

B. TECH 5th SEMESTER

MECHANICAL ENGINEERING

MANUFACTURING TECHNOLOGY-II (ME)

MACHINE TOOLS:-Principles of copying, forming and generating, speeds and feeds for machine tools. classification, specification and operation of machine like lathe, shaper, drilling machines, milling machines, their accessories and tools, estimation of machining time. Boring machine, capstan and turret lathes, single and multispindle automatic lathes. Abrasive machining –types, selection of grinding wheels, grinding machine-types and operation.

NEWER MACHINING TECHNIQUE: abrasive jet machining, ultra sonic machining, electro discharge machining, electro chemical machining, chemical milling.

METAL CUTTING: Mechanics of metals cutting, Merchant's analysis, tool life, Taylor's equation, Tool angles and shapes, tool materials, composition, properties and applications.

JIGS AND FIXTURES: Locating elements, clamping devices, principles of jigs and fixture design.

METROLOGY: Tolerance and allowance, limit system, limit gauge.

MECHANICS OF SOLIDS –II (ME 5113)

ANALYSIS OF STRAIN: Principal strain, mohr's circle of strain.

STRAIN ENERGY: strain energy due to bending and shear. Castigliano's theorem, application to the deflection and rotation of the beam, deflection of simply supported beam and cantilever beam due to shear.

THEORIES OF FAILURE: different theories of failure, comparison of theories of failure.

THICK SPHERICAL SHELLS: Radial and circumferential stress.

ROTATION OF DISCS: thin disc of uniform thickness, Radial and hoop stresses. Disc with central holes, disc of uniform strength.

SHEAR CENTRE :Shear centre for thin walled open cross section, shear flow.

UNSYMMETRICAL BENDING :Flexural stresses due to unsymmetrical bending of beam.

BEAM WITH LARGE ORIGINAL CURVATURE:Stress in crane hooks, ring and links.

FATIGUE: Fatigue of metals, strain method of obtaining fatigue range's formulae connecting stress range, maximum stress and ultimate strength, S-N curve, Gerber's formula, Goodman's law.

CREEP: Creep of metals, mechanism of creep, equicohesive temperature, creep curve, creep rate.

HEAT AND MASS TRANSFER

INTRODUCTION: Modes of heat transfer – conduction, convection and radiation.

CONDUCTION: Fourier law, thermal conductivity of solids and factors influencing thermal conductivity, general three dimensional heat conduction equations in Cartesian and cylindrical co-ordinates.

One-dimensional steady state conduction through single and composite plane walls, cylinder and spheres, critical thickness of insulation, conduction with internal heat source, heat transfer from fins.

CONVECTION: free and forced convection – hydrodynamic and thermal boundary layers – laminar and turbulent boundary layer over a flat plate. Heat transfer through tubes, constant wall temperature and constant heat flux (empirical relations) similarity conditions of heat transfer, Reynolds analogy. Application of dimensional analysis – empirical relations of convective heat transfer.

BOILING HEAT TRANSFER: pool, nucleate and film boiling. Heat transfer in condensations drop wise and film wise (empirical equations).

RADIATION: thermal radiations – monochromatic and total emissive power, absorptivity, reflectivity, transmissivity, black and grey bodies, Planck's law, Wien's law,

MASS TRANSFER: introduction – Fick's law of diffusion- diffusion coefficient, analogy between heat and mass transfer, elementary problems. Stefan-Boltzman law, Kirchoff's law, Black and gray surfaces, radiation shields, shape factor.

APPLIED THERMODYNAMICS

BOILERS:

Classification, boiler mounting and accessories, draft system, calculation of chimney height, equivalent evaporation, boiler efficiency and heat balance.

STEAM ENGINE:

Construction and working of simple steam engines, ideal and actual indicator diagram, diagram factor, mechanical efficiency and estimation of cylinder dimension, missing quantities, governing, William's line.

STEAM NOZZLE:

Flow through nozzles, shape and flow area, effect of friction, wet and supersaturated flow, estimation of flow area.

STEAM CONDENSER:

Type, cooling water requirement, air leakage and air pump capacity, vacuum and condenser efficiency, steam injector, spray pond and cooling tower.

STEAM TURBINE:

Construction and working of steam turbines, impulse and reaction turbines, inlet and outlet velocity diagrams – work output and efficiency, pressure and velocity compounding, regenerative and reheat cycles.

REFRIGERATION:

Refrigeration machine, heat pump, COP, unit of refrigeration, ideal refrigeration cycles, Bell-colemon air refrigeration systems.

VAPOUR REFRIGERATION SYSTEMS: Simple vapour compression refrigeration cycles, wet and dry compression, sub-cooling and superheating, actual vapour compression cycles, flash chamber and accumulator.

ENGINEERING ECONOMICS AND MANAGEMENT

ENGINEERING ECONOMY:

(a) Simple and compound interest, annuities (b) depreciation: cause and methods (c) comparison of alternative and replacement studies: (i) equivalent annual cost method, (ii) present worth method, (iii) rate of return method.

ACCOUNTING:

(a) Double entry book keeping, (b) journal, (c) ledgers, (d) manufacturing account: profit and loss accounts, (e) balance sheet.

COSTING:

(a) cost and cost accounting, elements, (b) break even analysis, determining selling price and profitability, (c) over-head cost allocation, (d) costing system, job costing, unit costing, process costing, operating cost, departmental cost, (e) cost control : actual and standard cost, budget and budgetary control.

ENTREPRENEURSHIP DEVELOPMENT:

(a) Introduction to entrepreneurship, (b) motivation, (c) psychological factors, risk taking behavior, (d) rural entrepreneurship, (e) self employment.

MANAGEMENT AND ORGANIZATION:

(a) Principle of management, (b) elements of management, planning, organizing direction and control, (c) Organization structure and charts, line, staff functional and committee organization.

INDUSTRIAL MANAGEMENT:

(a) Industrial ownership LP proprietorship, partnership, Joint Stock Company and cooperative societies, (b) site selection, (c) plant layout: process oriented product oriented layouts, line balancing.

PRODUCTION MATERIALS MANAGEMENT:

(a) Production types: job order, batch and mass production, (b) inspection and quality control, (c) inventory control, economic order quantity.

OPTIMIZATION TECHNIQUES:

(a) Linear programming: graphical method, analytical method of solution (two variables), (b) CPM & PERT.

PERSONAL MANAGEMENT:

(a) Functions: manpower planning, recruitment, selection, training, promotion, discipline, welfare, (b) job evaluation, (c) merit rating, (d) wages and incentives

MARKETING MANAGEMENT:

(a) Market research and sales forecasting, (b) sales management, (c) advertisement and sales promotion
Books

ELECTRICAL ENGINEERING

MICROPROCESSOR AND INTERFACING (EE 5109)

8085:- Architecture, introduction, Pin function, Internal Organization.

8085 Programming: - Instruction sets, Introduction, Programming algorithm, Instruction timing

8085 interrupts, 8085 Interfacing with memory, 8255 Interfacing with I/O, I/O ports, DMA and Interrupt controller chips, Introduction to 8255.

Introduction to 8086:- Architecture, Pin Configurations, Instruction set.

POWER SYSTEM-II (EE 5110)

Power System Control: - Voltage, Active and Reactive Power Control, VAR Compensators.

Fault Analysis: Symmetrical Components, Unsymmetrical fault and Symmetrical Faults.

Transient Stability: Equal Area Criteria, methods of improvement of transient stability. Introduction of Multi-machine transient stability.

Load Flow Study: Bus Classification, Nodal Admittance matrix, Development of Load Flow equations. Gauss- Siedal method and Newton- Raphson method.

INSTRUMENTATION II (EE 5111)

TRANSDUCER-

Types and classification, selection, strain gauge, inductive and capacitive,

Piezoelectric transducer, temperature transducers, Shaft angle encoder, digital displacement transducer.

Measurement of velocity, Acceleration, force, flow of liquids, liquid levels, digital temperature measurement.

vector voltmeter, frequency meter, universal counter & q-meter.

Data acquisition system, Analog and digital signal conditioning and its instrumentation scheme. AC and DC telemetry,

Introduction to laser based instrumentation scheme.

Data logger, PC based instrumentation, IEEE 488 bus.

EMF (PH)

Gradient, Divergence, Gauss's Divergence Theorem, Curl, Stoke's Theorem,

Gauss's Law, Potential Function, Poisson's and Laplace's Equations, Electrostatic Uniqueness Theorem, Ampere's Law, Faraday's Law, Magnetic Scalar and Vector Potential.

Maxwell's Equations and Boundary Conditions, Displacement Current, Plane Electromagnetic Waves in perfect Isotropic Dielectric, Partially Conducting Media and Good Conductors and Skin Depth, Poynting's theorem.

Polarization of Electromagnetic Waves, Normal and Oblique Incidences of Electromagnetic Waves at Plane Perfect Conducting and Dielectric Boundaries, Total International Reflection, Brewster's Angle, Surface Impedance.

Parallel-Plane Transmission line, Parameters of a Parallel-Plate Transmission Line, Equivalent circuit of a Parallel-Plate Transmission line, Voltage and Current in Terms of the Sending-End and Receiving-End, Variables, The input Impedance, Quarter Wavelength line, Low-loss Radio Frequency and UHF Transmission lines, UHF Lines as a Circuit Elements, Reflections at Discontinuity Points Along Transmission Lines, Standing Waves in Transmission Lines. Voltage Standing-Wave Ratio, Quarter Wave Impedance, Inverting Transformer, Impedance Matching with Single Shunt Stub.

Guided Waves, Waves Between Parallel Planes, Transverse Electric Waves, Transverse Magnetic Waves, Characteristics of TE and TM Waves, TEM Waves, Velocities of Propagation, Wave Impedances, Rectangular Guides. TM & TE Waves in Rectangular Guides, Impossibility of TEM Waves in Rectangular Waveguide, Wave Impedances and Characteristic Impedances.

Radiation, General Solution of Maxwell's Equations, Expression for E and H in terms of Potentials, Retarded Potentials, Radiation Mechanism, Radiation Fields of an Alternating Current Element (Oscillating Electric Dipole)

ELECTRICAL MACHINE-II (EE 5112)

SYNCHRONOUS MACHINE :-

Construction and types of windings, generators and motors operations, Armature reaction, phasor diagram, Salient pole machine, Two axis theory, d-q model, Voltage regulation, operation of synchronous machine as infinite bus, parallel operation

of synchronous generator, Synchronization, Starting of synchronous motor, V- curves, torque angle characteristics and hunting,
Single phase Motors - induction type, Double revolving field theory, equivalent Ckt. Characteristics & starting of single phase motor, capacitor motor, shaded pole motor, repulsion motor, reluctance start induction motor, synchronous type, Hysteresis motor, Reluctance motor, Stepper motor its type, application and characteristic, Special electric motors- PMBLdc motor, tachometer, Two phase control motor, Synchro.

PRODUCTION ENGINEERING

PRODUCTION TOOLING & DESIGN I (PE 5103)

Introduction to Jigs and Fixtures. Basic principle followed in the design of Jigs and Fixtures. Jig classification and drill bushes and its types. Typical Jigs for components requiring drilling, reaming, tapping, counter boring and spot facing. Job holding and clamping devices used in mass production of identical jobs. Fixtures characteristics and setting-piece, milling fixtures, turning Fixtures, grinding fixtures, Assembly and inspection of fixtures. Universal assembled fixtures.

Design of tools for making holes, Deep drilling tools, Cutting forces in drilling, milling Cutter's types, design parameters and its calculation. Design and construction of form tool and relieving cutters. Design of Reamers and thread cutting tools.

Broaching types, construction and design features in general and regrinding of tool.

METROLOGY (PE 5104)

Principles of measurements: Line standard: Imperial standard yard, standard meter, wave length standards, end bars, effect of environment on measuring accuracy, Dimensional and geometrical accuracy, sine and cosine error.

Tolerance and Limit Systems: System of tolerance and fits, ISA and BIS system of tolerances and fits, the economics of wide and close tolerance, principles of limit gauging of plain work, Design and manufacture of gauge.

Measuring Instruments: Linear measurement: Direct measuring tools, comparators types, relative merit and limitations, optical instruments, projectors and microscopes, angular measurements: clinometer, taper gauges, sine bar; Angle blocks and Auto collimators, circular division testers, optical dividing head.

Geometrical form of surfaces: Concepts and measurements of flatness, straightness, Parallelism, perpendicularity, roundness, cylindricity, Runout and concentricity, errors in positioning. Uses of interference methods, Measurements of surface texture.

Screw Thread Measurements : Systems of screw threads. Principles of limit gauging of threaded work, measurements of screw threads, external and internal threads and measuring instruments.

Spur Gear Measurements : Measurements of spur gear parameters, individual and accumulative error measurements.

Machine tool tests: Alignment tests and Practical tests
Concept of on-line inspection.

ENGINEERING ECONOMY (PE 5105)

Fundamental economic concepts and basic economic laws relating to market and prices. Selection in present terms economy. The time element is economy study, interest and interest formulas. Nominal and effective interest rates, calculation of equivalent involving interest. Present worth, properties, capitalized costs and capitalized values.

Comparison of alternatives, Selection and replacement of equipment from amongst multiple alternatives.

Uncertainty in economy studies, decision making under known probabilities, decision trees in evaluation of alternatives.

Promotion of a company and its legal aspects. Raising of capital, equity capital and borrowed capital. General accounting and double entry, book keeping, journals and ledgers, income statement, balance sheet and their analysis.

Cost accounting, cost elements and cost structure, Methods of allocating factory over-head, various classification of cost and use of cost data in economy studies.

Depreciation and depreciation accounting, classification and types of depreciation and accounting for the recovery of cost of capital assets. Value time function, common methods of depreciation, accounting and their selection.

Economy of operation and minimum cost analysis for purchase, production order, maintenance tooling etc. Break even analysis, effect of price on profit.

MANUFACTURING PROCESS – II (PE 5106)

Foundry : Patterns, Pattern materials, types of patterns, Pattern allowances. Mould and core making, properties of molding and core sands, Sand testing, Machine Molding. Gating, Riser and solidification of casting. Special casting processes: Centrifugal casting, investment casting, Die casting, Continuous casting and shell molding. Working principle and operation of cupola. Cleaning of casting, inspection of casting, casting defects.

Welding and Allied Process : gas welding and gas cutting processes.

Electric Arc Welding : Carbon Arc welding, Shielded-Metal Arc Welding, Submerged Arc Welding, TIG (or GTAW) welding, MIG(or GMAW) welding, Electroslag welding, Plasma Arc welding.

Resistance welding : Spot, Seam, Projections, Butt welding etc.

Thermit welding, atomic hydrogen welding, Ultrasonic Welding, explosive welding, electron beam welding, Laser beam welding, Soldering, Brazing and Braze-welding. Under water welding processes.

Design of welded joints. Weldability and weldability testing. Inspection (Destructive and non-destructive testing).

INDUSTRIAL ORGANIZATION AND MANAGEMENT (PE 5107)

Business Organization : Legal forms of Business organization – single ownership, partnership and joint stock company and their formation. Ownership and operation of a joint stock company through Board of Directors.

Principles of Management: The element of managerial functions-planning organizing, staffing, Direction and control. Authority and responsibility, leadership and principles of co-ordination. Uses of committee as a management tool, span of control.

Organization structure : Line and staff, Functional Lateral(Fayol's Bridge) and metric organization structures. Organization chart and organization manual. Departmentation.

Budget and Budgetary control: Functions, types and preparation of budgets.

Marketing Management: Function of sales and marketing, Channels of distribution, Sales promotion, Advertising and publicity.

Human Resource Development : Main functions of personnel department, Morale, motivation and behavior, Handling of Industrial grievance through joint consultation and collective bargaining. Workers participation in management. Industrial legislation: Factories Act, Trade unions, Trade dispute Act, Workmen's compensation Act, Payment of wages Act.

METALLURGICAL ENGINEERING

Principles of Physical Metallurgy (ML 5107)

Alloys, solid solutions, Hume-Rothery's rules, intermetallic compounds, Hume-Rothery's rule for normal valency compounds, electron compounds, Hagg's principles for interstitials compounds.

Binary equilibrium diagram: Isomorphism, eutectic, eutectoid, peritectic, monotectic and synthetic, Cu-Ni, Al-Si system, portion of Cu-Zn, Cu-Sn, Al-Cu, Pb-Sn binary system and Ternary system of commercial importance.

Free Energy Composition Diagram: Construction of typical free energy composition diagram using metallurgical thermodynamics expression for typical equilibrium diagram like isomorphism and eutectic, spinodal decomposition.

Methods of detection of phase changes and construction of equilibrium diagrams- Dilation Magnetic, Microscopic, X-ray, Electric resistivity methods.

Iron Making (ML 5108)

Raw materials and their properties : Iron ores, agglomerates and coke; Preparation of ores: sintering and palletizing. Blast furnace burdening and distribution; testing of raw materials for blast furnace.

Design : Blast furnace profile, stove and gas cleaning units; instrumentation; refractories used in blast furnace and stove.

Reactions : Temperature profile inside the blast furnace; reactions, thermodynamic equilibria in stack, bosh and hearth. Irregularities in blast furnace operation and their remedies.

Slags : Formation of primary and bosh slag; slag composition; effect of Al_2O_3 , MgO and SiO_2 ; slag control, metal-slag reactions.

Modern developments : Bell-less top charging system, high top pressure, humidified and oxygen enriched blast and auxiliary fuel injection through tuyers and their effect on productivity and coke rate. Furnaces of 10,000 tpd. and above, on line computer control.

Charge calculations and material balance.

Alternative routes of iron making : SL/RN, MIDREX, HYL – III, COREX, Fluidised bed reactors, ROMELT, Hismelt etc.

PHASE TRANSFORMATION (ML 5109)

Fick's Law of Diffusion, Darken's Equation, variation of Diffusion Coefficient with Temperature and Concentration, Self Diffusion, Determination of Diffusion Coefficient, Mechanism of Diffusion, Kirkendall Effect.

Classification of Phase Transformation Processes. Solidification of Metals & Alloys : Types of Solidification, factor affecting solidification, Homogeneous and Heterogeneous nucleation.. Theory of Nucleation and Growth, Role of Under Cooling and Super Cooling Equiaxed, Dendritic and Columnar Grains.

Thermodynamics and Kinetics constraints during nucleation. Interface and diffusion controlled growth processes.

Nucleation and growth- Energy consideration, homogeneous nucleation, growth kinetic, overall transformation rate.

Solid state transformation, Austenite-Pearlite , Austenite-Bainite and Austenite-Martensite transformation. Tempering of steel, Sub-Zero treatment. Principle of selective hardening of steel.

Order-disorder transformation: Examples of order structure, long and short range order, detection of super lattices, influence of ordering on properties.

Mechanical Behavior of Materials (ML 5110)

Plastic Deformation of Single Crystals : Defects in crystals, Deformation by slip, Slip in perfect lattice, Critical resolved shear stress for slip, Deformation by twinning.

Dislocation theory : Types of dislocations, Nucleation and sources of dislocations, Elastic properties of dislocations, Forces on dislocation, Dislocations in FCC lattice, Partial dislocations, dislocations climb, Interaction of dislocations, Dislocations point defect interaction, Work hardening of single crystals and poly crystals, Strain aging.

Fracture : Types of fracture in metals, Theoretical cohesive strength of metals, Griffith theory of brittle fracture. Viscoelastic response of polymers.

Fracture mechanisms of polymers, ceramics, and composites.

Tensile Behaviour : True stress – true strain curve, Strain hardening coefficient, Instability in tension, Effect of strain rate and temperature on flow properties.

Fatigue of Metals : Stress cycles, S – N curves, Fatigue crack growth.

Creep of Metals : Time dependent mechanical behavior, Creep curve, Creep mechanism.

Physics of Materials (ML 5111)

Free electron theory and its limitations, zone theory of FCC & BCC metals, Band diagram for conductors, semiconductors and insulators, Extrinsic and intrinsic semi-conductors, P-N semi conductors.

Generation of X-rays: Mosley's law, absorption, filters, x-ray tube and filament type.

X-ray diffraction, Bragg's law, order of reflection, factor affecting intensity viz. atomic scattering factor, structure factor, Lorenz polarization factor, absorption factor, multiplicity factor and calculation of integrated intensity of x-ray, X-ray crystallography, stereographic projection.

X-ray diffraction methods: Laue methods, Rotation crystal method and powder methods. Film loading in Debye Scherrer camera, specimen preparation, high temperature powder camera and a short description of Diffractometer.

Application of x-rays, precise lattice parameter determination, crystal structure determination for cubic systems, determination of solvus curves, qualitative determination of the presence of unknown compound, qualitative determination of phases, grain size determination, pole figure & residual stress measurement .

CHEMICAL ENGINEERING

PROCESS INSTRUMENTATION (CL 5108)

Introduction to process variables; static and dynamic characteristics of instruments and their general classification. Elements of measuring system and their functions signal transmission Transmitters Electronic pneumatic transducers. Principles, construction and operations of instruments for the measurement, transmission, control/ indication/ recording of various process variables such as temperature, pressure flow, liquid level humidity and composition.

Principles and construction of electro-pneumatic transducer, pneumatic to electrical converter, multiplexers

Construction and characteristics of final control elements such as pneumatic control valve, stepper motor motorized valve.

Principles and construction of pneumatic electronic controller

Introduction of data acquisition system and intelligent instruments

Process instrumentation diagrams and symbols, Instrumentation of process equipments such as distillation column, heat exchanger etc.

MASS TRANSFER OPERATIONS – I (CL 5109)

- 1) Molecular diffusion, convective diffusion, Fick's law, diffusivities, Differential equation for diffusion steady state equimolar counter diffusion, diffusion of A through stagnant B for liquid and gases.
- 2) Convective diffusion-mass transfer coefficient, Diffusion between two phases, interphase diffusion, Equilibrium, equilibrium relation, two film theory, overall mass transfer coefficient.
- 3) Diffusion in Turbulent flow-Eddy diffusion, mixing length, wetted wall column; mass, heat and momentum transfer, analogies, J D Factor.
- 4) Humidification-phase relations and definitions, Humid heat, humid volume, Enthalpy, adiabatic saturation process, wet bulb temp. dew point Lewis relation, humidity Charle's calculation for humidification dehumidification operations
- 5) Drying, Equilibrium, insoluble solids, soluble solids equilibrium Critical free bound and unbound moisture content, Drying operation, Batch drying, direct dryers, indirect dryers, rate, of batch drying, drying curve, mechanism of batch drying, cross circulation drying through circulating drying, continuous drying-Tunnel dryers, tube types dryers, Direct and indirect drum dryer continuous direct heat dryers, Drying at high temperature and low temperature.
- 6) Evaporator-Evaporation, evaporation with direct heating steam headed evaporators natural circulation units, horizontal tubes, vertical tubes coil evaporators forced circulation evaporators, film type Units.
- 7) Operation of evaporators-Heat transfer co-efficient, operation under vacuum, single and multiple effect evaporators, Economy and capacity of multiple effect system, calculations, forward and back ward and mixed feed operation, vapor recompression, integration of evaporators, into total plant economy.

CHEMICAL REACTION ENGINEERING I (CL 5110)

HOMOGENEOUS REACTION

1. Chemical Kinetics: Type of reaction. Analysis of simple and complex rate equations. Constant volume & Variable volume system. Thermodynamics restrictions.
2. Ideal Reactors: Concept of ideality. Development of design expressions for batch, tubular & stirred tank reactors. Combination of the different reactors. Comparison, advantage & limitations in application.
3. Thermal Characteristics of Reactors: Isothermal, adiabatic and non-adiabatic conditions. Principle of reactor Stability & optimization. Simplified objective functions Residence Time Distribution: Residence time functions and relation among them. Application to ideal reactors, Modeling of real system. Non-ideality parameters. Prediction of reactor performance. Concepts of micro and macro mixing.

3. FLUIDIZATION ENGINEERING (CL 5111)

1. Flow through packed beds-Ergun equation,
2. Phenomena of fluidization liquid like behaviour of a fluidized bed, Types of fluidization-particulate and Aggregative fluidization Advantages and disadvantages of fluidization over packed beds and moving beds. Industrial applications. Minimum fluidization velocity, Terminal velocity and pressure drop in a fluidized bed
3. Average particle size, sphericity, voidage, Expansion of liquid-solid fluidized bed, Richardson, Zaki equation, use of dimensional analysis,
4. Brief idea of the mechanism of gas-solid fluidization homogeneous & bubble phase, size of bubble, bubble velocity and its expansion.
5. Design of batch & continuous fluidizer for heat & mass Transfer, Entrainment & Elutriation-Entrainment at or above TDH, Entrainment below TDH

PROCESS ENGINEERING – II (CL 5112)

1. Petrochemicals:- Constituents and classifications, products of Refining, petrochemicals methods, synthetic gas, petrochemicals from Ethane, Ethylene & Acetylene, petrochemicals from Aromatics, Butanes, Butanes,
2. Cellulose derivatives, Oil & fats, Vegetable oils, animal fats, and waxes, soap and detergents, synthetic detergents, organic surface coatings.
3. Fermentation Industry:- Industrial alcohol, Absolute alcohol, beers wine liquor, butyl alcohols, Paint & varnish : Paints pigments, metallic powder, varnished Intermediate dyes, Intermediates, nitration, sulfonation, Oxidation & Alkylation, hydrolysis, condensation & Addition Reaction & Dyes.
4. Plastics: Polymerization fundamentals, thermosetting resins, thermoplastic resins, thermo plastics based on celluloses, laminate & synthetic fibers, viscose and cuproammonium Rayon, cellulose Acetates, nylons, Polyesters spun fibers, melt dry wet finishing of textiles.
5. Paper & pulp, production of pulp for paper, Recovery of chemical from paper manufacture, paper Board.
6. Sugar & starch; manufacture of sugar, starch and related products.
7. Pharmaceuticals, special significance, antibiotics, penicillin, streptomycin tetracyclines, anti-T-H drugs, Anti malarial drugs vitamin, manufacture of penicillin.
8. Pesticides U.D.T., B.H.C. parathion.

CIVIL ENGINEERING

WATER RESOURCE ENGINEERING – I (Vth Semester-CE 5106)

- 1 Hydrology :Definition, types, scope Historical development
- 2 Hydrologic cycle – concept, process Equation
- 3 Precipitation, measurements, presentation and analysis of data, Average depth of rain fall over area, estimation of missing records, DAD, Intensity-duration curve
- 4 Abstraction of precipitation – Infiltration Evaporation, Evapo-transpiration. Consumptive use and crop water requirement.
- 5 Hydrograph :- Discharge Hydrograph, Factor affecting shape of hydrograph, components of hydrograph, separation of base flow, Unit hydrograph, Elements of Unit Hydrograph, Derivation of Unit hydrograph, from simple & complex storm, conversion of duration, , synthetic unit hydrograph . IUH,
- 6 Introduction to open channel and Open Channel flow.
- 7 Energy and momentum principle and their application, total and specific energy, specific force, energy and momentum correction factors, critical flow, critical depth computation, transition
- 8 Uniform flow – Resistance equations :- Chezey`s & Manning`s equation Normal Depth ,
- 9 Design of Canal: Lacey`s theory, Kennedy theory, Tractive Shear approach

STRUCTURAL MECHANICS (Vth Semester-CE 5107)

1. Elements of Elasticity: - Concept of stress & strains stress & strain tensor. Three dimensional stress & strain analysis, Transformation of Stress & strain. Stress & strain invariants. Equilibrium equation, Compatibility equation, Boundary condition. Two dimensional problem in Cartesian co-ordinate, Solution by polynomials, Cantilever with end load, simple beam with udl, Stress Function strain gauges principle of photo elasticity. Strain configurations.
2. Elastic stability - Energy method analysis of long column. Euler`s theory of buckling for long column its limitation. Rankine – Gardon formulae, laterally loaded struts. Unsymmetrical bending of beams, shear center. Theory of elastic failure.
3. Elements of plastic theory: - Plastic hinge, shape factor collapse load for beams & portal frame. Uniqueness, upper & lower bound theorem. Effect of axial force & shear in plastic moment of sections.

ENVIRONEMNTAL ENGINEERING (Vth Semester-CE 5108)

1. Air Pollution: Major air pollutants, sources, effects of air pollutants, primary and secondary pollutants, Aerosol, inorganic and organic particulate matters
2. Water demand and quantity: - Population- forecast, design period, factors affecting population growth, water demand, actors affecting rate of demand, variations in rate of demand.
3. Quality of water :- sources of impurities, common impurities in water and their effect, water analysis , physical examination, chemical examination, biological examination, water borne diseases, WHO drinking standard.
4. Purification :- sedimentation, flocculation, coagulation, filtration, disinfection, water softening, aeration , miscellaneous treatment methods.
5. Distribution of water: - Methods of distribution, pressure in distribution, pressure in distribution mains, system of water supply, storage and distribution reservoir, layout of distribution system, design of distribution reservoir, layout of distribution system, design of distribution system.
6. Water supply for residential Building: - Introduction to pumps and pumping stations, Materials for service pipes, service connection, water meter, , loss of head through pipes and pipes fittings.
- 7 .Waste water treatment: - Sewage characteristics.
Sewerage system: Type, design, construction and maintenance.
Treatment: - Primary and secondary treatments, screens, grit chamber, sedimentation chamber, principle and design of activated sludge digestion, final disposal of sludge and effluents. Disposal of sewage by dilution, self purification of streams, sewage disposal by irrigation, waste water reuse, solid waste collection, re-utilization/disposal, B.O.D., C.O.D.
8. Rural sanitation: - Septic tank, Imhof tank, sulabh- souchalaya and other cheap method. Sanitary installation in residential buildings.

GEO TECHANICAL ENGINEERING I (Vth Semester-CE 5109)

1. Introduction and Nature of Soil: Soil problems in Civil Engineering. a general idea of Soil behaviors; Types of Soil; Formation, Structure and mineralogical composition; physical and Engineering properties of Soil, Atterberg Limits, grain-size analysis by sieving and sedimentation ; Activity of clays ; classification of soil, Particle size classification, Unified Soil classification I.S. Soil classification

2. Soil Hydraulic : Darcy's law, measurement of permeability in laboratory and in field; permeability of stratified soil ; Factors affecting permeability capillarity in Soil, neutral pressure and effective stress- their determination and utility, quick sand.
3. Seepage Analysis: Laplace's equation, Methods of obtaining flow nets. Flow nets for an-isotropic Soils; Application of flow net.
4. Consolidation: Definitions and measurement of consolidation, characteristics of Soil, void ratio- pressure relationships , mechanisms of consolidation : Terzaghi's theory of one dimensional consolidation ; Analysis of consolidation test data.
5. Shear Strength: shear strength parameters of Soil, Mohr-Coulomb strength theory; Effect of drainage conditions on shear strength direct shear test; Triaxial compression test, vane shear test and unconfined compression test, choice of test conditions; pore pressure parameters; shear strength of Cohesion less Soils; Liquefaction of sand; shear characteristics of saturated clays and silts and partially saturated clays ; Determination of in-situ shear strength.
6. Stress Distribution: Boussinesq's equation. Vertical pressure under a uniformly loaded circular area and below the corner of a uniformly loaded rectangular area. Newmark's chart; Westergard's equations.
7. Compaction: Definition, laboratory compaction tests; theory of compaction factors affecting compaction,. Effect of compaction on Soil properties, Field compaction methods; measurement and control of field compaction.

STEEL STRUCTURE – I (Vth Semester-CE 5110)

Introduction: - Properties of structural steel, I.S. Rolled sections, I.S. specifications.

1. Design Approach:-Design philosophy I.S. Loading load combination, factor of safety, permissible and working stress, Elastic method, limit states of design, plastic design.
2. Connections: - Riveted Bolted and Welded connections, strength & efficiency.
3. Tension Members. :- rolled section and built up section
4. Compression Members :- Rolled sections & built up section , lacing & batting
5. Flexural Member: - Stability of flange and web, built up section plate girders including stiffeners, curtailments of flange plates.
6. Beam. Column: - Stability consideration, Interaction formulae.
7. Column Bases :- Stability base, gusseted base and Grillage footing

ELECTRONICS & COMMUNICATION ENGINEERING

EMF (PH)

Gradient, Divergence, Gauss's Divergence Theorem, Curl, Stoke's Theorem,

Gauss's Law, Potential Function, Poisson's and Laplace's Equations, Electrostatic Uniqueness Theorem, Ampere's Law, Faraday's Law, Magnetic Scalar and Vector Potential.

Maxwell's Equations and Boundary Conditions, Displacement Current, Plane Electromagnetic Waves in perfect Isotropic Dielectric, Partially Conducting Media and Good Conductors and Skin Depth, Poynting's theorem.

Polarization of Electromagnetic Waves, Normal and Oblique Incidences of Electromagnetic Waves at Plane Perfect Conducting and Dielectric Boundaries, Total International Reflection, Brewster's Angle, Surface Impedance.

Parallel-Plane Transmission line, Parameters of a Parallel-Plate Transmission Line, Equivalent circuit of a Parallel-Plate Transmission line, Voltage and Current in Terms of the Sending-End and Receiving-End, Variables, The input Impedance, Quarter Wavelength line, Low-loss Radio Frequency and UHF Transmission lines, UHF Lines as a Circuit Elements, Reflections at Discontinuity Points Along Transmission Lines, Standing Waves in Transmission Lines. Voltage Standing-Wave Ratio, Quarter Wave Impedance, Inverting Transformer, Impedance Matching with Single Shunt Stub.

Guided Waves, Waves Between Parallel Planes, Transverse Electric Waves, Transverse Magnetic Waves, Characteristics of TE and TM Waves, TEM Waves, Velocities of Propagation, Wave Impedances, Rectangular Guides. TM & TE Waves in Rectangular Guides, Impossibility of TEM Waves in Rectangular Waveguide, Wave Impedances and Characteristic Impedances.

Radiation, General Solution of Maxwell's Equations, Expression for E and H in terms of Potentials, Retarded Potentials, Radiation Mechanism, Radiation Fields of an Alternating Current Element (Oscillating Electric Dipole)

DIGITAL COMMUNICATION (EC)

1. Introduction
A historical perspective in the development of digital communication. Elements of digital communication system.
2. Source encoding
Pulse code modulation, quantization noise, linear and non linear quantization, companding. Differential pulse code modulation, delta modulation, adaptive delta modulation, Delta sigma modulation, linear predictive coders.
3. Multiplexing:
Introduction to different type of multiplexing, Frequency Division & Time Division Multiplexing: multiplexing hierarchy, synchronous and asynchronous multiplexing, pulse stuffing and word stuffing.
4. Baseband transmission
Baseband signal receiver: integrate and dump type filter probability of error calculations, optimum filters, coherent reception, matched filter and its transfer function. Probability of error of matched filter.
Regenerative repeater, Bit synchronization, Inphase and midphase synchronizer. Early late gate synchronizer. Frame synchronization.
5. Different type of line coding – UPNRZ, UPRZ, PNRZ, PRZ, Manchester, differential encoding and their spectral characteristic, self synchronization properties of some of the encoded signal.
6. Equalization
Inter symbol interference (ISI), Purpose of equalization, Eye pattern, Nyquist criterion for zero ISI, fixed equalizer. Design of equalizer, Adaptive equalizer, Decision directed equalizer, Adaptive decision directed equalizer, Partial response signaling.
7. Digital modulation techniques

BPSK, DPSK, BFSK, MARY-PSK & -FSK, QPSK, MSK principles, QASK, Error calculation.

9. Spread-spectrum modulation
Pseudo-Noise Sequence, A notion of Spread Spectrum, Direct-Sequence Spread-Spectrum with Coherent Binary Phase-Shift Keying, Processing Gain, Probability of Error, Frequency-hop Spread Spectrum, Code-Division Multiple Access.
10. Information theory and coding
Concept and measure of information, Entropy, Discrete and continuous messages, Message source, zero memory source, extension of zero memory source, Markov source and their entropy, Channel with and without memory, Channel capacity, Hartley and Shannon's law.
Properties of code: Uniquely decodable codes, Instantaneous codes, Kraft inequality and Macmillan inequality, Construction of instantaneous codes, Hoffman and Shannon – Fano coding.

MICROPROCESSOR AND INTERFACING (EE 5109)

8085:- Architecture, introduction, Pin function, Internal Organization.

8085 Programming:- Instruction sets, Introduction , Programming algorithm , Instruction timing

8085 interrupts, 8085 Interfacing with memory, 8255 Interfacing with I/O, I/O ports, DMA and Interrupt controller chips, Introduction to 8255,.

Introduction to 8086:- Architecture, Pin Configurations, Instruction set.

COMPUTER ORGANIZATION & ARCHITECTURE (CS 51)

Concepts & Terminology: Digital computer concepts; Von-Neumann concept; Hardware & Software and their nature; structure & functions of a computer system, Role of operating system.

Memory Unit: Memory classification , characteristics ; Organization of RAM , address decoding ROM/PROM/EEPROM ; Magnetic memories , recording formats & methods , Disk & tape units; Concept of memory map , memory hierarchy , Associative memory organization ; Cache introduction , techniques to reduce cache misses , concept of virtual memory & paging.

CPU Design: The ALU – ALU organization , Integer representation , 1s and 2s complement arithmetic ; Serial & Parallel Address; implementation of high speed Address Carry Look Ahead & carry Save Address; Multiplication of signed binary numbers-Booth's algorithm ; Divide algorithms- Restoring & Non-Restoring ; Floating point number arithmetic; Overflow detection , status flags.

Instruction Set Architecture- Choice of instruction set ; Instruction word formats ; Addressing modes.

Control Design – Timing diagrams; T-States , Controlling arithmetic & logic instruction , control structures ; Hardwired & Micro programmed, CISC & RISC characteristics.

Pipelining - General concept , speed up , instruction & arithmetic pipeline; Examples of some pipeline in modern processors , pipeline hazards; Flynn's classification –SISD ,SIMD , MISD , MIMD architectures-Vector and Array processors & their comparison , Concept of Multiprocessor; Centralized & distributed architectures.

Input/output Organization : Introduction to Bus architecture , effect of bus widths , Programmed & Interrupt I/O , DMA.

LINEAR & DIGITAL CONTROL SYSTEMS (EE 51)

Introduction and types of feedback control system , Block diagram and signal flow graph analysis, Time domain analysis of control system, Stability concept, Routh stability criterion, Root locus technique, frequency domain analysis, Concept of PID controller, Bode plot , Nyquist plot, state variable formulation, analysis and solution.

Transform analysis of Sample data systems.

State space analysis of sampled data systems.

MINING ENGINEERING

1. UNDERGROUND COAL MINING-I (MN 5101)

Opening of Deposits: Developments of mine for in-seam mining and horizon mining (including shaft pillar and their comparison, advantages and disadvantages), division into levels and districts.

Bord and Pillar Mining : Development- General principle, suitability, advantages and disadvantages. Layout of Bord & Pillar panel using conventional, semi-mechanised and mechanised technologies, size of panel, statutory provisions.

Pillar Extraction- preparatory arrangement for depillaring operation, statutory provision for depillaring, principle and designing of pillar extraction, factors affecting choice of pillar extraction, depillaring with caving and stowing,

Longwall Mining: Longwall Methods, suitability, advantages and disadvantages. Layout of the workings for the required output, length and orientation of longwall faces, Shape & size of development roadways and gate roads and their maintenance.

2. SURFACE MINING-I (MN 5102)

Basic Concept of Surface Mining: Status of surface mining in India. Selection between surface mining and underground mining. Preliminary evaluation of surface mining prospects; stripping ratio -- concepts and significance.

Opening up of deposits with Box Cut: Selection of site,

Production benches -- formation parameters and factors affecting their selection.

Preparation for Excavation: Working principles of Ripper and Scraper- cycle of operation, application and limitation.

Drilling and blasting: drilling principles, types of blast hole drills, estimation of number of drill for a given mine production, blast design, determination of charge weight, factors affecting blast design, calculation of charge required per hole, problems associated with drilling and blasting, secondary blasting.

Excavation and Transportation: Cyclic methods-- shovel-dumper, pay-loader, dragline.

3. MINING MACHINERY-I (MN 5103)

Prime Mover for Mining Machinery: I.C. engine, hydraulic power, pneumatic power, elements of mechanical power transmission - gear, belt, chain, coupling, clutch and brake.

Rope haulage: Construction of the wire ropes, rope haulages -- gravity, direct, balanced direct, main & tail, endless, reversible endless. Suitability of these haulages and their limitations. Dimension of ropes, drum and pulleys, care and maintenance of ropes, changing of haulage ropes, rope splicing, safety appliances in haulage road, signaling, Statutory requirements of haulages.

Track Laying: Rails, joints, crossings, plates, turn tables, and curves, track extension

Aerial Ropeways: Types, construction, application and operation

Mine Locomotives: Types, constructional features of compressed air, diesel, battery and electric trolley-wire locomotives, comparison of various locomotive haulages, comparison of rope and locomotive haulages.

Conveyors: Principle types and their operations, installation, tensioning devices, shifting, maintenance and applicability.

Shuttle cars, Stage loaders, Bridge conveyors, Capacity calculation.

4. MINE SURVEYING (MN 5104)

Surveying Instruments: Mining theodolites, Miners' Dial, loose and fast needle traversing with Miners' Dial.

EDM, Total Station, Gyro-theodolite & GPS- Introduction to their working principles and applications.

Correlation Survey: Correlation of underground and surface surveys, different methods of correlation-- connection through adit, incline and shafts, method of connection through single and double vertical shafts. Connections by the use of magnetic needle.

In-pit Survey: Setting out a point of known rectangular coordinate. Control of directions and gradients for inclined shafts, slopes, levels and tunnels. Maintaining alignments, simple curve laying belowground, laying out and fixing of mine boundaries claim, subsidence surveys on surface and underground. Stope Surveying: Stope surveying with Hanging Compass and Alignometer, tape triangulation, radiation and other methods.

Mine Plans and Sections: Legal requirements as to mine plans and sections in India, preparation and preservation of plans and sections, representation of geological and other surface and underground features on mine plans and sections.

Astronomy: Astronomical terms and definitions, Introduction to field astronomy, determination of true meridian, latitude, longitude and time including hour angle.

5. MINE ENVIRONMENTAL ENGINEERING-1 (MN 5105)

Atmospheric air- Its composition. Mine air-its composition and variation. Origin, occurrence, physical, chemical and physiological properties of mine gases. Various types of damp. Sampling and analysis of mine air. Methane content and pressure. Methane drainage. Methane layering. Monitoring of gases. Radon sources in mines, permissible dose, measurement and control.

Heat and humidity: Sources of heat in mines, effect of heat and humidity. Thermal properties of rocks- geothermal gradient. Calculation of heat flow and temperature rise in mine airways.

Psychometry: Kata thermometer, methods of improving of cooling power of mine air.

Air conditioning – basic vapour cycle, surface spray tower representative layouts.

Air flow through mine openings: Reynold's Number, Laws of air flow, resistance of airways, equivalent orifice, distribution of air, flow control devices.

Natural Ventilation: Calculation of NVP from air density, thermodynamic treatment, artificial aids to natural ventilation.

COMPUTER SCIENCE ENGINEERING & INFORMATION TECHNOLOGY

OPERATING SYSTEMS (CS 51)

Introduction

Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure

Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management

Processes : Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads : overview, benefits of threads, user and kernel threads.

CPU scheduling : scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization : background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks : system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management

Memory Management : background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory : background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems : file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management : I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management : disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.

Protection & Security

Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

SOFTWARE ENGINEERING (CS)

Software Quality

Software Quality Assurance, Software Metrics, Software Validation, Static and Dynamic Analysis, Symbolic Equation, Mutation Analysis, Dynamic Testing, Unit Testing, White-box and Black-box Testing, Test Case Generation, Integration Testing, Bottom-up and Top-down Testing, System Testing, Function Testing, Performance Testing, Acceptance Testing, Installation Testing, Theoretical Foundation of Testing, Formal Verification, Test tools.

User Interface

Module Introduction, Objectives of Usability, How to Approach Usability, Designing with Usability in mind, Measuring Usability, Guidelines for User Interface Design, User Interface Elements, Dialog Design, SSADM, Methodology for Dialog Design, Prototyping Tools.

Software Reliability

Reliability, Hazard, MTTF, Repair and Availability, Steady-State Availability, Estimation of Residual Errors, Reliability Models, Software Complexity, Cyclomatic Complexity, Halstead's Metrics.

Project Management

Issues in Project Management, Management Functions, Software Project Management Plan, Software Management Structure, Personnel Productivity, Software Project Complexity, Software Metrics – Basic Consideration, Size Oriented and Function Point Oriented; Software Cost Estimation Techniques, Algorithmic Cost Modeling, The COCOMO Model, Project Scheduling, Software Project Planning, Scheduling Risk Management.

COMPUTER ORGANIZATION & ARCHITECTURE (CS 5106)

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Memory Unit : Memory classification , characteristics ; Organization of RAM , address decoding ROM/PROM/EEPROM ; Magnetic memories , recording formats & methods , Disk & tape units; Concept of memory map , memory hierarchy , Associative memory organization ; Cache introduction , techniques to reduce cache misses , concept of virtual memory & paging.

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Instruction Set Architecture- Choice of instruction set; Instruction word formats; Addressing modes.

Control Design – Timing diagrams; T-States, Controlling arithmetic & logic instruction, control structures; Hardwired & Micro programmed CISC & RISC characteristics.

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MICROPROCESSOR AND INTERFACING (EE 5109)

8085:- Architecture, introduction, Pin function, Internal Organization.

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Introduction to 8086:- Architecture, Pin Configurations, Instruction set.

FORMAL LANGUAGES & AUTOMATA THEORY (CS 5107)

Finite State Machines

Definition, concept of sequential circuits, state table & state assignments, concept of synchronous, asynchronous and linear sequential machines

Finite State Models

Basic definition, mathematical representation, Moore versus Mealy m/c, capability & limitations of FSM, state equivalence & minimization, machine equivalence, incompletely specified machines, merger graph & compatibility graph, merger table, Finite memory, definite, information lossless & inverse machines : testing table & testing graph.

Structure of Sequential Machines

Concept of partitions, closed partitions, lattice of closed partitions, decomposition: serial & parallel.

Finite Automata

Preliminaries (strings, alphabets & languages, graphs & trees, set & relations), definition, recognition of a language by an automata - idea of grammar, DFA, NFA, equivalence of DFA and NFA, NFA with ϵ -moves, regular sets & regular expressions: equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, two way finite automata equivalence with one way, equivalence of Moore & Mealy machines, applications of finite automata.

Closure Properties of Regular Sets

Pumping lemma & its application, closure properties minimization of finite automata: minimization by distinguishable pair, myhill-nerode theorem.

Context Free Grammars

Introduction, definition, derivation trees, simplification, CNF & GNF.

Pushdown Automata

Definition, moves, instantaneous descriptions, language recognised by PDA, deterministic PDA, acceptance by final state & empty stack, equivalence of PDA and CFL.

Closure Properties of CFLs

Pumping lemma & its applications, ogden's lemma, closure properties, decision algorithms.

Introduction to ZRL & CSL

Introduction to Z. Regular language properties and their grammars, Context sensitive languages.