

**CE/CS/EB/EC/EE/EI/IT/ME/SE 401 ENGINEERING MATHEMATICS III**

**MODULE 1**

Complex Analytic functions and conformal mapping: curves and regions in the complex plane, complex functions, limit, derivative, analytic function, Cauchy – Riemann equations, Elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions.

Conformal mapping: Linear fractional transformations, mapping by elementary function like  $Z^2$ ,  $e^z$ ,  $\sin z$ ,  $\cos z$ ,  $\sin hz$ , and  $\cos hz$ ,  $Z + 1/Z$

**Module II**

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residue theorem, evaluation of real integrals using integration around unit circle, around the semi circle, integrating contours having poles, on the real axis.

**Module III**

Partial differential equations:

Formulation of partial differential equations.

Solutions of equations of the form  $F(p,q) = 0$ ,  $F(x,p,q) = 0$ ,  $F(y,p,q) = 0$ ,  $F(z,p,q) = 0$   $F_1(x,p) = F_2(y,q)$ , Lagrange's form  $Pp+Qq = R$

Linear homogeneous partial differential equations with constant co-efficient

**Module IV**

Vibrating string: one dimensional wave equation, D'Alembert's solution, solution by the method of separation of variables

One dimensional heat equation, solution of the equation by the method of separation of variables,

Solutions of Laplace's equation over a rectangular region and a circular region by the method of separation of variables.

**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**

Advanced Engineering Mathematics Erwin Kreyszig, Wiley Eastern

Complex Variables & Applications Churchill R.V.. Mgh Publishers.

Advanced engineering mathematics M.C.Potter, J.L.Goldberg Oxford University Press

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

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 402 CHEMICAL ENGINEERING II

### Module I

#### Heat transfer

Heat transfer by conduction, steady state conduction, Fourier's law, heat transfer coefficient, heat exchangers- shell and tube heat exchanger and double pipe heat exchanger, LMTD, individual heat transfer coefficient, overall heat transfer coefficient, heat transfer by convection- natural convection, forced convection in laminar and turbulent flow (elementary ideas). Radiation heat transfer - laws of radiation. Evaporators – heat transfer in evaporators, single effect evaporator calculations, types of evaporators

### Module II

#### Mass transfer

Principles of mass transfer, Fick's law of molecular diffusion, diffusion in solids and liquids. Distillation - relative volatility, simple distillation, steam distillation, distillation with reflux, principle of azeotropic and extractive distillation. McCabe Thiele method of calculation of number of theoretical stages, total, minimum and optimum reflux.

Absorption, equilibrium solubility of gases in liquids, plate and packed columns, packing materials.

### Module III

#### Mass transfer

Introduction to drying-equilibrium moisture and free moisture, critical moisture content, bound and unbound water, rate of drying curves, drying equipments-tray dryers, tower dryers, rotary dryers, fluid-bed dryers, spray dryers.

Principle of liquid-liquid extraction, liquid-liquid equilibrium, equipment for liquid extraction - mixer settlers, spray towers, Bollmann extractor. Solid- liquid extraction- simple leaching, major equipments for solid -liquid extraction

### Module IV

#### Chemical reaction engineering

Classification of reactions, variables affecting rate of reaction, definition of reaction rate. Kinetics of homogeneous reactions – concentration dependent term of a rate equation, temperature dependent term of a rate equation, theories of reaction – collision theory, transition theory, Arrhenius equation. Interpretation of rate data in constant volume batch reactors. Ideal reactors – the concept of ideality, design expressions for batch, tubular and stirred tank reactors. Elementary ideas of non-ideal reactor performance, residence time distribution.

#### Text books

1. W.L. McCabe, J.C. Smith & Peter Harriott, *Unit Operations of Chemical Engineering*, McGraw-Hill Book Co,
2. O. Levenspiel, *Chemical Reaction Engineering*, John Wiley & Sons,

#### Reference books

1. W.L.Badger & J.T. Banchero, *Introduction to Chemical Engineering*, Tata McGraw-Hill
2. Robert E. Treybal , *Mass Transfer Operations*, Mc Graw Hill
3. Christie J. Geankoplis, *Transport Process and Unit Operations*, Prentice Hall India Pvt Ltd.
4. Lanny D. Schmidt, *The Engineering of Chemical Reactions*, Oxford University Press, 2005.

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 403 STRENGTH OF MATERIALS

### MODULE I : Simple Stress and Strain and Principal Stresses

Axial and shear stresses and strains - elasticity , Hook's law - Factor of safety , Stepped bars , Bars of uniformly varying cross-sections - Lateral Strain - Poisson's ratio - Volumetric strain - elastic constants and their relationships - stresses in composite bars due to axial loading and temperature . Strain energy due to axial load - stresses due to impact and suddenly applied loads.

State of stress at a point - Normal and tangential stresses on a given plane - Principal stresses and their planes , plane of maximum shear - Mohr's circle of stresses .

### MODULE II : Shear Force and Bending Moment

Relationship connecting intensity of loading, shearing force and bending moment; Shear force and bending moment diagrams for cantilever , simply supported and overhanging beams subjected to concentrated load and UDL - maximum bending moment and point of contraflexure.

Theory of simple bending-assumptions and limitations - Derivation of bending formula and its applications to engineering problems

### MODULE III : Deflection of Beams and Thin and thick walled structures

Differential equation of the elastic curve. Slope and deflection of beams by method of successive integration, McCaulay's method.

Hoop and longitudinal stresses in thin walled cylindrical and spherical shells subjected to internal pressure - Changes in dimension and volume; Thick Cylinders - Lamé's equations , shrink fit , compound cylinders, wire wound cylinders.

### MODULE IV: Torsion and Columns

Theory of torsion and assumptions - Torsion of solid and hollow circular shafts - Power transmission, strength and stiffness of shafts. Close and open coiled helical springs.

Theory of columns- buckling and stability, buckling of long columns, Euler's Formula, Long columns with different support conditions.

### Textbook :

1. Gere , M.J., " *Mechanics of Materials* " , Thomson Learning .
2. Subramanian, R., " *Strength of Materials* ", Oxford University Press, 2005.

### References :

1. Popov, E.P., " *Analysis of Structures* , " Khairna Publishers, 1985.
2. Vazirani, V.N and Ratwani, MM, " *Mechanics of Materials* " , Prentice Hall , 1982.
3. Ramamurtham, S., " *Strength of Materials* " , Dhanpat Rai & Sons , 1974 .

### 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 404 FIRE ENGINEERING – I

### MODULE –I

Introduction- temperature, heat, specific heat, flash point, fire point, ignition, combustion; Ignition-pilot ignition, spontaneous ignition, ignition sources; Types of combustion-rapid, spontaneous, explosion; Product of combustion-flame, heat, smoke, fire gases. Development of fire-incipient, smoldering, flame and heat stages; Diffusion flames-zones of combustion, smouldering combustion, characteristics of diffusion flame; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spoilover, Boilover, Slopover, Dust explosion, BLEVE, UVCE; Classification of fire based on material.

### MODULE – II

Spread of flames in solids and liquids, linear and three dimensional fire propagation; Smoke – constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, visibility in smoke, principles of spreading quantity of smoke, smoke movement; Pressurization modeling of smoke movement; Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO<sub>2</sub>, Nitrogen oxide, Sulphur dioxide.

### MODULE III

Use and maintenance of fire Service Equipments-Hydrants and stand pipes, Hose reels-hose fittings-coupling, Branches, Branch holders, Radial branches, Monitors, Nozzles, Collecting heads, suction, hose fittings, adopters and ramps. Introduction to fire fighting vehicles and appliances:- Pumps, primers. Crash tenders, rescue tenders, hydraulic platforms, turntable ladders, hose laying tenders, control vans, fire boats. Ladders- features of extension ladders, wheels escape, hook ladder, turn-table, Snorkel, safety devices, uses and maintenance. Small gear and miscellaneous equipment's-General purpose tools and equipment, Lamps and lighting sets. Ropes and Lines- Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches, General rope work.

### MODULE IV

Fire hydraulics: Brief explanation of fire stream, pressure loss or gain because of elevation, static flow and hydraulic pressures, suction, drafting, friction loss. Advantages of multiple lines. Discharge capacities of nozzles on hose lines. Nozzle reaction. Pressure differential fire ground hydraulics: - method of determining flow and direction loss; standard nozzle pressures; GPM method Application of GPM method for hand lines, multiple hose lines, master stream appliances, stand pipes and appliances, conversion of various hose sizes, small lines, unequal discharge pressure, back pressure, unequal hose diameters.

### Text Books

1. Ron Hirst, “*Underdowns Practical Fire Precautions*”, Gower Publishing Company Ltd., England, 1989.
2. HMSO, “*Manual of Firemanship 1 to 13*”,
3. Jain V.K., “*Fire Safety in Buildings*”, New Age International (P) Ltd., New Delhi, 1996
4. James F Cassey, “*Fire service hydraulics*”,

### Reference Books

1. Gupta R.S., “*A Hand Book of Fire Technology*”,
2. Kevin Cassidy, “*Fire Safety and loss Prevention*”,
3. N F P A, “*Fire Protection Hand Book*”,
4. NSC, “*Accident Prevention Manual for Industrial Operation*”
5. Panchdhari A.C., “*Management of Fire*”,

### 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 405 ELECTRICAL TECHNOLOGY AND SAFETY IN ELECTRICAL SYSTEMS

### Module I

Construction and Principle of operation of d.c machines – e.m.f equation of a generator – use of interpoles – characteristics of shunt, series and compound generators – starting and speed control – losses and efficiency.

Construction and Principle of operation of single phase transformers – e.m.f equation – phase diagrams – equivalent circuit – regulation – losses and efficiency.

Protective relays – Requirement of relay – types of protection – classification – distance relay, differential relay, state relays.

### Module II

Synchronous machines – types – e.m.f equation – winding factors – armature reaction and leakage resistance. Synchronous motor – methods of starting – applications.

Induction Motors – Construction and principle of operation – equivalent circuit – Torque – slip characteristics – method of starting – applications.

Circuit breakers – function of switch gear – arc phenomenon – initialization of an arc – arc interruption – recovery voltage and restriking voltage – MCB and ELCB. Faults in power systems – causes – types.

### Module III

Fuses – types – selection – advantages and disadvantages.

Grounding – neutral grounding – solid grounding – resistance grounding – arc suppression coil grounding. Equipment grounding for safety – grounding substation – grounding of line structure.

Earthing

Effect of electric and magnetic fields – Human safety aspects – effect of current and voltage on human beings – typical V-I characteristics of skin – Electric shocks and their prevention.

Insulation – classes of insulation – FRLS insulation – continuity test.

### Module IV

Safety during installation of plant and equipment. Safe sequences in installation – risk during installation. Safety during testing and commissioning. Test on relays – protection and interlock systems for safety.

Hazardous zones – classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus. Selection of equipments in hazardous area.

Electrical fires – hazards of static electricity . Safe procedures for electrical maintenance - Statutory requirements. Safety provisions in Indian Electricity Act & Rules.

### Text Books

1. H. Cotton : *Electrical Technology*, Wheeler Publishing Company, 1983.
2. Swan. H.W : *Electrical Safety*

### Reference Books

1. S.L. Uppal : *A Textbook of Electrical Engineering*, Khanna Publishers, Delhi..
2. NSC, Chicago : *Accident Prevention Manual for Industrial Operations*
3. M.G. Say : *Electrical Earthing and Accident prevention*
4. S. Rao, and H.L. Saluja : *Electrical Safety, Fire Engineering and Safety Management*, Khanna Publishers, Delhi.
5. *Indian Electricity Act & Rules.*

Type of Questions for University Examination

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

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## SE 406 FIRST AID AND EMERGENCY PROCEDURES

### Module I

Aims and Objectives. First Aid principles-Role of the first aider-sequence of action on arrival at scene. Vital signs-breathing -pulse. Introduction to the body-basic anatomical terms-body cavities-head- cranium - thorax-abdomen and pelvis.

Biomechanics – Structure and functions of musculoskeletal systems, tendons, ligaments, fascia, bone, muscles, joints and basic mechanisms.

The respiratory system-respiratory failure - asphyxia- abdominal thrust in Heimlich manoeuvre. Chest injuries-types-fractured ribs -pneumothorax- haemothorax.

### Module II

The nervous system-functions-components -brain - cerebrum - cerebellum - medulla oblongata -cerebro - spinal fluid-spinal cord-autonomic nervous system. Unconsciousness-causes-level of consciousness-management of unconscious casualty-problems of unconsciousness. Fainting-recognition-management-aftercare. Diabetes - hypoglycaemia - hyperglycaemia- management. Seizures (epileptic fits, convulsions) features- management , stroke. Head injuries-fractures of the base-vault and sides of skull.

### Module III

The circulatory system-heart attack-chest compression- CPR

Shock -causes - signs and symptoms - management of shock.

Eye-eye injuries-foreign body in eye-eye trauma-corrosive chemical in eye-arc eye. Wounds-bleeding-classification-types of wounds-case of wounds-bleeding from special sites.

### Module IV

Fractures- classification of fractures-principles of immobilisation- sprains and dislocation.

Broad and narrow fold bandages-hand bandages-slings.

The skin. Burns-rule of nines-pure thermal burns. Electric burns. Chemical burns. Radiation burns. Cold burns.

Poisoning. Physical fitness. Lifting - casualty handling. Use of stretchers.

### References:

- 1) *Manual of first aid to the injured* : St. John Ambulance Association.
- 2) *First aid text book* : American National Red Cross
- 3) *Manual of First aid instruction* : US Bureau of Mines
- 4) V.V. Yudenich, *Accident First Aid*, Mir Publishers, Moscow

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**SE 407 STRENGTH OF MATERIALS LAB**

Standard tension test on M.S rod using U.T.M and a suitable extensometer

Torsion test on M.S specimen

Double shear test on M.S rod

Impact Tests- Izod and Charpy

Hardness tests –Brinell,Vickers and Rockwell hardness

Test on springs

Tests on wood

(a) Flexural test (b) Compression test

Compressive strength of masonry units

(a) Bricks (b) Stone (c) hollow block units

Fatigue test

Strut test

Verification of Clerk Maxwell's law of reciprocal deflection and determination of Young's Modulus.

*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 408 ELECTRICAL TECHNOLOGY LAB**

1. Verification of Kirchoff's Laws
2. Verification of Superposition Theorem
3. Study of B.H. Curve on C.R.O
4. Measurement of power in an A.C. circuit by 3 ammeter and 3 voltmeter method
5. Load test on a d.c. series motor
6. Speed characteristics of d.c. shunt motor
7. Regulation of a Transformer
8. Load characteristics of a 3 phase induction motor
9. Study of protective relays and circuit breakers.
10. Study of insulation testing and ground testing.

*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.*