B.E. 401 - ENGINEERING MATHEMATICS III

Unit I

Functions of complex variables : Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem , Application of Residues theorem for evaluation of real integrals

Unit II

Errors & Approximations, Solution of Algebraic & Trancedental Equations (Regula Falsi , Newton-Raphson, Iterative, Secant Method), Solution of simultaneous linear equatins by Gauss Elimination, Gauss Jordan, Crout's methods , Jacobi's and Gauss-Siedel Iterative methods

Unit III

Difference Operators, Interpolation (Newton Forward & Backward Formulae, Central Interpolation Formulae, Lagrange's and divided difference formulae), Numerical Differentiation and Numerical Integration.

Unit IV

Solution of Ordinary Differential Equations(Taylor's Series, Picard's Method, Modified Euler's Method, Runge-Kutta Method, Milne's Predictor & Corrector method), Correlation and Regression, Curve Fitting (Method of Least Square).

Unit V

Concept of Probability : Probability Mass function, Probability density function. Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution ,Gamma Distribution ,Beta Distribution ,Testing of Hypothesis |:Students t-test, Fisher's z-test, Chi-Square Method

Reference:

(i) Numerical Methods using Matlab by J.H.Mathews and K.D.Fink, P.H.I.
(ii) Numerical Methods for Scientific and Engg. Computation by MKJain, Iyengar and RK Jain, New Age International Publication
(iii) Mathematical Methods by KV Suryanarayan Rao, SCITECH Publuication
(iv) Numerical Methods using Matlab by Yang,Wiley India
(v) Pobability and Statistics by Ravichandran ,Wiley India
(vi) Mathematical Statistics by George R., Springer

CM 402 – Material Science and Technology

Unit I Mechanical, Thermal & Electrical properties of Materials and their measurement.

Unit II Atomic Structure, Inter atomic attraction, Molecular structure, crystallanity, Solid solutions, crystal imperfections, Electronic structure and Electromagnetic properties/

Unit III Single phase metal deformation, Failure of Metals, Theories of alloying, phase relationship, iron-carbon diagram, Nomenclature of steels, utilization of cast iron, mild steel,
stainless steel, lead and graphite in Chemical Engg. System.

Unit IV Theories of Corrosion and corrosion – control, stability of materials in service: Chemical, Thermal and Radiolytic stability.

Unit V Composite materials; Semiconductors, Superconductors, Surface Modifications using
linings of plastics, rubber, glass, ceramics etc.

References:

1. Van Vlack; MATERIAL SCIENCE
2. WOOLEF; <Title>; VOL. 1,2,3,4.
3. Perry RH & Don WG; PERRYS CHEMICAL Engineering HAND BOOK; Mc Graw Hill.
4. Murthy; Structures and properties of Engg Materials; TMH
5. Narula; Material science; TMH
6. Vijaya; Material Science; TMH
7. O.P. Khanna; MATERIAL SCIENCE & METALLURGY; Dhanpat Rai Publication.
8. S.K. Hajra Choudhry; MATERIALS SCIENCE & PROCESSES; Indian Book Distrib Co.

CM 403 – Fuel Technology

Unit I Solid Fuels: Coal & lignite reserves in India, Classifications of coal, Washing of Coal, Analysis of Coal, proximate and ultimate analysis.

Unit II Coal carbonization: Mechanism of Low temperature carbonization and high temperature carbonization, by product recovery from coke oven; properties of coke coal; grinding, pulverization, briquetting of solid fuels.

Unit III Liquid Fuels: Origin of petroleum production, Indian Petroleum resources and their nature, Petroleum processing, distillation, cracking thermal & catalytic, coaking, reforming, Isomerisations, Crude oil classification, Reserves of Hydrocarbon in INDIA, introduction to Petroleum refining & processing, atmospheric & Vacuum crystallization.

Unit IV Petroleum product and their utilization, blending of petrol for octane number boosting, **Transport fuels**: Disel, Petrol, AVL (Aviation Liquid Fuel), Kerosene, fuel & furnace oil, Testing of petroleum product: Flash Point, pore point, Fire point, Octane number, Cetene number, viscosity and viscosity index, API.

Unit V Gaseous fuels: Natural gas, Synthetic gases, their composition & properties, producer gas, Water gas, Coal Gas, LPG, CNG,Hydrogen as a fuel.

References:

1. Sarkar S; Fuel and Combustion; Orient Long men Ltd.
2. Gupta OP; Fuel and Combustion; Khana Pub
3. Gary ;Refining of Petroleum Techonology

List of Experiments :

1. To carry on proximate analysis of the given coal sample.
2. To determine the calorific value of the coal by Bomb-Calorimeter method.
3. To determine the viscosity of the given oil sample by Redwood Viscometer. No. 1 and No. 2
4. To determine the viscosity of a given oil sample by Saybolt viscometer.
5. To determine viscosity of a given coal tar with the help of tar viscometer.
6. To determine the flash and fire points of the given oil sample by Penskey Martin's apparatus..
7. To determine the flash and fire points of the given oil sample by Abel's apparatus.
8. To determine the flash and fire points of the given oil sample by Cleveland apparatus.
9. To determine the carbon residue of the given oil by Conradson method.
10. To determine cloud and pour point of given oil sample (coconut) by cloud and pour point apparatus.
11. To determine the composition of given gas by Orsat apparatus.

Note: Each student should perform at least eight experiments out the above list.

CM 404 – Fluid Particle Mechanics

Unit I Particulate Solid: Properties of particulate solids Evaluation of siza & shape, surface and population of particles, standard screens and screen analysis of solids.

Unit II Size Reduction: Principles of communication, size reduction; crushing, grinding, pulverizing and ultra fining size reduction equipment, power requirement in communication.

Unit III Mixing: Mixing of solids, Mixing equipment's, Design & Power requirement of mixers, Mixer effectiveness and mixing index.

Unit IV Separation Principles of Separation techniques for system involving solids, liquids & gases, classification, sedimentation and filtration, Separation equipments.

Unit V Transportation and Handling of Solids Selection of conveying devices for solids: Belt, Chain, Screw – conveyors, Elevators and pneumatic conveying devices; Elementary design aspects of the devices. Visit to Chemical Engg. Industry engaged mainly with Mechanical Operation.

Unit VI Fluidization Particulate & aggregative fluidization, characteristic of fluidized bed due to particle size, size distribution, shape and density, pressure drop through a fluidized bed, Character of dense phase fluidization as revealed by pressure drop fluctuations. Up flow and down flow fluidization, Fluid Catalytic process, bed drying, Mass transfer in fluidized beds.

References:

1. Perry RH & Don WG; PERRY'S CHEMICAL Engineering HAND BOOK; Mc Graw Hill.
2. Nevers De; Fluid Mechanics for Chemical Engineers; TMH
3. Banchero Badker; Introduction to chemical engg; TMH
4. McCabe S, Harriot ; Unit Operations of Chemical Engg; TMH
5. Narayan CM, Bhattacharya BC; Mechanical operations for chemical eng.; PHI

List of Experiments :

1. To analyses the given sample by differential, cumulative methods using standard screen.
2. Determination of size & surface area of irregular particles using a Measuring gauge.
3. To study Crushing behavior & to determine the Rittinger's & Bond's Constant of the given solid in a Jaw Crusher.
4. To determine the efficiency of a ball mill for grinding a material of known.
5. To determine the power consumption of the Hammer Mill.
6. To determine the specific cake resistance for the given slurry by Leaf Filter.
7. To determine the efficiency of a given cyclone separator.
8. To determine the efficiency of fluidized characteristic bed.
9. To study the Dorr type of thickener.
10. To study the Plate & Frame filter press.

CM 405 – Fluid Mechanics

UNIT-1 Review of fluid properties: Engg units of measurement, mass density specific wt. specific volume, specific gravity, surface tension, capillarity viscosity, bulk modulus of elasticity, pressure & vapor pressure, fluid statics: pressure at a point, pressure variation in static fluid absolute & gauge pressure, manometers, dimensional analysis & dynamic similitude dimensional homogeneity, use of Buckingham pi-theorem, calculation of dimension less numbers.

UNIT-2 Kinematics of Flow: Types of flow-ideal & real, steady & unsteady, uniform & nonuniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation points, separation of flow, sources & sinks, velocity potential, stream function, flow nets-their utility & method of drawing flow nets.

UNIT-3 Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. The moment of moment of momentum equation, forces on fixed and moving vanes and other applications. Fluid Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.) flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

UNIT-4 Fluid machinery: Pumps, fans blowers, compressor & vacuum pumps, power & head requirement for pumps.

UNIT-5 Laminar flow: introduction to laminar & turbulent flow, concept of Reynolds number & friction factor; friction factor for rough & smooth pipe loss of head due to friction in pipes & fittings.

References: -

1. McCabe Smith;Unit Operation for Chemical Engg. TMH
2 Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
3. Som and Biswas; Fluid Mechnics and machinery; TMH
4. Cengal; Fluid Mechanics; TMH
5. White ; Fluid Mechanics ; TMH
6. JNIK DAKE; Essential of Engg Hyd; Afrikan Network & Sc Instt. (ANSTI)
7. Douglas; Fluid Mechanics; Pearson
8. R Mohanty; Fluid Mechanics; PHI
9. Gupta; Fluid Mechanics; Pearson.
10 Rajpoot R. K. ;Fluid Mechanics and Hydrolic Machine.
11 Bansal R.K.; Fluid Mechanics and Hydrolic Machine.

List of Experiment:

1. To determine the local point pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.

3. Calibration of Venturimeter
4. Determination of Cc, Cv, Cd of Orifices
5. Calibration of Orifice Meter
6. Calibration of Nozzle meter and Mouth Piece
7. Reynolds experiment for demonstration of stream lines & turbulent flow
8. Determination of metacentric height
9. Determination of Friction Factor of a pipe
10. To study the characteristics of a centrifugal pump.
11. Verification of Impulse momentum principle.

CM 406 – Computer Aided Process Calculations

1. Introduction to Microsoft Excel.
2. Basic Operations
3. Using function
4. Unit conversions of chemical process.
5. Material Balance solution using Excel.
6. Energy Balance Solution Using Excel.

List of Experiments

1. Calculation of multi variable equations.(i.e. gauss elimination method)
2. Problems related to flow measurement
3. Problems related to roults law. and ideal gas equations.
4. Problems related to material balance (i.e stichiometry, crystallization etc)
5. problems related to energy balance