

CE/CS/EB/EC/EE/EI/IT/ME/SE 301 ENGINEERING MATHEMATICS 1I

MODULE 1

Matrices and Vector spaces: Rank of matrix, Echelon and normal form, Solutions of linear systems of algebraic equations, Eigen values and Eigen vectors, Cayley Hamilton theorem (non proof).

Vector Spaces – Subspaces, - Linear Independence of vectors-Linear span-Dimension and Basis. Linear transformations.

MODULE II

Fourier series and Fourier integrals: Forier series of Periodic functions- Euler formulae for Fourier coefficients- functions having period 2π , arbitrary period-even and odd functions-half range expansions, Fourier integral, Fourier cosine and sine transformations, linearity property, transform of derivatives, convolution theorem (no proof)

MODULE III

Laplace transforms: Linearity property, transforms of elementary functions, Laplace transforms of derivatives and integrals, differentiation and integration of transforms, convolution theorem (no proof) use of Laplace transforms in the solution of initial value problems, unit step function, impulse function - transform of step functions, transforms of periodic functions.

MODULE IV

Vector calculus: Scalar and Vector point functions-Gradient and directional derivative of a scalar point function- Divergence and Curl of a vector point functions-their physical meanings.

Evaluation of line integral, surface integral and volume integrals, Gauss's divergence theorem, Stoke's theorem (No Proof of these theorem), conservative force fields, scalar potential.

TEXT BOOKS

Advanced engineering mathematics: R.K.Jain, S.R.K.Iyengar, Narosa Publishers.

Advanced engineering mathematics: C.R.Wilie & L.C.Barrett, Mgh

REFERENCES

Mathematical techniques for engineers & scientists Larry C Andrews, Ronald C Philips, Phi Publishers

Advanced engineering mathemartics M.C.Potter, J.L.Goldberg Oxford Unversity Press

Higher engineering mathematics: B.S.Grewal, Khanna Publihsers

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules.

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B.

SE 302 CHEMICAL ENGINEERING I

Module I

Material balance

Introduction to chemical engineering, basic chemical calculations-mole concept, methods of expressing composition-mole fraction, weight fraction, volume fraction, concentration of liquid solutions- molarity, molality, normality, ppm. Ideal gases and gas mixtures- ideal gas law, Amagat's law, Dalton's law, Henry's law, average molecular weight, density of gases, partial pressure and partial volume calculations. Material balance involving chemical reactions and not involving chemical reactions, simple calculations involving recycle, bypass and purge streams.

Module II

Energy balance

Energy balance- heat capacity, specific heat and enthalpy, heat capacity of gases at constant pressure, heat capacity of gaseous mixtures, latent heats, enthalpy changes accompanying chemical reactions-standard heat of formation and standard heat of combustion, standard heat of reaction.

Module III

Chemical Engineering Thermodynamics

Chemical thermodynamics, fundamental concepts and definitions- types of thermodynamic systems and properties- closed, open and isolated system- intensive and extensive properties- path and state functions, first law of thermodynamics, second law of thermodynamics, entropy, change in entropy, Maxwell relations, heat capacity in terms of entropy, equation of state of gases, the principle of corresponding states, compression and expansion of fluids – Joule Thomson expansion. Gibbs free energy change, equilibrium constant, effect of temperature on equilibrium constant.

Module IV

Mechanical operations

Solids : Properties of solids, methods of size analysis-differential and cumulative, screening, screening equipment, effectiveness of screens. Size reduction of solids, types of equipment - jaw crushers, gyratory crushers, hammer mills, ball mill, power requirement, laws of crushing. Handling of solids – principle of operation of belt conveyers, bucket elevators and pneumatic conveyers.

Fluids : Flow of solids through fluids – maximum settling velocity. Sedimentation – Laboratory batch sedimentation, calculation of area and depth for continuous thickeners. Principle of centrifugal separation. Filtration : equipments for filtration - plate and frame filter press, rotary drum filter, constant pressure and constant rate filtration, filter media, filter aids.

Text books :

1. W.L. McCabe, J.C. Smith & Peter Harriott, *Unit Operations of Chemical Engineering*, McGraw-Hill
2. K.V. Narayanan, *Stoichiometry and Process Calculations*, Prentice-Hall of India Pvt. Ltd.

References :

1. W.L.Badger & J.T. Banchero, *Introduction to Chemical Engineering*, Tata McGraw-Hill
2. K.V. Narayanan, *A Text Book of Chemical Engineering Thermodynamics*, Prentice Hall India Pvt Ltd.
3. Christie J. Geankoplis, *Transport Process and Unit Operations*, Prentice Hall India Pvt Ltd.

Type of Questions for University Examination

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SE 303 FLUID MECHANICS AND FLUID FLOW MACHINES

Module I

Scope of fluid mechanics – Dimensions and units – Definition of fluid - Fluid properties – density, specific weight, pressure, viscosity, surface tension and capillarity, compressibility – Rheologic classification.

Fluid Statics – Pressure at a point – Basic equation of fluid statics – Hydrostatic equations for incompressible and compressible fluids – Hydrostatic force on a submerged plane and curved surfaces – Buoyancy and equilibrium of floating bodies – Absolute and gauge pressure – Pressure measurement by manometers and pressure gauges.

Module II

Fluid Kinematics and Fluid Dynamics - continuum Lagrangian and Eulerian approaches – Classification of fluid motions – path line, stream line, streak line, stream tube, one, two and three dimensional flow, velocity field – acceleration of fluid particle in a velocity field- Continuity equation (one and three dimensional differential forms)- equation of stream line – stream function – velocity potential function – circulation – flow net – fluid dynamics – equations of motion – Euler’s equation along a streamline – Bernoulli’s equation – applications – venturi meter, orifice meter, pitot tube.

Dimensional analysis – Buckingham’s Pi theorem – applications – similarity laws and models.

Module III

Incompressible Fluid Flow – Viscous flow – Navier – Stoke’s equation (statement only) – Shear stress, pressure gradient relationship – laminar flow between parallel plates – Laminar flow through circular tubes (Hagen Poiseuille’s) – Hydraulic and energy gradient – flow through pipes – Darcy-Weisbach equation – pipe roughness – friction factor – Moody’s diagram – minor losses – flow through pipes in series and in parallel – power transmission.

Boundary layer flows, boundary layer thickness, boundary layer separation – drag and lift coefficients.

Module IV

Fluid machines : definition and classification – exchange of energy – Euler’s equation for turbo machines – head and specific work – components of energy transfer – degree of reaction.

Hydro turbines : definition and classification – Francis turbine – Kaplan turbine – working principle – work done – specific speed – efficiency – performance curve for turbines.

Pumps : definition and classification – Centrifugal pump : working principle, velocity triangles, specific speed, efficiency and performance curves – Reciprocating pumps: working principle, indicator diagram and performance curves – cavitation in pumps – Rotary pumps : working principle of gear and vane pumps.

Text Books

1. Kumar, K.L., *Engineering Fluid Mechanics*, Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995.
2. Vasandani, V.P., *Hydraulic Machines – Theory and Design*, Khanna Publishers, 1992

References

1. Streeter, V.L. and Wylie, E.B, *Fluid Mechanics*, McGraw Hill, 1983.
2. Edward J. Shaughnessy Jr., Ira M. Katz, and James P. Schaffer., *Introduction to Fluid Mechanics*, Oxford University Press, 2005.
3. Jagadish Lal, *Hydraulic Machines*, Metropolitan Book Co, Delhi
4. Som and Biswas, *Introduction to Fluid Mechanics and Machinery*, Tata McGraw Hill

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- Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules.
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SE 304 MANUFACTURING PROCESSES

Module I

Engineering Materials:- Classification , Properties - mechanical, thermal, chemical and technological. Iron and Steel-Processes and Classifications. Non-ferrous metals, processes, properties and use. Heat treatment of steels- purpose and methods. Processes-annealing, normalising, hardening, tempering.

Module II

Welding :-Introduction, weldability, Types of welding, Gas welding, Arc welding - submerged arc, TIG, MIG. Resistance welding, Solid state welding, Electron beam welding, Laser beam welding. Oxygen cutting. Heat affected zones, Weld defects, Inspection of welded joints.

Module III

Metal Casting:- Pattern- pattern materials, types of patterns, pattern allowance, Moulding sands- properties and classification. Core and core sands. Moulding process. Special casting methods- die casting, centrifugal casting, investment casting, slush casting. Casting defects and inspection.

Module IV

Metal Forming:- Mechanical working of metals. Hot working, cold working. Methods and process of rolling, forging, and extrusion.

Machining:- Metal cutting, Orthogonal and Oblique cutting, Cutting tool materials. Classification of machine tools - lathe, shaper, milling machine, drilling machine and grinding machine . Advanced machining methods- ECM, EDM, USM, AJM.

Text Books:

- 1) S. Kalpakjian and S.R. Schmid, *Manufacturing Engineering and Technology*, Pearson Education Asia
- 2) P.C. Sharma, *A Text Book of Production Technology*, S. Chand & Co, New Delhi.

References:

- 1) *Welding Handbook - Vol. I to V* : American Welding Society.
- 2) Hein, Lopper and Rosenthal, *Principles of Metal Casting*
- 3) Chapman, *Workshop Technology Vol. I, II, III*

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SE 305 ELEMENTS OF MACHINE DRAWING

Module I

Limits, fits & tolerances: IS 919 code, cylindrical fits, tolerance symbols, standard preferred sizes and fits, hole based dimensioning, symbology for form, location and runout, tolerancing for position, concentricity, location, roundness, perpendicularity and runout.

(2 sheets).

Module II

Drawings of joints : Welded joints , types, welding symbols, drawing of welded machine parts with details of welding.

Brackets, blocks, base plate and crankshaft.

Pipe joints : Coupler joints, nipple joints, union, socket and spigot, integral flanged joints and hydraulic joints.

(6 sheets)

Module III

Screwed fastenings : Screw thread forms, vee and square threads, conventional representation of threads, hexagonal headed bolt and nut, square headed bolt, nut locking arrangements, various types of machine screws and set screws, foundation bolts, lock bolt bolt with square plate, ray bolt and Lewis foundation bolt.

(3 sheets)

Cotter and Pin joints : socket and spigot joints ,gib and cotter joint for rectangular rods, sleeve and cotter joints, knuckle joint.

(3 sheets)

Textbooks:

- 1) N.D.Bhatt : *Machine Drawing*, Charotar Publishing House, Anand
- 2) P.I. Varghese & K.C. John: *Machine Drawing*

References:

- 3) P.S. Gill : *Geometric Drawing*, Kataria & Sons, Ludhiana
- 4) Parkinson : *First year engineering Drawing*, Pitman, London
- 5) K.R.Hert : *Engineering Drawing with problems and solutions*, ELBS

SE 306 PRINCIPLES OF SAFETY MANAGEMENT

Module I

Introduction-Safety -Goals of safety engineering. Need for safety. Safety and productivity .
Definitions: Accident, Injury , Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. History of safety movement .Theories of accident causation
Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need , types, advantages

Module II

Accident prevention Methods- Engineering, Education and Enforcement.
Safety Education & Training -Importance, Various training methods, Effectiveness of training, Behaviour oriented training. Communication- purpose, barrier to communication.
House keeping: Responsibility of management and employees. Advantages of good house keeping. 5 s of house keeping.
Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

Module III

Monitoring Safety Performance : Frequency rate, severity rate, incidence rate, activity rate.
Cost of accidents-Computation of Costs- Utility of Cost data. Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis(JSA), Safety surveys, Safety audits. Safety Inventory Technique.

Module IV

Accident investigation –Why? When? Where? Who? & How? . Basics- Man- Environment & Systems .Process of Investigation –Tools-Data Collection-Handling witnesses- Case study.
Accident analysis –Analytical Techniques-System Safety-Change Analysis-MORT-Multi Events Sequencing-TOR.

Text Books :

- 1) N.V. Krishnan, *Safety Management in Industry*, Jaico Publishing House, 1997
- 2) Ronald P. Blake, *Industrial Safety*., Prentice Hall, New Delhi, 1973
- 3) David L. Goetsch, *Occupational Safety and health*, Prentice Hall
- 4) Ted S. Ferry, *Modern Accident Investigation and Analysis*, John Wiley & Sons

Reference :

- 1) Willie Hammer, *Occupational Safety Management and Engineering*, Prentice Hall
- 2) Alan Waring, *Safety Management System*, Chapman & Hall
- 3) John V. Grimaldi and Rollin H.Simonds, *Safety Management*, All India Traveller Book Seller, Delhi.
- 4) *Accident Prevention Manual for Industrial Operations* : National Safety Council, Chicago

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SE 307 MACHINE SHOP

Introduction to Lathe: Spindle drive - work holding devices - types of Lathe tools - tool holders - tool movement - selection of speeds. Feed and depth of cut - use of cutting coolants - Principle of thread cutting - V-thread and Square thread - thread standards - cutting tool types - grinding of tools - selection of cutting speeds. **Exercises:** Exercises involving cylindrical turning, Taper, Turning, Facing, Shoulder turning and curve turning - thread cutting.

Introduction to machine tools like horizontal milling machines, vertical milling machines, slotting and shaping machines, work holding devices- spindle drives- milling cutters - gear milling - surface slot milling - indexing head - simple and differential indexing - grinding wheel - specification and selection - drilling and reaming - capstan and turret lathes - ideas of tool layout.

Exercise : Exercises on lathe - curve turning, multi start thread, drilling and boring, internal thread.

Exercises on milling machines - surface milling and slot and keyway milling, straddle milling, machining of spur and helical gears.

Exercises on - Shaper and slotting - machining of plane and bevel surfaces - keyway and slot machining, exercises on drilling and reaming, surface grinding and tool grinding.

References:

- 1) *Production technology* : HMT
- 2) *Tool Engineer's hand book* : ASTME
- 3) Burghardt, Axllered and Anderson, *Machine tool operations 1 & 2*
- 4) B.L. Boguslavsky, *Automatic and semiautomatic lathes*, Pease publications.
- 5) *Fundamentals of tool design* : ASTME

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners. A candidate shall secure a minimum of 50 % marks separately for the two components to be eligible for a pass in that subject.

SE 308 FLUID MECHANICS AND MACHINERY LAB

Study of pipe fittings, and study of devices used for measurement of pressure, velocity, rate of flow, metacentric height and radius of gyration of floating bodies.

Experimental verification of Bernoulli's theorem.

Steady flow through pipes - determination of friction factor and Reynold's number.

Determination of the loss coefficients for pipe fittings.

Hydraulic coefficients of mouth pieces, nozzles and orifices.

Calibration of Venturimeters, orifice meters, nozzle and bend meters.

Force due to impact of jets on vanes.

Performance characteristics of centrifugal pumps at constant speed.

Constant head characteristics of Francis turbine.

Performance of hydraulic ram.

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