R16 SYLLABUS
FOR
AGRICULTURAL ENGINEERING

For

SECOND YEAR ONLY

(Applicable for batches admitted from 2016-2017)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

KAKINADA - 533 003, Andhra Pradesh, India

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

FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS

Objective: To enable the students to design efficient water conveyance systems like canals, channels and pipes from places of origin to delivery points by acquiring knowledge on the principles of mechanics of fluids, water measurement and regulation and open channel hydraulic principles.

Unit – I:
Fluids-definitions-classification-properties, dimensions. Fluid pressure–introduction– Measurement of fluid pressure–peizometer tube manometry–types of manometers. Mechanical gauges-Bourdon's tube pressure gauge-Diaphragm pressure gauge–Dead weight pressure gauge. Fluid Static force on submerged surfaces–Total force on horizontal, vertical and inclined surfaces. Center of pressure of an inclined immersed surface-Centre of pressure of a composite section. Pressure on a curved surface and its applications. Kinematics of fluid flow– introduction – continuity of fluid flow – Types of flow lines.

Unit –II:
Boundary layer theory- Thickness of Boundary layer, Thickness of Boundary layer in a laminar flow, Thickness of Boundary layer in a turbulent flow, Prandtl's Experiment of Boundary Layer separation. Dynamics of fluid flow – Various forms of energy in fluid flow, frictional loss, general equation. Bernoulli's theorem, Euler's equation of motion. Practical applications of Bernoulli's theorem, Verturimeter, pitot tube, Orifice meter.

Unit – III:
Buoyancy of flotation – metacentric height. Flow through orifices (Measurement of Discharge) – Types of orifices, Jet of water, vena contracta, Hydraulic coefficients, Experimental Method for Hydraulic Coefficients, Discharge through a rectangular orifice. Flow through Orifices (Measurement of Time) – Time of Emptying a square, rectangular or circular tank through an orifice at its bottom, time of emptying a hemispherical tank through an orifice at its bottom. Time of emptying a circular horizontal tank through an orifice at its bottom. Time of emptying a tank of variable cross-section through an orifice. Flow through Mouthpieces – Types of Mouthpieces – Loss of Head of a liquid flowing in a pipe, Discharge through a Mouthpiece. Flow over Notches- Types of notches, Discharge over a Rectangular Notch, Triangular Notch, Stepped Notch. Time of emptying a tank over a Rectangular Notch, Triangular Notch. Flow over weirs – Types of weirs, Discharge over a weir, Francis's formula for Discharge over a Rectangular weir (Effect of End Contractions), Bazin's formula for Discharge over a rectangular weir, velocity of approach, Determination of Velocity of Approach.

Unit – IV:
Flow through simple pipes – Loss of head in pipes, Darcy's formula for loss of Head in pipes, Chezy's formula for loss of head in pipes. Transmission of power through pipes, Time of emptying a tank through a long pipe, Time of flow from one tank into another through a long pipe. Flow through compound pipes – Discharge through a compound pipe (Pipes in series)-Discharge through pipes in parallel, Equivalent size of a pipe, Discharge through branded pipes from one reservoir to another.

Unit – V
Dimensional analysis and similitude – Rayleigh's method & Buckingham's pi theorem. Types of similarities, Dimensional analysis, dimensionless numbers, introduction to fluid machinery. Open channel hydraulics- classification of open channel and definitions. Chezy's formula for discharge through an open channel.

Unit – VI:
Bazin's formula for discharge through open channel, Numerical Problems on design through open channel, Kutter's formula for discharge, Problems on design. Manning's formula for discharge through an open channel. Channels of most economical cross sections – Conditions for maximum discharge through a channel of rectangular section, trapezoidal section, circular section. Specific energy concept-Specific energy of a following fluid, specific energy diagram, critical depth, Type of flows, critical velocity. Velocity and Pressure profiles in open channels. Hydraulic jump, Types of Hydraulic Jumps, Depth of Hydraulic Jump, Loss of Head due to Hydraulic Jump.

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics, Modi P M and Seth S. M. 1973. Standard Book House, Delhi.
2. Open Channel Hydraulics, Chow V T, 1983, McGraw Hill Book Co., New Delhi.

REFERENCES:

1. A Text book of Hydraulics, Fluid Mechanics and Hydraulic Machines, Khurmi, R. S. 1970. S. Chand & Company Ltd., New Delhi.

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RENEWABLE ENERGY SOURCES

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-II

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion. Wind Energy Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

UNIT-III

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT-IV

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

UNIT-V

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-VI

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, seebeck, peltier and Joule-Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Renewable energy resources/ Tiwari and Ghosal/ Narosa.
2. Non-Conventional Energy Sources /G.D. Rai

REFERENCES:

1. Renewable Energy Sources /Twidell & Weir
2. Solar Energy /Sukhatme
3. Solar Power Engineering / B.S Magal Frank Kreith & J.F Kreith.
4. Principles of Solar Energy / Frank Krieth & John F Kreider.
5. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
6. Non-Conventional Energy Systems / K Mittal /Wheeler
7. Renewable Energy Technologies /Ramesh & Kumar /Narosa

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GROUND WATER HYDROLOGY, WELLS AND PUMPS

Objective: To enable the students to acquire knowledge on aquifers and estimation of their different properties like hydraulic conductivity, transmissibility, storage coefficient, specific yield, leakage factor, hydraulic resistance under steady and unsteady state conditions in wells dug under different aquifers, well drilling and development methods and equipment design of gravel pack in bore well. Further to make the students to acquire knowledge on various pumps available commercially, their selection, operation and maintenance with due importance to find out the cost of operation

Unit – I: Water Resources status of India-Occurrence and Movement of ground water and Aquifers – Types of Water bearing formations – unconfined, confined, semi confined aquifers – perched water table condition – diagramatic representation.

Unit – II: Classification of wells – Design of open wells – Ground water replenishment – Ground water exploration –Methods of drilling of wells – Common well drilling difficulties – Gravel packing – well screens – Development of well -

Unit – III: Aquifer characteristics influencing yield of wells - Determination of aquifer parameters – Steady state and unsteady state conditions – Well interference and multiple well point systems in coastal areas.

Unit – IV: Surface and subsurface exploitation and estimation of ground water potential – Artificial ground water recharge – Ground water project formulation – Classification of indigenous pumps – Wind powered water lifts – Solar powered and biogas operated water lifts – Reciprocating pumps -

Unit – V: centrifugal pumps – Terminology on Horse Power – Selection of pump-installation and trouble shooting of pumps – performance characteristic curves – Effect of change of impeller dimensions on performance characteristics

Unit – VI: Hydraulic Ram – Propeller pumps - Mixed flow pumps - Air lift pumps – Priming – Vertical Turbine pumps – Submersible pumps – Cost economics

REFERENCES:

1. Ground water and tube wells - Garg S P 1985. Oxford and IBH publish in company limited, New Delhi.
2. Water Well land Pump Engineering – Michael A M and Khepar S T 1989 Tata Mc-Graw Hill Publishing company limited, New Delhi.
3. Irrigation Theory and Practice – Michael A M 2008 Vikas Publishing House Pvt. Ltd, New Delhi.

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PROPERTIES AND STRENGTH OF MATERIALS

Objective: To enable the students to know about different materials used for engineering constructions like buildings, roads, farm structures and metals and other materials for manufacturing farm equipment, implements, dairy and food processing equipment.

Unit- I:
Properties of Engineering Materials, Classifications of Rocks, Sources of Stones and Natural bed of Stones, Properties, Varieties and uses of stones, Properties, Composition and uses of Bricks, Classification and tests of bricks, Properties, varieties and uses of Tiles, Properties, varieties and uses of Lime, Properties, varieties and uses of Cement, Properties, varieties and uses of Cement Mortar, Properties,

Unit - II
Varieties and uses of Concrete, Properties, varieties and uses of Sand, Properties, varieties and uses of Paints, Properties, varieties and uses of Varnishes, Properties, varieties and uses of Distempers. Characteristics and uses of Glass, Characteristics and uses of Rubber, Characteristics and uses of Plywood, Characteristics and uses of Plastics,

Unit-III:
Characteristics and uses of Wrought Iron, Characteristics and uses of Cast Iron, Characteristics and uses of Steel, Characteristics and uses of Aluminium, Characteristics and uses of Copper, Characteristics and uses of Nickel, Alloys of Aluminium and its properties, Alloys of Copper and its properties, Alloys of Nickel and its properties, Definition and Types of Timber, Seasoning of Timber, Industrial Timber and uses of Timber, Methods of heat treatment of Steel.

Unit-IV:
Introduction – Stresses, Tensile, Compressive and Shear-strains, Units-Elastic Curve- Elastic Limit – Poisons Ratio, Stresses in uniformity tapered circular sections- Stresses in bars of composite , Sections, Thermal Stresses and Strains in simple bars and composite bars, Elastic Constants- Young's Modulus (E), Bulk Modulus 9K0 and shear Modulus (G)- Relation between them, Stresses on oblique planes, Mohr's Circle method- Direct stresses in one plane, Direct Stresses in two planes- accompanied by shear stress. Deflection of beams, Relation between slope, deflection and radios of curvature. Methods of finding out slopes & deflections of beams, Double integration method. Slope and Deflection equations off a simply supported beam with a central point load, simply supported beam with eccentric point load. Simply supported beam with a uniformly distributed load, Columns and Struts

Unit-V:
Euler's column theory. Assumptions of Euler's column theory, Buckling load-derivations, Types of end conditions of columns; both ends hinged, both ends fixed, one end fixed and other hinged, Expression for buckling load of a column with one end fixed other free- with one end fixed and other hinged Expression for buckling load of a column with both ends hinged- with both ends. Fixed Types of end conditions of columns; both ends hinged, both ends fixed, one end fixed and other is hinged & one end fixed and other end is free. Types of end conditions of columns; both ends hinged, both ends fixed, one end fixed and other is hinged & one end fixed and other end is free. Limitations of euler's formula- Rankine's formula for columns.

Unit-VI:
Riveted joints, types of joints- strength of a rivet and riveted joint-efficiency of a riveted joint Design of riveted joints, Eccentric riveted connections, Welded joist, types of welded joints, Strength of welded joints, technical terms. Design of welded joints, eccentric welded joints. Design of welded joints, eccentric welded joints. Dams, forces acting, stressed at the base of dam. Stability of dams, design of base width of dams. Propped cantilever and beams – Deflection and slope Equations, Fixed and continuous beams – Deflection and Slope Equations, Super position theorem – claypeyron's theorem of three moments, Application of Clayperon's theorem of three moments, Moment distribution methods. Analysis of statistically indeterminate beams.

TEXT BOOKS:

1. Engineering Materials, Rangwala, S.C.1994. Charotar Publishing House, Anand.
2. Strength of Materials by Ramamrutham S. 2003. Dhanapathrai & Sons, Nai Sarak, New Delhi.

REFERENCES:

1. Material of constructions Deshpande R S 1977. United Book Corporation, Poona.
2. Manufacturing Process. Hazra Choudhury 1985. Media Promoters and Publishers Private Limited, Bombay.
3. Workshop Technology (Part-I) Chapman W.A.J. 1994. Aronold Publishers, New Delhi.
4. Engineering Materials. Rangwala S.C. 1994. Charotar Publishing House, Anand.
5. Mechanics of Structures (Vol.I) Junarkar S.B. 2001 - Charotar Publishing House, Anand.

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ELECTRICAL SYSTEMS

Unit- I:

Independent, Dependent Sources and Kirchoff's Laws, Maxwell's Loop current method and its problems, Nodal Voltage Method and its problems, Thevenin's Theorem and its problems, Norton's Theorem and its problems, Superposition Theorem and its problems, Reciprocity and Maximum power Transfer, Star-Delta Conversion Method and its problems.

Solution of DC circuit by Network Theorems, Sinusoidal steady state response of circuits, Instantaneous and Average Methods, Concept of Power Factor, Reactive and Apparent Poser, Concept and Analysis of Balanced Polyphase circuits, Laplace Transform method of finding step response of DC circuits, Series and Parallel Resonance.

Unit-II:

Electromotive force, Reluctance, Magnetic circuit, Determination of Ampere Turn Hysteretic losses and eddy current losses, Transformer-working principle, Construction of single phase transformer, EMF equation of transfer, Core type transformer, shall type and difference between shell and core type transformer, Electric circuit, dielectric insulation, leakage reactance in transformer.

Unit III:

Voltage regulation, transformer test, open circuit and short circuit tests, Losses in a transformer efficiency of transformer, condition for maximum efficiency, Equivalent circuit of transformer, theory of an ideal transformer, Phaser diagram of an ideal transformer, transformer on non load, Phaser diagram of transformer on load, problems solved. DC Generator, Principle of working construction, field system, armature, Commentator, other accessories of DC generator, EMF equation of DC generator, Torque equation, DC armature winding, lap winding wave winding terms used in armature winding, Armature reaction, Demagnetizing & Cross magnetizing ampere turns, methods of compensating armature reaction.

Unit – IV

Excitation of DC generator-shunt generator, series generator, compound generator, Commutation-Resistance commutation, EMF commutation, Characteristics of DC generator-separately exited, shunt, series, compound generator, DC Motor-working principle, value of back EMF, voltage equation of DC motor, Characteristics of DC motor–Characteristics of series, shunt, compound motor, Torque of DC motor, Armature Torque, shaft Torque-efficiency of DC motor.

Unit-V:

Factors controlling the speed, Flux control and armature control of shunt motors, Motors starters and their necessity, shunt motor and series motor starter, Principle of operation of single phase induction motor, double field revolving theory Equivalent circuit of single phase induction motor without core loss and with core loss, Single phase – split induction motor, shaded pole, motor, Power factor, disadvantage low power factor, power factor improvement.

Unit – VI

Measurement of power in three phase system, single watt meter, two watt meter method, Measurement of power in single phase system, using current transformer and voltage transformer, Three phase induction motor – working principle, production of rotation field, Construction – Starter, rotor, operation, Torque equation, Starting (DOL, Autotransformer, Star delta starter) and speed control methods.

TEXT BOOKS:

1. A text book of Electrical Technology Vol. II -Theraja BL & Theraja A K 2005. S. Chand & Company Ltd., New Delhi.

REFERENCES:

1. Basic Electrical Engineering, ANWANI M L 1997. Dhanpat Rai & Co. (P) Ltd. New Delhi.
2. Electrical Engineering Fundamentals, Vincent DelToro 2000. Prentice – Hall of India (P) Ltd., New Delhi

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SURVEYING

UNIT – I

INTRODUCTION: Overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications. Distance measurement conventions and methods; use of chain and tape, Electronic distance measurements, Meridians, Azimuths and Bearings, declination, computation of angle.

UNIT – II

LEVELING AND CONTOURING: Concept and Terminology, Temporary and permanent adjustments- method of leveling. Characteristics and Uses of contours- methods of conducting contour surveys and their plotting.

UNIT – III

COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

UNIT - IV

THEODOLITE: Theodolite, description, uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite. Trigonometrical leveling, Traversing.

UNIT – V

TACHEOMETRIC SURVEYING:

Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position. Types of curves, design and setting out – simple and compound curves.

UNIT - VI

INDTRODUCTION TO ADVANCED SURVEYING : Introduction to geodetic surveying, Total Station and Global positioning system, Introduction to Geographic information system (GIS).

TEXT BOOKS:

1. "Surveying (Vol – 1, 2 & 3), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi
2. Duggal S K, "Surveying (Vol – 1 & 2), Tata Mc-Graw Hill Publishing Co. Ltd. New Delhi, 2004.
3. Text book of surveying by C. Venkataramaiah, University Press

REFERENCES:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004
3. Chandra A M, "Plane Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
4. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
5. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi

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FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS LAB

Practical:

1. Determination of metacentric height
2. Verification of Bernouli's theorem
3. Measurement of discharge with a venturimeter
4. Measurement of velocity with a pilot tube
5. Determination of coefficient of discharge of rectangular weir
6. Determination of coefficient of discharge of triangular weir
7. Determination of coefficient of discharge of trapezoidal weir
8. Determination of hydraulic coefficient of orifices
9. Experiment on broad crested weir
10. Determination of head losses in pipes
11. Experiments on open channels
12. Determination of roughness coefficients of open channels
13. Measurement of velocity and pressure profiles in open channels
14. Construction of flownet
15. Problems on construction of flownet

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SURVEYING LAB

LIST OF EXERCISES:

1. Survey of an area by chain survey (closed traverse) & Plotting
2. Determination of distance between two inaccessible points with compass.
3. Surveying of a given area by prismatic compass (closed traverse) and plotting after adjustment.
4. Radiation method, intersection methods by plane Table survey
5. Two point and three point problems in plane table survey
6. Fly leveling (differential leveling)
7. An exercise of L.S and C.S and plotting
8. One exercise on contouring.
9. Study of theodolite in detail - practice for measurement of horizontal and vertical angles.
10. Measurement of horizontal angles by method of repetition and reiteration.
11. Trigonometric Leveling - Heights and distance problem (Two Exercises)
12. Heights and distance using Principles of tacheometric surveying (Two Exercises)
13. Area determination, traversing contouring using total station
14. Determination of remote height and state out using total station
15. Distance, gradient, Difference in height between two inaccessible points using total station

List of Major Equipment:

1. Chains, tapes, Ranging rods, cross staff, arrows
2. Compasses and Tripods, Optical square.
3. Plane tables, Alidade, Plumbing fork, trough compasses
4. Leveling instruments and leveling staves
5. Box sextants, planimeter.
6. Theodolites, and leveling staffs.
7. Tachometers.
8. Total station.

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THEORY OF STRUCTURES

Objective: The Students will have acquired knowledge on the design principles of beams, slabs, columns, foundations and RCC structures.

Unit-I:
Introduction to loads and BIS codes – Analysis and designing of single reinforced sections – Properties of reinforced concrete, advantages, assumptions, modular ratio, equivalent area of R.C.C., Stress and strain diagram, neutral axis, moment of resistance, design of rectangular section.

Unit-II:
Analysis of balanced over reinforced and under reinforced sections – Under reinforced sections, over reinforced sections, problems. Analysis and designing of double reinforced sections – Modular ratio for compression shell equivalent area of steel in compression, neutral axis, moment of resistance, steel beam theory, problems. Shear stresses in beams – Shear stress induced in homogeneous and R.C. beams, nominal shear stress, varying depth, effect of shear in R.C. beams, failures, shear resistance of concrete without shear reinforcement.

Unit- III:
Design of shear reinforcement, problems. Vertical stirrups and inclined bars – Development of length, development of stress in R.C.C. Anchorage for reinforced bars–Anchorage for reinforced bars, anchorage bars in tension, anchorage bars in compression. Curtailment of bars – Decision on the curtailment of bars, design considerations for bond, general concept of bond.

Unit- IV:
Design of flanges beams (CT and I beams). Design of one way slabs – Loading on slabs, arrangement of reinforcement, design of one way slab. Design of one way slabs – Problems on design of one way slabs. Design of one way slabs – Design of reinforced brick slabs, problems. Design of one way slabs – Rankine – Grashoff theory, shear force on the edges, design, problems, Merco's method.

Unit-V:
Design of two way slabs – Torsion reinforcement, load and bending moment, problems, slabs with edges fixed. Design of two way slabs – Provision of torsion reinforcement, Marcor's method, problems. Axially loaded columns – Types of columns, effective length of columns, long and short columns, composite columns.

Unit- VI:
Axially loaded columns – Basic rules for design of columns, arrangement of transverse reinforcement, problems. Foundations – Types of foundations, design criteria. Foundations – Problems on design criteria. Retaining walls – Earth pressure on a retaining wall, active earth pressure, passive earth pressure. Stability of walls – Conditions for stability of retaining walls, problems.

TEXT BOOKS:

1. Mechanics of Structures Vol. I, Junarkar,S.B. 2001 – Charotar Publishing Home, Anand.
2. Mechanics of Materials, Dr. B.C. Punmia, Laxmi Publications.

REFERENCES:

1.Strength of materials, R.S. Khumi 2001 – S. Chand & Company Ltd., 7361, Ram Nagar, New Delhi – 110055.
2.Treasure of R.C.C. Design, Sushil Kumar 2003 – R.K.Jain – 1705-A, Nai Sarak, Delhi

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HEAT AND MASS TRANSFER

Objective: To enable the students to know about the transport phenomenon in materials through heat and mass transfer for applications in unit operations of dairy and food engineering.

Unit – I:
Introductory concepts, application of Heat and mass transfer-modes of heat transfer examples, Fourier's law of heat transport, Introduction to steady state heat transfer –one dimensional steady state heat conduction equation.
Thermal conductivity of different materials – measurement-Insulation Materials, One dimensional steady state conduction through plane and composite walls, Conduction through tubes and spheres with and without heat generation, Conduction through multilayer tubes.

Unit – II:
Electrical analogy-conduction through materials in parallel, Combined convection and conduction and overall heat transfer coefficients-problem solving, Concept of critical thickness of insulation for a cylinder-problem solving,

Unit III:
Radiation heat transfer-Introduction. Absorptivity, reflectivity and transmissivity. Black body and monochromatic radiation, Plank's law, Stefan-Boltzman law, Kichoff's law, grey bodies and emissive power, solid angle intensity of radiation, Radiation exchange between black surfaces, geometric configuration factor. Heat transfer analysis involving conduction, convection and radiation by networks.

Unit IV:
Unsteady state heat transfer-unsteady state system with negligible internal thermal resistance-equation for different geometries, Fins-heat transfer from extended surfaces-types of fins-numiricals, Free and force convection.
Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced convection. Useful non dimensional numbers and empirical relationships for free and forced convection,

Unit V:
Equation of laminar boundary layer on flat plate and a tube, Laminar forced convection on a flat plate and in a tube, Combined free and forced convection, Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units, Heat exchanger analysis restricted to parallel and counter flow heat exchangers.

Unit – VI:
Steady state molecular diffusion in fluids at rest and in laminar flow-Flick's law mass transfer coefficients-Reynold's analogy.

REFERENCES:

1. Transport processes and Unit Operations, Geankoplis C.J. 1992. Allyn and Bacon Inc., Newton, Massachusetts.
2. Heat Transfer, Holman JP 1989. McGraw Hill Book Co., New Delhi.
3. Fundamentals of Heat and Mass Transfer, Incropera F P and De Witt D P 1980 John Wiley and Sons. New York.
4. Engineering Heat Transfer, Gupta CP and Prakash R 1994. Nem Chand and Bros., Roorkee.
5. Heat transfer, Rajput S. Chand & Co, New Delhi.

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THEORY OF MACHINES

Objective: To educate the students about the kinematics of machine elements, links and pairs and other systems in different machines for applications in the manufacturing of machines and their elements.

Unit–I:
Introduction, Element, Link, Pairs. Kinematics Chains and Pairs- Types, lower and higher pairs. Mechanism – types and inversions. Lower and higher pairs. Four bar chain, slider crank chain and their inversions - Determination of velocity and acceleration using graphical (relative velocity and acceleration) methods. Instantaneous center – Lindring.

Unit II
Types of gears, Law of gearing. Velocity of sliding between two teeth in mesh Involute and cucloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted and epicyclical gear trains - Determining the velocity ratio by tabular method. Turning moment Diagrams, Coefficient of fluctuation of speed and energy.

Unit-III:
Weight of fly wheel, flywheel applications. Belt drives, types of drives. Belt materials, Length of belt, Power transmitted, Velocity ratio, Belt size for flat and v-belts.

Units-IV:
Effect of centrifugal tension, creep and slop on power transmission, chain drives Types of friction, Laws of dry fiction, Friction of pivots and collars. Single disc, Multiple disc and cone clutches. Rolling friction, Anti-friction bearings.

Unit -V
Types of Governors, Constructional details and analysis of Watt, Porter and Proell governors – Spread of governors. Effect of friction, controlling force, curves, sensitiveness, stability, hunting, Isochronism's, power and effort of a governor,

Unit-VI:
Static and dynamic balancing, Balancing of rotating masses in one and different planes, Partial primary balancing of reciprocating masses. Cams and Foversees.

TEXT BOOK:

1. Theory of Mechanisms and MachinesJgdish Lal 1991. Metropolitan Book Co. Pvt. Ltd., 1 Netaji Subash Marg, New Delhi.
2. Theory of Machines, Khurmi R S and Gupta JK 1994. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.

REFERENCES:

1 Theory of Machines, Thomas Bevan 1984. CBS Publishers
2 Theory of Machines, Ballaney P L 1985 Khanna Publishers, 2- B Nath Market, Nai Sarak, New Delhi
3. Mechanisms and Machine Theory, Rao J S and Dukkipatti R V 1990. Wiley Astern Ltd., New Delhi
4. Theory of Machines, Rattan S B 1993. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asf Ali Road, New Delhi

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SOIL MECHANICS

Objective: Students will be trained on concepts and analysis of soil properties, stress conditions of loaded soil, consolidation and soil failure theories. The knowledge imparted will be used in higher level design considerations for construction of soil and water conservation structures, irrigation and drainage structures.

Unit–I:
Introduction of soil mechanics – Field of Soil Mechanics. Soil on three phase systems – Physical and index properties of soil. Classification of soils - General, Particle size classification. Classification of soils - textural classification, I.S. classification. Stress condition in soils – Effective and neutral stress.

Unit-II:
Concept on Bousinesq's analysis – Vertical pressure distribution on vertical line, vertical pressure under a uniformly loaded circular area, vertical pressure due to a line load. Concept on Bousinesq's analysis – Vertical pressure under strip load, vertical pressure under a uniformly loaded rectangular area, equivalent point load method. Concept on Westerguard's analysis – Point load pressure distribution, uniformly loaded circular area. Westerguard's analysis – Uniformly loaded rectangular area, comparisons between Bousinesq's and Westerguard's solutions. Newmark's influence chart – Preparation, problems.

Unit-III:
Shear strength – Introduction, Mohr's stress circle, stress systems with principal planes parallel to the coordinate axes. Shear strength – Introduction, Mohr's stress circle, stress systems with principal planes parallel to the coordinate axes. Shear strength – Mohr – Coulomb failure theory, effective stress principle. Measurement of shear strength – Introduction, direct shear test, tri-axial compression test, stress conditions in soil specimen during tri-axial testing. Measurement of Shear strength – Advantages of tri-axial test, graphical solutions, unconfined compression test, vane shear test. Problems on shear strength.

Unit-IV:
Compaction of Soils – Standard test and Modified proctor test. Abbot Compaction test. Jodhpur mini compaction test. Field compaction method and control.

Unit – V:
Consolidation of soil – one dimensional analysis spring analogy–Terzaghi's theory. Laboratory consolidation test. Calculation of coefficient of volume change – Coefficient of consolidation.

Unit-VI:
Earth pressure – Plastic equilibrium in soils. Active and Passive states of earth pressure. Rankine's theory of earth pressure. Earth pressure for cohesive soils. Simple numerical Exercises on earth pressure. Stability of slopes – infinite and finite slopes. Friction Circle method. Taylor's stability number.

TEXT BOOK:

1. Soil Mechanics and Foundations, Punmia B C, Jain A K and Jain A K, 2005. Laxmi Publications (p) LTD. New Delhi

REFERENCES:

1. Basic and Applied Soil Mechanics, Gopal Ranjan and Rao A S R 1993. Willey Eastern Ltd., New Delhi.
2. Soil Engineering Vol.1, Alam Singh 1994. CBS Publishers, and Distributions, Delhi.

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

L	T/P/D	C
4	-/-/-	3

SURFACE WATER HYDROLOGY

Objective : To enable the students to acquire knowledge and skills on hydrological (rainfall and runoff) measurements in watersheds, hydrological design of structures, prediction of volume and rates of runoff with tools like hydrographs and unit hydrographs, reservoir planning with flood routing techniques for application in natural resources management.

Unit-I:
Hydrology-definition, hydrology cycle and its components. Forms of Precipitation Rainfall, Characteristics of rainfall in India (types of monsoon). Measurement of Rainfall – Recording and Non-Recording Rain gauges- Rain gauge network density for different topographic conditions – Point rainfall analysis - Presentation of Rainfall data – Mass Curve and hyetograph, Mean Precipitation over an area – Arithmetic Mean, Thiessen Polygon, Isohyetal methods, DAD Relationships and curves. Probability Analysis of Rainfall – Return Period, Plotting position by Weibull's method – Rainfall events at different probability levels (20% , 40%, 60%, 80%)

Unit-II:
Intensity-Duration-Frequency-Relationship ($i= ((KT^x)/(D+A)^n$)Determination of net effective rainfall-infiltration indices- Phi index. Runoff-definition-components of runoff-direct runoff and base flow, overload flow and interflows, pictorial representation of different routes of runoff. Runoff characteristics of streams – perennial, intermittent and ephemeral streams, Measurement of stream flows.

Unit-III:
Measurement of stage and velocities, staff gauge, wire gauge, automatic stage recorders, current meters (horizontal and vertical axis meters), calibration ($V= a N_s + b$). Rainfall-Runoff relations ($R=a P + b$), curve fitting and determination of 'a' and 'b' and (correlation coefficient), factors affecting runoff. Definition and Estimation of peak runoff and design peak runoff rate, rational method and curve number techniques.

Unit-IV:
Hydrographs-definitions and components, factors affecting flood hydrographs, hydrograph separation for simple and complex storms – Method I (straight line method, $N=b A^{0.2}$), other Methods II and III. Unit Hydrographs-concept and the three implications of the definitions and the two basic assumptions (linear response and time invariance). Effects of the characteristics of storms(duration of rain, time-intensity pattern, areal distribution of runoff and amount of runoff) on the shape of the resulting hydrographs .Derivation of Unit hydrographs, average unit hydrographs from several storms of the same duration (proper procedure of computing average perk flow and time to peak). Derivation of unit hydrographs for complex storms.

Unit-V:
The conversion of unit hydrograph duration, methods for unit hydrographs of different durations, (1) method of superposition and (2) S-curve. S-curve method, explanation of concept and application. conversion of unit graph duration by S-curve method, determination of lower duration graph from the given higher duration graph and vice-versa. Synthetic unit hydrograph, Concept, Snyder' synthetic unit hydrograph, formulas relating hydrograph features (basin lag, Peak flow and time base of the unit hydrograph). Instantaneous unit hydrograph, Concept and application, SCS Triangular Hydrograph - Application of Hydrology - Flood control and Regulation, Flood mitigation, Floodplain mapping, Retards.

Unit VI : Flood Routing-introduction, two broad categories of flood routing and channel routing, hydrologic routing and hydraulic routing, basic equations. Hydrologic storage routing, Schematic representation of storage routing, modified Pul's method (semi-graphical method). Explanation of the features of the modified Pul's method. Flood routing through a reservoir by modified Pul's method. Applications of Hydrology in land and water management, watershed management.

TEXT BOOKS:

1. Engineering Hydrology. Raghunath H.M. 1986. Willey Eastern Limited, New Delhi.
2. Watershed Hydrology, Suresh R. 1997. Standard Publisher and Distributors, New Delhi.

REFERENCES:

1. Engineering Hydrology. Subramanyam K. 1984. Tata Mc. Graw – Hill Publishing Co., Limited, New Delhi.
2. Hydrology for Engineers Linsley R.K. Kholer A. & Paul Hus J.L.H. 1988, Mc-Graw Hill Book Co. New Delhi.
3. Watershed Management. Dhruvanarayana, VV. 1990. ICAR Publication, New Delhi.

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

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FARM POWER AND TRACTOR SYSTEMS

Objective: To enable the students for acquiring the knowledge pertaining to systems like transmission system clutch, types of clutches, types of Gear, sliding, constant mesh type tractor power out lets like P. T.O, belt pulley, drawbar, traction theory rolling, resistance, rim pull, crawler tractor.

Unit-I:
Source of Farm Power – Conventional & Non Conventional Energy Sources - Classification of Tractor and I.C Engines – Study of I.C Engine components and their construction, operating principles and functions – Engine systems and their construction details and adjustment.

Unit-II:
Valves and valve mechanism – Fuel and air supply stems – Cooling and lubricating systems – Electrical & ignition systems – I.C Engine fuels – their properties – Detonation and knocking in IC engines – Study of properties of coolants, antifreeze and anti corrosion materials – Lubricant types & study of their properties – Engine governing systems. Introduction to transmission system – Power transmission system of Tractor – Functions of a power transmission system. Clutch – Necessity of clutch in a tractor – Essential features of good clutch – Principal working of clutch – Clutch repairs and maintenance.

Unit-III:
Types of Clutch – Friction clutch, Dog clutch and Fluid coupling – Friction clutch – Single Plate clutch or single disc clutch, Multiple plate clutch or multiple disc clutch, cone clutch. Single Plate clutch or single disc clutch – constructional details and principle of working mechanism. Multiple plate clutch, splinted sleeve clutch type – constructional details and principle of working mechanism Ratchet & Pawl arrangement mechanism – constructional details and principle of working mechanism. Gears – Necessity for providing gear box – selective sliding type & constant mesh type – Mechanical advantage in gears – Torque ratio in Gears – working of Gear box. Differential unit and Final drive – Differential – Functions of crown wheel – Differential lock – functions – Final drive – functions of Final drive.

Unit-IV:
Fluid coupling and torque connector – Brake mechanism – Requirements of good braking systems – classification of brakes – Mechanical brake and Hydraulic brake – working mechanism. Steering mechanism – Qualities of Steering mechanism, Main parts of steering mechanism Types of steering boxes – working of hydraulic steering. Hydraulic control system – working principals – Basic components of Hydraulic system – Types of hydraulic system – Position control –Draft control – Mixed control – Precautions for hydraulic system.

Unit-V:
Tractor power out lets – P.T.O. Construction details, Tractor power out let – Belt pulley constructional details, Tractor power out let – Draw bar – construction details. Traction-Traction efficiency – Method for improving traction – Coefficient of traction – Rolling resistance – Wheel Slip or Track slip – Rimpull – crawler tractor.

Unit-VI:
Tractor testing – Preparation of tests – Types of tests – Test at the main power take off – Test at varying speeds at full load – Test at varying load-Belt or pulley shaft test – Drawbar test-Tractor engine performance. Determination of centre of Gravity – Suspension method – Balancing method – Weighing method. Tractor chassis machines – Functions of chassis frame – Tractor chassis – Mechanics of Tractor chassis.

TEXT BOOKS:

1. Farm Tractor Maintenance and Repair. Jain. S.C. and Roy C.R. 1984. TMH Publishing Co. Ltd., New Delhi.
2. Tractors and their power units. Lijedhal J.B. Carleton W.M. Turnquist P. K. and Smith D.W. 1984. AVI Publishing Co. Inc., Westport, Connecticut.

REFERENCES:

1. Elements of Agricultural Engineering. Jagadeshwar Sahay. 1992. Agro Book Agency, Patna.
2. Farm Gas Engines and Tractors. Fred J.R. 1963. Allied Publisher Pvt. Ltd., Bombay.
3. Farm Machines and their Equipment. Nakra C.P., 1986. Dhanpet Rai and Sons. 1982 Nai Sarak, New Delhi.

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SOIL SCIENCE AND AGRONOMY FIELD LAB

PART-A

1. Study of soil profile and collection of soil samples.
2. Determination of bulk density ad particle density of soils.
3. Determination of soil texture.
4. Determination of Proctor moisture content.
5. Determination of soil moisture at different tensions.
6. Determination of hydraulic conductivity of soil. Choose any six labs
7. Determination of infiltration rate soil.
8. Determination of soil strength and soil colour.
9. Determination of pH and EC of soils.
10. Determination of organic carbon content in soils.
11. Estimation of available P & K of soils.
12. Determination of anions and cations in irrigation water.

PART-B

1. Visit to college farm.
2. Study of meteorological instruments.
3. Measurement of rainfall and evaporation.
4. Practice of Ploughing.
5. Practice of pudding.
6. Identification of crops and seeds.
7. Identification of manures and fertilizers. Choose any six labs
8. Seed bed preparation for nursery.
9. Practice of sowing.
10. Soil moisture estimation by direct method.
11. Practice of fertilizer application.
12. Practice of inter cultivation.
13. Practice of weeding.
14. Practice of harvesting.
15. Practical examination.

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MACHINE DRAWING AND COMPUTER GRAPHICS LAB

1. Preparation of manual drawings with dimensions from Model and Isometric drawings of objects and machine components.
2. Assembly drawings of machine components – Screw jack, knuckle joint, stuffing box and cotter joint
3. Drawing of missing views.
4. Dimensioning methods and principles of dimensioning
5. Concept of sectioning, Revolved and oblique section. Explanation of full sectioning and half sectioning concepts.
6. Sectional drawing of simple machine parts – foot step bearing, shaft support, stuffing box
7. Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints.
8. Square headed and hexagonal nuts and bolts.
9. Different types of lock nuts, studs, machine screws
10. Application of computers for design. Definition of CAD, benefits of CAD.
11. CAD System components & computer hardware for CAD.
12. Explanation of draw tool bar commands in Auto CAD software
13. Drawing of riveted joints and thread fasteners.
14. Computer Graphics for agricultural engineering applications.
15. Practice in the use of basic and drawing commands on AutoCAD.
16. Generating simple2-D drawings with dimensions using AutoCAD.
17. Small projects using CAD.

REFERENCES:

1. Elementary Engineering Drawing. Bhat. N.D. 1995. Charotar Publishing House, Anand.
2. Machine Drawing. Bhatt N.D and Panchal V.M. 1995. Charotar Publishing House, Anand.
3. Machine Drawing. Narayana K.L. Kannaiah P. and Venkata Reddy K. 1996. New Age International Ltd., New Delhi.
4. Mastering CAD / CAM with Engineering Subscription Card. Ibhrahim Zeid, McGraw-Hill Science / Engineering / Math; 1st Edition (May 21, 2004).
5. Principals of CAD / CAM / CAE/ Systems. Kunwoo Lee, Addison – Wesley.

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

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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
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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.

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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.

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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.

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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

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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.

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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.

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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.

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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.

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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.

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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.

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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

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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

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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.

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

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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.

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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.

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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.

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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