaporation, basic evaporator construction, factors affecting liquid boiling point, thermodynamics of evaporation (phase change, boiling point elevation, Duhring plot, factor influencing the overall heat transfer coefficient, influence of feed liquor properties on evaporation, factors influencing the economy of evaporation, Types of evaporation equipment. Natural circulation evaporators – Batch type, horizontal short tube, vertical short tube, natural circulation with external calendria, long tube, forced circulation (General forced circulation, plate, expanding flow, mechanical /agitated thin film), Drying – Drying methods (radiation, dielectric, spray, foam, spray, roller, fluidized bed, freeze).

Unit – VI:

Freezing – Introduction, freezing point curve for food and water, freezing points of common food materials, freezing time calculation by using Plank's equation, types of freezing equipment, Juice extraction – Single stage liquid –liquid extraction processes Types of equipment design for liquid-liquid extraction, continuous multistage countercurrent extraction, Juice extraction – Liquid solid leaching (process, preparation of solids. rate of leaching types of equipment of leaching. Filtration - ultra-filtration, processing variables, applications or ultra-filtration in milk processing, reverse osmosis, Membrane separation – Membrane separation methods, gel filtration and on exchange, Thermal processing - Thermal death time curve, reaction kinetics of the heat treatment of milk and its use for the assessment of UHT treatment methods, change in milk produced by heating, Plant utilities requirement – Electricity, water, power.

REFERENCES:

1 Food Engineering and Dairy Technology, Kessler H G 1981. Veriag A. Kessler, Freising.
2 Outlines of Dairy Technology, Sukumar De 2005. Oxford University Press, New Delhi
3 Principles of Food Science, Fennema O R 2006. Marcel Dekkar Inc., New York.
4 Food Science, Chemistry and Experimental Foods, Swaminathan M 2006. The Bangalore Printing & Publishing Co., Ltd., Bangalore

OPEN ELECTIVES

III Year B.Tech. Ag. Engg II Sem.	**L**	**T/P**	**C**
	4	**-/-**	**3**

OPERATIONS RESEARCH
(Open Elective)

UNIT – I

Introduction: Development – Definition– Characteristics and Phases – Types of operation Research models – applications. **Allocation:** Linear Programming - Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

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 – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – dominance principle – m X 2 & 2 X n games -graphical method.

Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT – V

Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost- Single period model.

UNIT – VI

Dynamic Programming: Introduction –Terminology- Bellman's Principle of optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages – Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research /J.K.Sharma 4e. /MacMilan
2. Operations Research / R.Pannerselvam 2e.,PHI Publications

REFERENCES:

1. Operations Research /A.M.Natarajan, P.Balasubramani, A. Tamilarasi/ Pearson Education.
2. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman
3. Introduction to O.R /Taha 8e/PHI
4. Operations Research / Wagner/ PHI Publications.
5. Operations Research / S.D.Sharma-Kedarnath
6. O.R/Wayne L.Winston/Thomson Brooks/cole

Introduction to O.R/Hiller & Libermann (TMH).

DIGITAL CONTROL SYSTEMS

Preamble:

In recent years digital controllers have become popular due to their capability of accurately performing complex computations at high speeds and versatility in leading non linear control systems. In this context, this course focuses on the analysis and design of digital control systems.

Learning objectives:

- To understand the concepts of digital control systems and assemble various components associated with it. Advantages compared to the analog type.
- The theory of z–transformations and application for the mathematical analysis of digital control systems.
- To represent the discrete–time systems in state–space model and evaluation of state transition matrix.
- To examine the stability of the system using different tests.
- To study the conventional method of analyzing digital control systems in the w–plane.
- To study the design of state feedback control by "the pole placement method."

UNIT – I:

Introduction and signal processing

Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Signals and processing – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

UNIT–II:

Z–transformations

Z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

UNIT–III:

State space analysis and the concepts of Controllability and observability

State Space Representation of discrete time systems – State transition matrix and methods of evaluation – Discretization of continuous – Time state equations – Concepts of controllability and observability – Tests(without proof).

UNIT – IV:

Stability analysis

Mapping between the S–Plane and the Z–Plane – Primary strips and Complementary Strips – Stability criterion – Modified routh's stability criterion and jury's stability test.

UNIT – V:

Design of discrete–time control systems by conventional methods

Transient and steady state specifications – Design using frequency response in the w–plane for lag and led compensators – Root locus technique in the z–plane.

UNIT – VI:

State feedback controllers:

Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula.

Learning outcomes:

- The students learn the advantages of discrete time control systems and the "know how" of various associated accessories.
- The learner understand z–transformations and their role in the mathematical analysis of different systems(like laplace transforms in analog systems).

- The stability criterion for digital systems and methods adopted for testing the same are explained.
- Finally, the conventional and state–space methods of design are also introduced.

Text Book:

1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition

Reference Books:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control and State Variable Methods by M.Gopal, TMH

***

ROBOTICS AND AUTOMATION

UNIT – I**: BASIC CONCEPTS** Automation and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system, Dynamic stabilization of Robotics. ,**POWER SOURCES AND SENSORS** Hydraulic, Pneumatic and electric drivers – Determination HP of motor and gearing ratio, variable speed arrangements, Path Determination - Machinery Vision – Ranging – Laser – Acoustic, Magnetic Fiber Optic and Tactile Sensor

UNIT – II: **MANUPULATORS** Construction of Manupulators, Manupulator Dynamic and Force Control, Electronic and Pneumatic manupulators., **ACTUATORS AND GRIPPERS** Pneumatic, Hydraulic Actuators, Stepper Motor Control Circuits, End Effecter, Various types of Grippers, Design consideration.

UNIT – III: Differential transformation and manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

UNIT IV: **KINEMATICS** Forward and Inverse Kinematic Problems, Solutions of Inverse Kinematic problems, Multiple Solution, Jacobian Work Envelop – Hill Climbing Techniques.

UNIT V: **PATH PLANNING** Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages.

UNIT VI: **CASE STUDY** Multiple Robots – Machine Interface – Robots in Manufacturing and Non- Manufacturing applications – Robot Cell Design Selection of a Robot.

TEXT BOOKS: 1. Industrial Robotics by Groover M P, Pearson Edu.

2. Robotics by Fu K S, McGraw Hill.

REFERENCES:

1. Robotics by CSP Rao and V.V. Reddy, Pearson Publications
2. Robotics and Control by Mittal R K & Nagrath I J, TMH.
3. An Introduction to Robot Technology,by P. Coiffet and M. Chaironze ,Kogam Page Ltd. 1983 London.
4. Robotic Engineering by Richard D. Klafter, Prentice Hall
5. Introduction to Robotics by John J Craig, Pearson Edu.
6. Robot Dynamics and Control by Mark W. Spong and M. Vidyasagar, John Wiley & Sons.

INDUSTRIAL POLLUTION CONTROL ENGINEERING

Learning objectives:

- Pollution is a worldwide, global problem. In an industrially developing country like India, industrial pollution is going to be a potential threat to the public health and it's good. The issue is to be emphatically addressed to the future generation for their welfare. Industrial growth cannot be under mined and the environmental pollution resulting due to phenomenal industrial growth is to be monitored with extreme care and caution. This course, essentially deals with the technology and techniques to reduce the dangerous levels of pollutants in the atmosphere.
- The student is informed about the emissions from chemical industries, and guidelines set by the environmental protection agencies for maintaining clean-air. Standards for the level of pollutants from the industries have been given for subsequent monitoring.
- For monitoring, the student is required to know the characterization of industrial effluents, BOD, COD, TOC values, methods of determination of these characteristic, for all types of pollutants from all chemical and petroleum industries.
- Having given information about the characterization, the student is made conversant with various methods of treatment- primary as well as tertiary treatments. The course offers latest techniques such as Ion exchange, RO, Ultra filtration, along with the conventional systems already existing.
- Treatment of wastewaters (in the effluent streams) - Processes, Methods and equipment needs are presented for their subsequent applications.
- Monitoring methods are taught for pollution control. Sampling methods for acquiring samples and their analysis are discussed.
- The student is acquainted with the various control methods and equipment required for control has been discussed for suitably designing the appropriate process and equipment for a given industrial pollutant.

UNIT-I:

Types of emissions from Chemical industries and Effects of environment, Environment legislation, Type of pollution and their sources, Effluent guidelines and standards.

UNIT-II:

Characterization of effluent streams, Oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve mathematical, Controlling of BOD curve, Self-purification of running streams, Sources and characteristics of pollutants in fertilizer, paper and pulp industry, petroleum and petroleum industry.

UNIT-III:

Methods of Primary treatments: Screening, Sedimentation, Flotation, Neutralization, and methods of tertiary treatment.

Brief studies of Carbon absorption, Ion exchange, Reverse osmosis, Ultra filtration, Chlorination, Ozonation, treatment and disposal

UNIT-IV:

Introduction to waste water treatment, Biological treatment of wastewater, Bacterial and bacterial growth curve, Aerobic processes, Suspended growth processes, Activated aerated

lagoons and stabilization ponds, Attached growth processes, Trickling filters, Rotary drum filters, and Anaerobic processes.

UNIT-V:

Air pollution sampling and measurement: Types of pollutant and sampling and measurement, ambient air sampling: Collection of gaseous air pollutants, Collection of particulate air pollutants. Stack sampling: Sampling system, Particulate sampling, and gaseous sampling.

UNIT-VI:

Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification.

Cleaning of gaseous equipments particulate emission control: Collection efficiency, Control equipment like gravitational settling chambers, Cyclone separators, fabric filters, ESP. Scrubbers and absorption equipment

Outcomes:

- A course of this nature makes the student socially conscious about the methods for a clean environment. After knowing the technology of reducing pollutant levels in the environment, he can deal with the efficient treatment of effluent streams, (liquids, solids and gaseous streams) and design water / sewage treatment systems at an affordable cost.
- The information given in the course may help the student to monitor the environmental pollutants in the respective industry and try to implement the techniques and methods highlighted in the above course to the best of his ability.

Text Book:

1. Environmental Pollution and Control Engineering, Rao C. S., Wiley Eastern Limited, India, 1993.

Reference Books:

1. Pollution Control in Process Industries, S.P. Mahajan, TMH., 1985.
2. Waste Water Treatment, M.Narayana Rao and A.K.Datta, 3rd Edition, Oxford and IHB, 2008.
3. Industrial Pollution Control and Engineering, Swamy AVN, Galgotia publications, 2005.

FINITE ELEMENT METHODS

Course Objectives:

1. To learn basic principles of finite element analysis procedure
2. To learn the theory and characteristics of finite elements that represent engineering structures
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others
4. Learn to model complex geometry problems and solution techniques.

UNIT-I

Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

UNIT – II

Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III

Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – IV

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT-V

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT – VI

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu / Prentice – Hall.
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.

REFERENCES:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGrawHill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind variational methods and weighted residual methods in FEM
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements, and 3-D element .
3. Develop element characteristic equation procedure and generation of global stiffness equation will be applied.
4. Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
5. Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer, and fluid flow.

WATER RESOURCES SYSTEM PLANNING AND MANAGEMENT

Course Learning Objectives:

The course is designed to

1. Introduce the concepts of system analysis in the planning, design, and operation of water resources.
2. Appreciate mathematical optimization methods and models.
3. Learn and apply basic economic analysis tools to water resources projects.
4. Understand linear, nonlinear and dynamic programming techniques and apply them to various water resources systems planning and design problems.
5. Appreciate simulation and management techniques in water resources systems.

Course Outcomes

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

a. Apply optimization methods to solve problems related to water resource systems.
b. perform basic economic analysis to evaluate the economic feasibility of water resources projects
c. Formulate optimization models for decision making in water resources systems.
d. Use simulation models for planning and design of Water Resources Systems.

SYLLABUS:

UNIT – I

Introduction: Concepts of systems analysis, definition, systems approach to water resources planning and management, role of optimization models, objective function and constraints, types of optimization techniques.

UNIT – II

Linear programming: Formulation of linear programming models, graphical method, simplex method, application of linear programming in water resources, revised simplex method, duality in linear programming, sensitivity analysis.

UNIT – III

Dynamic programming: Principles of optimality, forward and backward recursive dynamic programming, curse of dimensionality, application for resource allocation.

UNIT – VI

Non-linear optimization techniques: Classical optimization techniques, Lagrange methods, Kuhn-Tucker conditions, Search techniques, overview of Genetic Algorithm

UNIT – V

Water Resources Economics: Basics of engineering economics, economic analysis, conditions of project optimality, benefit and cost analysis

UNIT – VI

Simulation and management: Application of simulation techniques in water resources, planning of reservoir system, optimal operation of single reservoir system, allocation of water

resources, optimal cropping pattern, conjunctive use of surface and sub-surface water resources.

TEXT BOOKS:

1. 'Water Resources System Analysis' by Vedula S and P P Mujumdar, McGraw Hill Company Ltd, 2005.
2. 'Water Resources Economics' by James D and R. Lee, Oxford Publishers, 2005.

REFERENCES:

1. 'Water Resources Systems Planning and Management - An Introduction to Methods, Models and Applications' by Loucks D P and E V Bee, UNESCO Publications, 2005 (http://ecommons.cornell.edu/bitstream/1813/2804/21/00_intro.pdf)
2. 'Optimal design of water distribution networks' by Bhave, P. R, Narosa Publishing house, 2003.

***

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
-	-/3	2

FARM MACHINERY LAB I

1. Study of various Farm Machinery, equipment.
2. Visit to machinery Production industry and ICAR, SAU'S research station. Determination of Field capacity and Field efficiency of primary tillage implements.
3. Draft and Fuel consumption measurement for different implements.
4. Study of different types of plough bottoms and shares of M.B. Plough.
5. Determination of disc angle, tilt angle, concavity of a disc plough.
6. Calculation of draft and horse power.
7. Study of seed-cum-ferti drill and seed metering mechanisms.
8. Calibration of seed drill and problems.
9. Study of sprayers, dusters and measurement of nozzle discharge and field capacity.
10. Study of earth moving equipment through exposure Visit. .
11. Construction and working of rotovators and weeding equipment
12. Practical Examination.

Text Books:

1. Principles of Farm Machinery. Kepner R.A., Bainer, R and Barger E.L., 1987. CBS Publishers and Distributors, Delhi.
2. Elements of Agricultural Engineering. Jagadeshwar Sahay. 1992. Agro Book Agency, Patna.

References:

1. Farm Machinery. Stone A.A. 1958. John Wiley and Sons. New York.
2. Farm Machinery and Equipment. Smith H.P. 1971. Tata Mc Graw-Hills. Publishing Co. Ltd., New Delhi.
3. Principals of Agricultural Engineering, Vol. I. Michael A.M. and Ohja T.P. 1985. Jain Brothers, New Delhi.
4. Land Reclamation Machinery. Borshahov Mansurov Sergecv 1988 Mir Publishers, Moscow.

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
-	-/3	2

FIELD OPERATION AND MAINTENANCE OF TRACTORS LAB II

1. Introduction to various systems of a tractor viz. fuel, lubrication, cooling, electrical, transmission, hydraulic and final drive system.
2. Familiarization with tractor controls and learning procedure of tractor starting and stopping.
3. Hitching, adjustments, settings and field operation of farm machinery.
4. Familiarization with different makes and models of 4- wheeled tractors.
Road signs, traffic rules, road safety, driving & parking of tractor.
7. Tractor driving - forward & reverse driving practice.
8. Tractor driving practice with two wheeled tractor trailer forward & reverse.
9. Study and practicing the hitching and de-hitching of implements.
10. Familiarization with tools and equipment used for maintaining and servicing of tractors
11. Dismantling and assembling of major engine parts.
12. Visit to tractor/ engine repair workshop, injection pump injector repair shop

TEXT BOOKS:

1. Gupta, R.B., and Gupta, B.K. (1987). Tractor Mechanic, Theory, Maintenance and Repair, . Sathya Prakashan and Tech India Publications, New Delhi.
2. Jain, S.C., and Rai, C.R. (1984). Farm Tractor - Maintenance and Repair. Tata Mc Graw- Hill Publishing Company Ltd, New Delhi.
3. Liljedahl John, B., Casleton Walter, M., Turnquist Paul, K., and Smith David, W. (1951). Tractors and Their Power Units, JohnWiley & Sons, New-York.
4. Mathus, M.L., and Sharma, R.P. (1994). A Course in Internal Combustion Engines. Danpat Rai & Sons, Delhi.
5. Mehta, M.L., Verma, S.R., Misra, S.K., and Sharma, V.K. (1995). Testing and Evaluation of Agricultural Machinery. National Agricultural Technology Information

REFERENCE BOOKS:

1. Ghosh, P.K, and Swain, S. (1993). Practical Agricultural Engineering. Naya Prokash, Calcutta.
2. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
3. Kepner, R. A., Bainer Roy, and Barges, E.C. (1978). Principals of Farm Machinery. CBS Publishers and Distributors, Delhi-17.
4. Michael, A. M. and Ojha, T.P. (1985). Principles of Agricultural Engineering. (Vol.II). Jain brothers, New Delhi.

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
-	-/3	2

SOIL AND WATER ENGINEERING LAB

1. Estimation of Soil Loss from using Cushocton Silt sampler and multi slot divisor.
2. Determination of sediment concentration through Oven Dry method.
3. Soil loss estimation using erosivity index and erodibility index.
4. Determination of rate of sedimentation and storage loss in reservoir.
5. Field planning for implantation of soil conservation measures.
6. Field visit to study different soil conservation structures
7. Field visit to study different gully control structures
8. Determination in filtration characteristics of soils.
9. Measurement of irrigation water with H-Flume.
10. Measurement of evapo-transpiration.
11. Visit to nearby irrigation projects
12. Use of current meter and water meter.

III Year B.Tech. Ag. Engg II Sem.

L	T/P	C
-	-/-	-

PROFESSIONAL ETHICS AND HUMAN VALUES

Course Objectives:

***To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality.**
***Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties.**

UNIT I: Human Values:
Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty – Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT: II: Principles for Harmony:
Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT III: Engineering Ethics and Social Experimentation:
History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments — Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV: Engineers' Responsibilities towards Safety and Risk:

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/sImmediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V: Engineers' Duties and Rights:

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights – Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes-Industrial Espionage- Price Fixing-Whistle Blowing.

UNIT VI: Global Issues:

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

- Related Cases Shall be dealt where ever necessary.

Outcome:

***It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.**

***It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.**

References:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill – 2003.
3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.
4. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill - 2013
9. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications