



ANNA UNIVERSITY
Chennai-25.
Syllabus for

B.Tech. Chemical Engineering

CM125 Chemistry I **3 0 0 100**

1. CHEMICAL THERMODYNAMICS 9

Definition of free energy and spontaneity - Maxwell relations - Gibbs-Helmholtz equation - Van't Hoff equations - Stoichiometry and energy balances in Chemical reactions.

2. DYNAMICS OF CHEMICAL PROCESSES 10

Basic concepts - composite reactions (opposing, parallel and consecutive reactions) - Collision theory - Thermodynamic formulation of reaction rates - unimolecular reactions - Chain reactions (Stationary and non-stationary) - Enzyme Kinetics - Michaelis - Menten Equation.

3. ELECTRODICS 8

Types of electrodes and cells - Nernst Equation - emf measurement and its applications - Principles of chemical and electrochemical corrosion - corrosion control (Sacrificial anode and impressed current methods).

4. WATER 8

Water quality parameters - Definition and expression - Estimation of hardness (EDTA method) - Alkalinity (Titrimetry) - Water softening (zeolite) - Demineralisation (Ion-exchangers) and desalination (RO) - Domestic water treatment.

5. POLYMERS 10

Monomer - Functionality - Degree of polymerisation - Classification based on source and applications - Addition, Condensation and copolymerisation - Mechanism of free-radical polymerisation - Thermoplastics and thermosetting plastics - Processing of plastics - Injection moulding, blow moulding and extrusion processes.

Total No of periods: 45

Text Books:

1. Alkins P.W., " *Physical Chemistry* ", ELBS, IV Edition, 1998, London.

References:

1. Balasubramanian M.R., Krishnamoorthy S. and Murugesan V., " *Engineering Chemistry* ", Allied Publisher Limited., Chennai, 1993.
2. Karunanidhi M., Ayyaswamy N., Ramachandran T and Venkatraman H., " *Applied Chemistry* ", Anuradha Agencies, Kumbakonam , 1994.
3. Sadasivam V., " *Modern Engineering Chemistry - A Simplified Approach* ", Kamakya Publications, Chennai , 1999.
4. Kuriakose, J.C. and Rajaram J., " *Chemistry in Engineering and Technology* ", Vol. I and II, Tata McGraw-Hill Publications Co.Ltd, New Delhi ,1996.
5. Jain P.C. and Monica J., " *Engineering Chemistry* ", Dhanpat Rai Publications Co.,(P) Ltd., New Delhi, 1998.

1. BASICS 5

Introduction - Units and Dimensions - Laws of Mechanics - Vectors - Vectorial representation of forces and moments - Vector operations.

2. STATICS OF PARTICLES 8

Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - single equivalent force.

3. EQUILIBRIUM OF RIGID BODIES 7

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.

4. PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes - First moment of area and the centroid - second and product moments of plane area - Parallel axis theorems and perpendicular axis theorems - Polar moment of inertia - Principal moments of inertia of plane areas - Principal axes of inertia - Mass moment of inertia - relation to area moments of inertia.

5. FRICTION 4

Frictional Force - Laws of Coloumb friction - Simple Contact friction - Rolling Resistance - Belt Friction.

6. DYNAMICS OF PARTICLES 16

Displacement, Velocity and acceleration their relationship - Relative motion - Curvilinear motion - Newton's Law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.

7. ELEMENTS OF RIGID BODY DYNAMICS 8

Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid Body - Work energy equation.

Total No of periods: 60

Text Books:

1. *Beer and Johnson, " Vector Mechanics for Engineers ", Vol. 1 " Statics " and Vol. 2 " Dynamics ", McGraw Hill International Edition, 1995.*
2. *Merriam, " Engineering Mechanics ", Vol.1 " Statics " and Vol.2 " Dynamics 2/e ", Wiley International, 1988.*

References:

1. *Rajasekaran S. and Sankara Subramanian, G., " Engineering Mechanics - Statics and Dynamics ".*
2. *Irving, H., Shames, " Engineering Mechanics - Statics and Dynamics ", Thrid Edition, Prentice-Hall of India Pvt.Ltd., 1993.*
3. *Mokoshi, V.S., " Engineering Mechanics ", Vol.1 " Statics " and Vol.2 " Dynamics ", Tata McGraw Hill Books, 1996.*
4. *Timoshenko and Young, " Engineering Mechanics ", 4/e, McGraw Hill, 1995.*
5. *McLean, " Engineering Mechancis ", 3/e, SCHAUM Series, 1995.*

(Revised Syllabus For B.E. / B.Tech. Programmes - Effective From June 2002)

1. MATRICES	9
Characteristic equation - Eigen values and eigen vectors of a real matrix. Some properties of eigen values, Cayley-Hamilton theorem, Orthogonal reduction of a symmetric matrix to diagonal form - Orthogonal matrices - Reduction of quadratic form to canonical form by orthogonal transformation.	
2. THREE DIMENSIONAL ANALYTICAL GEOMETRY	9
Direction cosines and ratios - Angle between two lines - Equation of a plane - Equation of a straight line - Coplaner lines - Shortest distance between skew lines - Sphere - Tangent plane - Plane section of a sphere - orthogonal spheres.	
3. GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	9
Curvature - cartesian and polar coordinates - Circle of curvature - Involutives and Evolutes - Envelopes - properties of envelopes - Evolute as envelope of normals.	
4. FUNCTIONS OF SEVERAL VARIABLES	9
Functions of two variables - Partial derivatives - Total differential - Differentiation of implicit functions - Taylor's expansion - Maxima and Minima - Constrained Maxima and Minima by Lagrangean Multiplier method - Jacobians - differentiation under integral sign.	
5. ORDINARY DIFFERENTIAL EQUATIONS	9
Simultaneous first order linear equations with constant coefficients - Linear equations of second order with constant and variable coefficients - Homogeneous equation of Euler type - equations reducible to homogeneous form - Method of reduction of order - Method of variation of parameters.	
6. TUTORIAL	15
Total No of periods: 60	

Text Books:

1. Kreyszig, E., " *Advanced Engineering Mathematics* " (8th Edition), John Wiley and Sons (Asia) Pte Ltd., Singapore, 2001
2. Veerarajan, T., " *Engineering Mathematics* ", Tata McGraw Hill Publishing Co., NewDelhi, 1999.

References:

1. Grewal, B.S., " *Higher Engineering Mathematics* " (35th Edition), Khanna Publishers, Delhi , 2000.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " *Engineering Mathematics* ", Volume I (4th Revised Edition), S. Chand & Co., New Delhi, 2000.
3. Narayanan, S., Manicavachagom Pillay, T.K., Ramanaiah, G., " *Advanced Mathematics for Engineering Students* ", Volume I (2nd Edition), S. Viswanathan (Printers & Publishers), 1992.
4. Venkataraman, M.K. " *Engineering Mathematics - First year* " National Publishing Company, Chennai (2nd Edition), 2000.

1. PROPERTIES OF MATTER	9
Elasticity - stress-strain diagram-factors affecting elasticity - Twisting couple on a wire-Shafts-Torsion pendulum-Depression of a cantilever- Young's modulus by cantilever-Uniform and Non Uniform bending-I shape girders-Production and measurement of high vacuum-Rotary pump-Diffusion pump-Pirani Gauge-Penning gauge-Viscosity-Oswald Viscometer-Comparision of viscosities.	
2. ACOUSTICS	9
Acoustics of buildings-Absorption coefficient-Intensity-Loudness-Reverberation time-Sabine's formula-Noise pollution-Noise control in a machine-Ultrasonics-production-Magnetostriction and Piezoelectric methods-Applications of ultrasonics in Engineering and Medicine.	
3. HEAT AND THERMODYNAMICS	9
Thermal conductivity-Forbe's and Lee's Disc methods-Radial flow of heat-Thermal conductivity of rubber and glass-Thermal insulation in buildings-Laws of thermodynamics-Carnot's cycle as heat engine and refrigerator-Carnot's theorem-Ideal Otto and Diesel engines-Concept of entropy-Entropy Temperature diagram of carnot's cycle.	
4. OPTICS	9
Photometry-Lummer Brodhum photometer-Flicker Photometer-Antireflection coating-Air wedge-Testing of flat surfaces-Michelson's Interferometer and its applications-Photoelasticity and its applications-Sextant-Metallurgical microscope-Scanning electron microscope.	
5. LASER AND FIBRE OPTICS	9
Principle of lasers-laser characteristics-Ruby-NdYAG, He-Ne, CO ₂ and semiconductor lasers-propagation of light through optical fibers-types of optical fibre-Applications of optical fibres as optical waveguides and sensors.	
Total No of periods: 45	

Text Books:

1. Arumugam.M., " Engineering Physics ", Anuradha Publications, 1998.

References:

- 1. Resnik R. and Halliday D., " Physics ", Wiley Eastern, 1986.*
- 2. Nelkon M. and Parker.P., " Advanced Level Physics ", Arnold-Heinemann, 1986.*
- 3. Vasudeva A.S., " Modern Engineering Physics ", S. Chand and Co., 1998..*
- 4. Gaur, R.K., and Gupta, S.L., " Engineering Physics ", Dhanpat Rai and Sons, 1988.*
- 5. Mathur, D.S, " Elements of properties of Matter ", S.Chand & Co., 1989.*

- 1. Preparation of standard solutions.
- 2. Estimation of hardness of water by EDTA method
- 3. Estimation of different types and amounts of alkalinity in water - Indicator method
- 4. Determination of dissolved oxygen - Winkler's method.
- 5. Estimation of iron in water - Spectrophotometric method.
- 6. Estimation of sodium in water - Flame Photometric method
- 7. Determination of molecular weight of polymers-Viscometric method.
- 8. Determination of total dissolved solids in water.
- 9. Corrosion experiments:
 - * Corrosion rate measurements
 - * Inhibition efficiency.
- 10. Electrochemistry experiments:
 - * Determination of emf.
 - * Single electrode potential
 - * Potentiometric and conductometric titration

Total No of periods: 30

GE133 Workshop Practice

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1. SHEET METAL 10

Tools and Equipments - Fabrication of tray, cone, etc., with sheet metal

2. WELDING 10

Tools and Equipments - Arc Welding of butt joint, Tap Joint, Tee fillet etc., Demonstration of gas welding.

3. FITTING 10

Tools and Equipments- Practice in Chipping, Filing, Drilling - making Vee joints, square and dove tail joints.

4. CARPENTRY 10

Tools and Equipments-Planning Practice-making halving joint and dove tail joint models.

5. FOUNDRY 10

Tools and Equipments Preparation of moulds of simple objects like flange, gear V- grooved pulley etc.

6. SMITHY 10

Tools and Equipments - Demonstration for making simple parts like keys, bolts etc.

Total No of periods: 60

References:

1. Venkatachalapathy V.S., " *First Year Engineering Workshop Practice* ", Raamalinga Publications, Madurai, 1999.
2. Kanaiah P.and Narayana K.C., " *Manual on Workshop Practice Scitech Publications* ", Chennai, 1999.

1. PRACTICALS

30

1. Young's modulus by non uniform bending.
2. Rigidity modulus and moment of inertia using Torsion Pendulum
3. Viscosity of a liquid by Poiseuille's method.
4. Wavelength determination using grating by Spectrometer.
5. Particle size determination by Laser
6. Thermal conductivity by Lees' disc.
7. Thickness of wire by Air wedge.
8. Thermo emf measurement by potentiometer.

Total No of periods: 30

1. ENVIRONMENTAL POLLUTION 8

Causes of pollution - Water pollution - Domestic, industrial and agricultural wastes - Assessment of pollution - D.O., B.O.D. and C.O.D. Treatment - Primary and secondary - sludge disposal - Air pollution - Environmental impact - Acid rain, green house effect and global warming - Ozone depletion Smog - Control measures - Soil and Noise pollution.

2. FUELS 10

Classification of fuels - Calorific value - determination - Coal - Ranking and analysis - Carbonisation of coal - Coal tar products - Metallurgical coke - Classification of Petroleum - Fractional distillation - Cracking - Reforming - Petrol - Diesel - Coal gas - Natural gas - Producer gas - LPG - Biogas.

3. BINDING MATERIALS 6

Cement and lime - Types - Composition and characteristics - Chemistry of setting and hardening - Grading and analysis - Adhesives - Types - Characteristics Epoxides, urethanes, polyvinyl alcohol and polyvinyl acetate.

4. POLYMERIC MATERIALS 10

Polytetrafluoroethylene, Polyamides (nylon 6, nylon 66, Kevlar), Polyesters (polyethylene terephthalate, polybutyleneterephthalate, aromatic polyester) polycarbonate, polyacetals, polysulphoes (applications only, manufacturing details not required) Composites: Matrix resins - Reinforcements - Applications.

5. INDUSTRIAL INORGANIC COMPOUNDS 11

Zeolites : Types - Applications - Ion exchange - Adsorbent - Separation process -Catalyst.

Pigments : Titanium dioxide - Lithophone - Zinc Oxide - Iron oxide - Ultramarine.

Bleaching agents : Reducing bleaching agents - Sulphur dioxide - Sodium hydrosulphite - Oxidizing bleaching agents - Calcium hypochlorite - Hydrogen peroxide - Chlorine dioxide.

Refractory: Silicon carbide - aluminium oxide - Ultramarine.

Lubricants : Silicone oil - Lithium grease - Graphite - Molybdenum disulphide.

6. PRACTICALS 30

Phenol water system - Kinetics of Ester Hydrolysis - Distribution Coefficient - Pigment analysis: Lead and Titanium - Melting point and Molecular weight Determination - Estimation of percentage composition of Glycerol (Viscometric method)

Total No of periods: 75

References:

1. *Kuriacose J.C., & Rajaram, J., " Chemistry in Engineering and Technology ", Volume 1 & 2, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 1989.*
2. *Jain, P.C., " Engineering Chemistry ", Revised and Enlarged Edition, Dhanpat Rai and Sons., New Delhi, 1990.*
3. *Puri P.C. and Sharma L.R., " Principles of Physical Chemistry ", Shoban Lal Naginchand and Company, Delhi, 1994.*
4. *Raymond B.Seymour, " Engineering Polymer source Book ", McGraw Hill Publishing Co., New York, 1990.*
5. *Miles D.C. and Briston J.H., " Polymer Technology ", Chemcial Publishing Co., Inc.,*
6. *Gopalan R., Venkappayya D. and Nagarajan S., " Engineering Chemistry ", Vikas Publishing House Pvt.Ltd., New Delhi, 1999.*

1. SEMICONDUCTORS AND RECTIFIERS 9

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction - VI characteristic of PN junction diode - Zener effect - Zener diode - Zener diode characteristic - Half wave and full wave rectifiers - Voltage regulation.

2. TRANSISTORS AND AMPLIFIERS 9

Bipolar Junction Transistor - CB, CE, CC - Configurations and characteristics - Biasing circuits - Elementary treatment of voltage amplifier - Class A, B and C power amplifiers - principles of Tuned amplifiers.

3. POWER AND CONTROL ELECTRONIC DEVICES 9

Field Effect Transistor - Configurations and characteristics - FET amplifier - SCR, Diac, Triac, UJI - Characteristics and simple applications - switching transistors - concept of feed back - negative feed back - application in temperature and motor speed control.

4. SIGNAL GENERATORS AND LINEAR IC'S 9

Sinusoidal oscillators - positive feed back - RC phase shift, Hartley, Colpitt's, Wien bridge Oscillators - multivibrators - operational amplifier - adder, multiplier, integrator and differentiators - Integrated circuits.

5. DIGITAL ELECTRONICS 9

Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra - Exclusive or gate - Half and full adders - flip flops - registers and counters - A/D, D/A conversion - Digital computer principle.

6. TUTORIAL 15

Total No of periods: 60

Text Books:

1. *Milman and Halkias, " Integrated Electronics ", McGraw Hill, 1979.*

References:

1. *Mehta,V.K., " Principles of Electronics ", S.Chand and Company Ltd., 1994.*

2. *Malvino & Leach, " Digital Principles and Applications ", McGraw Hill, 1986.*

1. ELECTRICAL CIRCUITS 9

Ohms Law - Kirchoff's Laws - steady state solution of DC circuits - Introduction to AC circuits - Waveforms and RMS value - power and power factor, single phase and 3 phase balanced circuits.

2. ELECTRICAL MACHINES 15

Principles of operation and characteristics of DC machines, Transformers (single phase and three phase) - Synchronous Machines - 3 Phase and single phase Induction motors - (op. principles).

3. ELECTRICAL MEASUREMENTS 6

Moving coil and moving iron instruments (Ammeter and Voltmeter) Dynamometer type watt meters and energy meters (op. principles).

4. PRACTICAL 30**Total No of periods: 60***Text Books:*

1. Mittle, V.N., " Basic Electrical Engineering ", TMH Edition, New Delhi, 1990.
2. Del Toro, " Electrical Engineering Fundamentals ", Prentice Hall of India Pvt.Ltd., New Delhi, Second Edition.

References:

1. Jimmie J.Cathey and Nasar, S.A., " Basic Electrical Engineering ", Schaurn outline series in Engineering, McGraw Hill Book Co.1987.
2. Deshpande, N.V., " Electrical Machines " A.A.Wheeler and Co. Ltd., New Delhi, 1994.

(Revised Syllabus For B.E. / B.Tech. Programmes - Effective From June 2002)

- 1. MULTIPLE INTEGRALS 9**
 Double integration in Cartesian and polar coordinates - Change of order of integration - Area as a double integral - Triple integration in Cartesian coordinates - Change of variables - Gamma and Beta functions.
- 2. VECTOR CALCULUS 9**
 Curvilinear coordinates - Gradient, Divergence, Curl - Line, surface & volume integrals - Statements of Green's, Gauss divergence and Stokes' theorems - Verification and applications.
- 3. ANALYTIC FUNCTIONS 9**
 Cauchy Riemann equations - Properties of analytic functions - Determination of harmonic conjugate - Milne-Thomson's method - Conformal mappings : Mappings $w = z + a$, az , $1/z$, z^2 and bilinear transformation.
- 4. COMPLEX INTEGRATION 9**
 Cauchy's theorem - Statement and application of Cauchy's integral formulae - Taylor's and Laurent's expansions - Singularities - Classification - Residues - Cauchy's residue theorem - Contour integration - Circular and semi Circular contours (excluding poles on real axis).
- 5. STATISTICS 9**
 Moments - Coefficient of correlation - Lines of regression - Tests based on Normal and t distributions, for means and difference of means - Chi Square test for goodness of fit.

Total No of periods: 45

Text Books:

1. Kreyszig, E., " *Advanced Engineering Mathematics* " (8th Edition), John Wiley and Sons, (Asia) Pte Ltd., Singapore, 2000.
2. Grewal, B.S., " *Higher Engineering Mathematics* " (36th Edition), Khanna Publishers, Delhi 2001

References:

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " *Engineering Mathematics* ", Volumes I & II (4th Revised Edition), S. Chand & Co., New Delhi, 2001.
2. Narayanan, S., Manicavachagom Pillay, T.K., Ramanaiah, G., " *Advanced Mathematics for Engineering Students* ", Volumes I & II (2nd Edition), S. Viswanathan (Printers & Publishers, Pvt, Ltd.), 1992.
3. Venkataraman, M.K. " *Engineering Mathematics III - A* ", National Publishing Company, Chennai, (13th Edition), 1998.

1. ELECTROSTATICS AND ELECTROMAGNETISM 9

Electric field and potential - Gauss theorem - Applications - dielectrics - capacitance - energy stored in a dielectric medium - types of capacitors - Loss of energy due to sharing of charges by the capacitors - electrical conductivity in conductors - Carey Foster's bridge - Maxwell's equations - Free space wave equation - Characteristic impedance.

2. QUANTUM PHYSICS 9

Development of quantum theory - Dual nature of matter and radiation - Compton effect - Pair production - Uncertainty principle - Equivalence of mass and energy Schrodinger's wave equation - Particle in a box - Electrons in a metal.

3. ATOMIC AND NUCLEAR PHYSICS 9

Characteristics of atomic spectra - molecular spectra - vector atom model - Stern and Gerlach experiment - Raman Effect and its applications - Liquid drop model - Explanation for Nuclear fusion - Shell model - Chain reaction - Criticality - Four factor formula - Q value - Power reactors - Laser induced Nuclear fusion.

4. ELEMENTARY CRYSTALLOGRAPHY 9

Crystalline and non-crystalline materials - Bravais lattices - Crystal systems - Symmetry elements - Simple crystal structures - Packing factor for sc, bcc, fcc, hcp structures - Miller Indices - Imperfections in crystals - Bragg's law and x-ray diffraction methods to study crystal structures.

5. NON DESTRUCTIVE TESTING 9

Liquid penetrant, Magnetic particle and eddy current methods - X-ray radiography - Fluoroscopy - Gamma ray radiography - Ultrasonic scanning methods - Ultrasonic flaw detector - Thermography.

6. PRACTICALS 30

1. Meter Bridge - Temp. Coefficient
2. Field along the axis of coil - Determination of H
3. Carey Foster's Bridge - Resistivity
4. X-ray diffraction - calculation of cell parameters
5. Newton's rings - Wavelength measurement
6. Spectrometer - Dispersive power of a prism
7. Rigidity modulus - static torsion
8. Ammeter & voltmeter calibration using potentiometer

Total No of periods: 75

Text Books:

1. Arumugam, M., " *Engineering Physics* ", Anuradha Publications, 1998.

References:

1. Beiser, A., " *Perspective of Modern Physics* ", John Wiley, 1985
2. Tayal, D.S., " *Nuclear Physics* ", Himalayan Publishers, 1998
3. Vasudeva, D.N., " *Fundamentals of Electricity and Magnetism* ", S.Chand & Co., 1985.
4. Hull, B. and John V., " *Nondestructive Testing* ", McMillan Education Ltd, London, 1988

1. PRINCIPLES OF GRAPHICS 16

Two dimensional geometrical construction - Conic sections, involutes and cycloids - Representation of three dimensional objects - Principles of projections - standard codes of principles.

2. ORTHOGRAPHIC PROJECTIONS 28

Projections of points, straight line and planes - ' Auxiliary projections ' - Projection and sectioning of solids - Intersection of surfaces - Development of surfaces.

3. PICTORIAL PROJECTIONS 8

Isometric projections - ' Perspectives ' - Free hand sketching.

4. COMPUTER GRAPHICS 8

Hardware - Display technology - Software - Introduction to drafting software.

Total No of periods: 60

Text Books:

1. Narayanan, K.L., and Kannaiah, P., " Engineering Graphics ", Tata McGraw-Hill Publishers Co., Ltd., 1992.

References:

1. William M. Neumann and Robert F. Sproul, " Principles of Computer Graphics ", McGraw Hill, 1989.
2. Warren J. Luzzadder and John M. Duff, " Fundamentals of Engineering Drawing ", Prentice-Hall of India Private Ltd., Eastern Economy Edition, 1995.
3. Natarajan K.V., " A Text Book of Engineering Drawing ", Private Publication, Madras, 1990.
4. Mathur, M.L. and Vaishwanar, R.S., " Engineering Drawing and Graphics ", Jain Brothers, New Delhi, 1993.

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1. MULTIUSER OPERATING SYSTEM | 4 |
| Unix: Introduction - Basic Commands - Vi editor - filters - Input/output redirection - piping - transfer of data between devices - shell scripts. | |
| 2. FUNDAMENTALS OF NETWORKING | 3 |
| Working on a networked environment - Accessing different machines from one node - concept of E-mail - Uses of Internet. | |
| 3. HIGH LEVEL LANGUAGE PROGRAMMING | 8 |
| C Language: Introduction - Operator - Expressions - Variables - Input/output statements - control statements - function arrays - pointer - structures - unions - file handling - case studies. | |
| 4. TUTORIAL | 45 |

Total No of periods: 60

Text Books and References:

1. *Stephan J. Kochen & Patrick H. Wood, " Exploring the UNIX System ", Techmedia, 1999.*
2. *Maurice J. Bach, " The design of UNIX Operating Systems ", Prentice Hall of India, 1999.*
3. *Ramos, " Computer Networking Concepts ", Prentice Hall International, 1999.*
4. *Balagurusamy, " Programming in ANSI C ", Tata McGraw Hill, 1999.*
5. *Kernighan and Ritchie, " The C Programming Language ", Prentice Hall of India, 1999.*
6. *Gottfried, " Programming with C ", Tata McGraw Hill, 1999.*
7. *Kutti, " C and UNIX Programming: A Conceptual Perspective ", Tata McGraw Hill, 1999.*
8. *Eric Nagler, " Learning C++ ", M/s. Jaico Publishing Co., 1998-99.*

1. ELECTRIC CIRCUITS 6

Definition - Ohm's law - series parallel circuit - parallel circuit - Division of current - Kirchoffs law; Superposition and Thevenin's Theorem; Star-delta transformation; Simplification of networks.

2. A.C.CIRCUITS 10

Alternating Voltage; Need for A.C.Voltage; Sinusoidal A.C. Voltage; R,RL and RLC networks; Impedance angle; Power and Power factor; Actual and apparent power; Resonance in A.C. Circuits; Series, parallel and series-parallel resonance; Vector Diagram (Phasor Diagram); Complex algebra applied to sinusoids; Three phase circuits; Three phase loading; Balanced loads; Simple problems.

3. D.C. MACHINES 10

Lenz's law of electromagnetic induction; Fleming's rule, Principle of operation of D.C. Machines; Kinds of D.C. Machines; Emf equation of D.C. generators; Speed control of D.C. motor; Starters; Application of D.C.Machines.

4. A.C. MACHINES 15

Principle of operation of A.C. Machines: Transformer; single and three phase induction motors, Alternators; Synchronous motors; Equivalent circuit, Regulation and efficiency of single phase transformer; Slip-torque characteristics induction motors; starting of induction motors. Emf equation, Regulation and synchronisation of alternators; Synchronous condenser; Hunting in synchronous motor; Single phase induction motors and their applications.

5. DRIVES 4

Industrial requirements and Ward Leonard System of Drives. Servo-Motors; Basic theory and applications.

Total No of periods: 45

Text Books:

1. *Cotton, H., " Electrical Technology ", Pitman Publishers, (1975).*
2. *Uppal, S.L., " Text Book of Electrical Engineering ", Khanna Publishers, (1975)*
3. *Theraja, D.L., " Text Book of Electrical Technology ", Nirja publishers (1995)*
4. *Marimuthu, P., " Basic Electrical and Electronic Engg. ", Prathiba Publishers, (1990).*

1. LAWS OF THERMODYNAMICS	10
Basic concepts and hints; Zeroth law; First Law of Thermodynamics - Statement and application; Steady flow energy equation; Second law of Thermodynamics - Statement; Limitations Heat Engine; Heat Pump, Available energy, Kelvin - Plank statement and Clausius statement; Equivalence entropy; Reversibility: Entropy charts; Third law of Thermodynamics - Statement.	
10. BALANCING	2
Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.	
2. HEATING AND EXPANSION OF GASES	5
Expressions for; work done; Internal energy, Hyperbolic and polytropic processes; Free expansion and Throttling.	
3. AIR STANDARD EFFICIENCY	5
Carnot cycle; Stirlings Cycle: Joule Cycle; Otto Cycle; Diesel Cycle; Dual combustion Cycle.	
4. I.C. ENGINES	4
Engine nomenclature and classifications; SI Engine: CI Engine; Four Stroke cycle' Two stroke cycle; Performance of I.C. Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.	
5. STEAM AND ITS PROPERTIES	4
Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Superheated steam. Use of steam tables; volume of wet steam; Volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle; Modified Rankine cycle.	
6. STEAM ENGINES AND TURBINES	3
Hypothetical indicator diagram of steam engine; Working of a simple steam engine; steam turbines - Impulse and Reaction types - Principles of operation.	
7. SIMPLE MECHANISM	3
Kinematic Link, Kinematic Pair Kinematic Chain; Slider Crank mechanism and inversions; Double slider crank mechanism and inversions.	
8. FLY WHEEL	4
Turning moment Diagram; Fluctuation of Energy; Design of fly wheel.	
9. DRIVES	5
Belt and rope drives; Velocity ratio; slip; Ratio of tensions; Length of belt; Maximum HP; simple compound and Epicyclic gear trains.	
Total No of periods: 45	

Text Books:

1. *Smith, " Chemical Thermodynamics ", Reinhold Publishing Co., 1977.*
2. *Bhaskaran, K.A., and Venkatesh, A., " Engineering Thermodynamics ", Tata McGraw Hill, 1973.*
3. *Pandya A. and Shah, " Theory of Machines ", Charatakar Publishers, 1975.*
4. *Nag, P.E., " Engineering Thermodynamics ", II Edition, Tata McGraw Hill Publishing Co., Ltd., 1995.*

1. STRESS, STRAIN AND DEFORMATIONS OF SOLIDS	8
Rigid bodies and deformable solids - forces on solids and supports - equilibrium and stability - strength and stiffness - tension, compression and shear stresses - Hooke's law and simple problems - compound bars - thermal stresses - elastic constants and poisson's ratio - welded joints - design.	
2. TRANSVERSE LOADING ON BEAMS	6
Beams - support conditions - types of beams - transverse loading on beams - shear force and bending moment in beams - analysis of cantilevers, simply-supported beams and over hanging beams - relationships between loading, S.F. and B.M. in beams and their applications - S.F. & B.M. diagrams.	
3. DEFLECTIONS OF BEAMS	8
Double integration method - Macaulay's method - Area - moment theorems for computation of slopes and deflections in beams - conjugate beam method.	
4. STRESSES IN BEAMS	9
Theory of simple bending - assumptions and derivation of bending equation ($M/I = F/Y = E/R$) - analysis of stresses in beams - loads carrying capacity of beams - proportioning beam sections - leaf springs - flitched beams - shear stress distribution in beams - determination of shear stress in flanged beams.	
5. TORSION	6
Torsion of circular shafts - derivation of torsion equation ($T/J = C/R = Gq/L$) - stresses and deformation of circular and hollow shafts - stresses and deformation of circular and hollow shafts - stepped shafts - shafts fixed at both ends - stresses in helical springs - deflection of springs - spring constant.	
6. COLUMNS	7
Axially loaded short columns - columns of unsymmetrical sections - Euler's theory of long columns - critical loads for prismatic columns, with different end conditions - effect of eccentricity.	
Total No of periods: 44	

Text Books:

1. *Junarkar, S.B., " Mechanics of Structures ", Vol. I, 21st Edition, Character Publishing House, nand, India, (1995).*
2. *William A.Nash, " Theory and Problems of Strength of Materials ", Schaum's Outline Series, McGraw Hill International Editions, Third Edition, 1994.*
3. *Elangovan, A., " Thinma Visai Iyal " (Mechanics of Solids in Tamil), Anna University, Madras, 1995.*

1. CARBOHYDRATES	8
Introduction - Mono and Disaccharides - Important reactions - Polysaccharides - Starch and Cellulose - Derivatives of Cellulose - Carboxy Methyl Cellulose and gun cotton - Structural aspects of cellulose.	
2. ORGANO METALLIC COMPOUNDS	5
Grignard reagents and their synthetic utility - Organo Silicon compounds.	
3. OILS, FATS AND WAXES	5
Analysis of oils and fats - classification of waxes	
4. HETEROCYCLIC COMPOUNDS	8
Furan, Thiophene, Pyrrole, Pyridine, and Indole - Their important derivatives	
5. DYES AND DYEING	7
Colour and Constitution	
- Synthesis of some important azodyes (Methyl orange, Methyl red and Congo red)	
- Synthesis of Triphenylmethane dyes (Malachite green, Para Rosaniline Anthraquinone dyes (Alizarin).	
- Phthalein dyes - Eosin preparation	
- Introduction to Natural and Reactive dyes	
6. AMINO ACIDS AND PROTEINS	5
Classification of proteins - Tests for proteins - Denaturation - Structural aspects of wool.	
7. PHARMACEUTICAL CHEMISTRY	7
Synthesis of antimalarial drugs - Isopentaquine and chloroquine - Antibacterial drugs - Synthesis of sulphanilamide, sulphapyridine.	

Total No of periods: 45

References:

1. Agarwal, O.P., " *Synthetic Organic Chemistry* ", Vth Edition, 1980-81, Goel Publishing House, Meerut.
2. Ashutoshkar, " *Medicinal Organic Chemistry* ", New Age International Private Ltd., 1993, Chennai.
3. Bahl, B.S. and Arun Bahl, " *Advanced Organic Chemistry* ", IIIrd Edition(1994), Sultan Chand and sons, New Delhi.
4. Mrs. Lakshmi, S., " *Pharmaceutical Chemistry* ", First Edition (1995), Sultan Chand and Sons, New Delhi.
5. Morrison, R.T. and Boyd, R.N., " *Organic Chemistry* ", VI Edition, Prentice Hall Inc.(1996), USA.
6. Tiwari, K.S., Vishnoi, N.K. and Vishnoi, S.N., " *A Text book of Organic Chemistry* ", Second Edition, Vikas Publishing House (1998), New Delhi.

(Revised Syllabus For B.E. / B.Tech. Programmes - Effective From June 2002)

- 1. PARTIAL DIFFERENTIAL EQUATIONS 9**
 Formation - Solutions of standard types of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.
- 2. FOURIER SERIES 8**
 Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity - Harmonic Analysis.
- 3. BOUNDARY VALUE PROBLEMS 9**
 Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.
- 4. LAPLACE TRANSFORMS 9**
 Transforms of simple functions - Basic operational properties - Transforms of derivatives and integrals - Initial and final value theorems - Inverse transforms - Convolution theorem - Periodic functions - Applications of Laplace transforms for solving linear ordinary differential equations upto second order with constant coefficients and simultaneous equations of first order with constant coefficients.
- 5. FOURIER TRANSFORMS 10**
 Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

Total No of periods: 45

Text Books:

1. Kreyszig, E., " *Advanced Engineering Mathematics* " (8th Edition), John Wiley and Sons, (Asia) Pte Ltd., Singapore, 2000.
2. Grewal, B.S., " *Higher Engineering Mathematics* " (35th Edition), Khanna Publishers, Delhi 2000.

References:

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " *Engineering Mathematics* ", Volumes II & III (4th Revised Edition), S. Chand & Co., New Delhi, 2001.
2. Narayanan, S., Manicavachagom Pillay, T.K., Ramanaiah, G., " *Advanced Mathematics for Engineering Students* ", Volumes II & III (2nd Edition), S. Viswanathan (Printers & Publishers, Pvt, Ltd.) 1992.
3. Venkataraman, M.K. " *Engineering Mathematics* " Volumes III - A & B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam, T.N. : <http://www.annauniv.edu/shan/trans.htm>

1. PHASE DIAGRAMS AND PHASE TRANSFORMATIONS 10

Gibb's Phase rule - Unary and binary phase diagrams - Al₂O₃ - Cr₂O₃, Pb-Sn, Ag-Pt and Fe-Fe₃C Systems - Lever rule - Invariant reactions - TTT diagrams - Microstructural Changes - Nucleation and growth - Martensitic transformations - Solidification and Crystallisation - Glass transition - Recrystallisation and grain growth - Nanophase materials.

2. MECHANICAL PROPERTIES 9

Elastic, anelastic and viscoelastic behaviour - Plastic deformation by slip - Critical resolved shear stress - Creep - Mechanism - Creep resistant materials - Ductile fracture - Brittle fracture - Griffith's theory - Fatigue fracture - S-N Curves - Fracture toughness.

3. ELECTRICAL AND MAGNETIC PROPERTIES 10

Free electron theory - Conduction by free electrons - Superconducting materials - Meissner effect - Types of Superconductors - Applications - Classification of dia-, para-, ferro-, antiferro- and ferri-magnetic materials - Domain structure - Hysteresis loop - Soft and hard magnetic materials - Metallic glasses and their applications - Magnetic tape and floppy disc materials - Shape memory alloys.

4. SEMICONDUCTING AND DIELECTRIC PROPERTIES 9

Elemental and compound semiconductors and their properties - Hall effect - Experimental arrangement - Applications - Different types of polarisation processes - Frequency and temperature effects on polarisation - Dielectric constant - Dielectric loss - Different types of dielectric breakdown - Ferroelectric materials.

5. THERMAL AND OPTICAL PROPERTIES 7

Specific heat capacity - Thermal conductivity - Thermal expansion - Fibre optic materials and their applications - Display materials - LED and LCD.

Total No of periods: 45

References:

1. Arumugam. M., " *Materials Science* ", Anuradha Technical Book Publishers, Kumbakonam, 1997.
2. Raghavan, V., " *Materials Science and Engineering* ", Prentice Hall of India, New Delhi, 1999.
3. Pillai, S.O., " *Solid State Physics* ", New Age International, 1998.
4. Van Vlack, L.H., " *Materials Science for Engineers* ", Addison-Wesley, 1985.
5. Kingery, W.D., Bowen, H.K., and Unimann, D.R., " *Introduction to Ceramics* ", John Wiley and Sons, 2nd Ed., 1991.

CH237 Chemistry Lab

0 0 4 100

60

- 1. Ore/alloy analysis
- 2. Pigment Analysis
- 3. Industrial Waste Water Analysis
- 4. Estimation of Phenol
- 5. Analysis of fertilizers
- 6. Sugar Analysis
- 7. Polymer Analysis

Total No of periods: 60

CH239 Mechanical Engineering Lab

0 0 3 100

60

- 1. Port timing diagram
- 2. Valve timing diagram
- 3. Study of 2,4 stroke I.C. Engines.
- 4. Study of steam engine and Gear box
- 5. Load test on 4 stroke Villiers Petrol Engine.
- 6. Load test on 4 stroke Lister Diesel Engine
- 7. Load test on 4 stroke P.S.G. Diesel Engine
- 8. Compression test
- 9. Deflection test
- 10. Hardness test (Rockwell and Brinell)
- 11. Spring test
- 12. Study on behaviour of columns
- 13. Torsion test
- 14. Impact test.

Total No of periods: 60

References:

1. *Jerry, O., Breneman, G.L., " Spreadsheet Chemistry ", Prentice Hall, Englewood Cliffs, 1991.*
2. *Hanna, O.T., Scandell, O.C., " Computational Methods in Chemical Engineering ", Prentice Hall, 1995.*
3. *Taxali, R.K., T.K., " dBase IV made simple ", Tata McGraw Hill 1991.*
4. *Myers, A.L., Seider W.D., " Introduction to Chemical Engineering and Computer Calculations ".*

- 1. ELECTROCHEMISTRY 11**
Electrical Conductance - Specific conductance - Equivalent conductance - Variation with dilution - Kohlrausch's law - Transport Number - Galvanic cells - EMF and its measurement - Reference electrode - Standard Hydrogen Electrode - Nernst equation - Electrochemical series - Applications of EMF measurements.
- 2. CHEMICAL KINETICS 6**
Kinetics of parallel and opposing reactions - Concept of activation energy - Arrhenius equation - Theory of absolute reaction rates - Kinetics of Enzyme catalysed reactions.
- 3. PHASE RULE 6**
Definition - Derivation - Application of phase rule to water system - Thermal Analysis - Cooling curves - Two Component system - Eutectic and compound formation.
- 4. ADSORPTION AND CATALYSIS 8**
Physical and Chemical adsorption - Types of adsorption isotherm, BET method, Gibbs equation, Homogeneous catalysis - Heterogeneous catalysis, Acid - base catalysis, Enzyme catalysis - Applications of catalysts in industries.
- 5. COLLOIDS 7**
Introduction to colloids - Properties of colloids - Electrokinetic phenomena - Donnan Membrane equilibrium - Emulsions - Gels - Colloidal electrolytes.
- 6. PHOTOCHEMISTRY 7**
Laws of Photochemistry, Quantum efficiency, Photochemical reactions, Actinometry, Kinetics and mechanism of hydrogen - bromine reaction.

Total No of periods: 45

References:

1. *Puri B.H. and Sharma L.R., " Principles of Physical Chemistry ", S.Nagin Chand and Company, Delhi (1994).*
2. *Kund and Jain, " Physical Chemistry ", S. Chand and Company, Delhi (1996).*
3. *Gordon M.Barrow, " Physical Chemistry ", Sixth Edition, Tata McGraw Hill (1998).*

1. NATURE OF MATERIALS	7
Micro and macro structures, properties and definitions; mechanical, thermal, chemical, electrical and magnetic properties, processing of metals and alloys - casting - hot and cold rolling - extrusion - forging - deep drawing - plastic deformation of metal, single crystals and polycrystalline metals - recovery and recrystallization of plastically deformed metals.	
2. FERROUS METALS	8
Pure iron; cast iron; mild steel, stainless steels, special steels and alloys; high temperature steels; iron - iron carbide phase diagram; heat treatment of plain - carbon steels. Manufacture, properties and application in chemical industries.	
3. NON-FERROUS METALS	16
Lead, tin and magnesium; manufacturing methods, properties and application in process industries.	
NON METALS	
i. POLYMERIC MATERIALS	
Polymerization reactions - Industrial polymerization methods - Crystallinity and stereo-isomerism in some thermoplastics - thermosetting elastomers - creep and fracture of polymeric materials.	
ii. COMPOSITE MATERIALS	
Fiber - reinforced - plastic composite materials - manufacturing methods - concrete - asphalt and asphalt mixtures - wood - sandwich structures.	
iii. CERAMIC MATERIALS	
Ceramic crystal and silicate structures processing of ceramics - properties - glasses - enamels.	
4. INORGANIC MATERIALS	3
Manufacture of cement and its properties; special cement; cement concrete; reinforced and prestressed concrete: their properties and applications; mixing and curing.	
5. CORROSION	6
Definition and scope; basic theories and mechanism of corrosion; types of corrosion; application of corrosion theories in equipment design and fabrication - anti-corrosion methods.	
6. COATINGS	3
Organic paints and coatings; metal coatings; ceramic coatings; lining.	
7. SELECTION OF MATERIALS	2
General criteria for selection of materials of construction in process industries.	

Total No of periods: 45

References:

1. *Carl, A. and Keyser, C.E., " Material Science in Engineering ", Marrill Publishing Company, 1968.*
2. *Leighou (Rober B), " Chemistry of Engineering Materials ", International Chemical Series, Ed by Hammett, P.B.*
3. *Henry R. Clauster, " Industrial and Engineering Materials ", McGraw Hill Book Company 1975.*
4. *Bhattacharya, B.C., " Selection of Material and Fabrication for Chemical Process Equipment (Question Based)", CEEDC, I.I.T., Madras.*

1. INTRODUCTION	5
Chemical processing, the role of chemical engineers in process industries, importance of block diagrams and flow charts, unit operations, unit processes, process utilities and economics, industrial safety and pollution, outline plant and equipment design, process control and instrumentation.	
10. AGRICHEMICAL INDUSTRIES	2
Insecticides, pesticides, herbicides, plant nutrients and regulators	
11. NUCLEAR INDUSTRIES	3
Production of uranium, thorium and zirconium from ores and minerals, separation of isotopes, waste disposal.	
12. ELECTROLYTIC AND ELECTROTHERMAL INDUSTRIES	2
Explosives, types and characteristics, industrial and military explosives, propellants for rockets.	
13. EXPLOSIVES AND PROPELLANTS INDUSTRIES	2
Paints, pigments, varnishes, lacquers, industrial and marine coatings.	
14. SURFACE COATING INDUSTRIES	2
Paints, pigments, varnishes, lacquers, industrial, and marine coatings.	
15. PHOTOGRAPHIC CHEMICALS	2
Photographic chemicals, manufacture of films, plates and papers, recovery.	
2. WATER IN INDUSTRY	2
Role of water treatment methods for industrial and domestic use, recovery of waste water, water conditioning.	
3. INDUSTRIAL GASES	4
Synthetic gas, natural gas, carbon dioxide sulphur-di-oxide, acetylene, helium and argon, hydrogen, oxygen, nitrogen.	
4. MARINE CHEMICALS	2
Sodium chloride, By-products of common salt industry, value added product.	
5. CHLORINE - ALKALI INDUSTRIES	4
Soda ash and sodium bicarbonate, Chlorine and caustic soda; bleaching powder and related bleaching agents, hydrochloric acid.	

6. SULPHUR AND SULPHURIC ACID INDUSTRIES 3

Mining and manufacturing of Sulphur, recovery of sulphur from polluting gases, sulphur trioxide and sulphuric acid.

7. PHOSPHORUS INDUSTRIES 3

Phosphate rock, beneficiation, phosphoric acid-phosphate.

8. NITROGEN INDUSTRIES 2

Synthesis ammonia and nitric acid

9. FERTILISER INDUSTRIES 6

Growth elements, function, nitrogenous fertilisers ammonium sulphate, ammonium nitrate and urea phosphoric fertilisers, single and triple super phosphate, ammonium phosphate, nitro phosphate, potassic fertilisers, potassium chloride, potassium nitrate and phosphate, compound fertilisers and bio-fertilisers.

Total No of periods: 44

References:

1. Austin, G.T. Shreve, " Chemical Process Industries ", Fifth Edition, McGraw Hill International Book Co., Singapore, 1984.
2. Dryden, C.E., " Outlines of Chemicals Technology ", Edited and Revised by Gopala Rao, M. and Sittig, M., Second Edition, Affiliated East-West Press, 1993.
3. Kent, J.A.(ed), Riggel, " Hand book of Industrial Chemistry ", Van Nostrand Reinhold, 1974.
4. " Chemtech 1-4 ", Chemical Engineering Education Development Centre, I.I.T., Madras 1975-1978.

1. INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS 9

ELECTROMAGNETIC RADIATION: Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance and transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, Classification of instrumental methods based on physical properties.

QUANTITATIVE SPECTROSCOPY: Beer-Lambert's Law, Limitations, Deviations (Real, Chemical, Instrumental). Nesslerimetry, Duboscq colourimetry, Estimation of inorganic ions such as Fe, Ni and estimation of Nitrite using Beer-Lambert's Law.

2. MOLECULAR SPECTROSCOPY 9

Various electronic transitions in organic and inorganic compounds effected by UV, Visible and infra red radiations, Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Woodward-Fischer rules for the calculation of absorption maxima (dienes and carbonyl compounds), Effects of auxochromes and effects of conjugation on the absorption maxima, Instrumentation for UV, VISIBLE and IR spectroscopies (Source, Optical parts and Detectors), Multicomponent analysis, Photometric titration (Experimental setup and various types of titrations), Applications of UV, VISIBLE AND IR spectroscopies.

3. ATOMIC SPECTROSCOPY 4

Atomic absorption spectrophotometry: Principle, Instrumentation and Applications, Various interferences observed in AAS (Chemical radiation and excitation).

4. POLARIMETRY AND REFRACTOMETRY 3

Principle, Instrumentation and Applications

5. ELECTROMETRIC METHODS OF ANALYSIS 7

Introduction to electrometric methods, difference between redox and acid-base reactions, types of cells, schematic representation of cells, single electrode potential, laboratory reference electrodes (Standard hydrogen, saturated calomel, Ag - AgCl and inert electrodes), ion-selective electrodes.

Potentiometry: Nernst equation, experimental set-up and measurement of pH; Conductometry - Measurement of conductance, experimental set-up and various titrations (strong and weak acid/base).

6. XRD ANALYSIS 3

Introduction, Mosley's law, Different emission and diffraction methods, various X-ray detectors.

7. THERMAL METHODS 5

Thermogravimetry: Instrumentation, factors affecting the shapes of thermograms, applications, thermograms of some important compounds (CuSO₄, 5H₂O, CaC₂O₄·2H₂O etc). Differential thermal analysis : Principle, Instrumentation and applications, differences between DSC and DTA. Applications of DSC (Inorganic and Polymer samples).

8. CHROMATOGRAPHIC METHODS 5

Classification of chromatographic methods, Column, Thin layer, Paper, Gas, High Performance Liquid Chromatographical methods (Principle, mode of separation and Technique). Separation of organic compounds by column and Thin layer, mixture of Cu, Co and Ni by Paper, separation of amino acids by paper, estimation of organic compounds by GC and HPLC.

Total No of periods:

References:

1. Parikh V.M., " *Absorption spectroscopy of organic molecules* ", Addison - Wesley Publishing Company, 1974.
2. Willard, H.H., Merritt. I.I., Dean J.a., and Settle, F.A., " *Instrumental methods of analysis* ", Sixth edition, CBS publishers, 1986.
3. Skoog D.A. and West D.M., " *Fundamentals of Analytical Chemistry* ", Saunders-college Publishing, 1982.
4. Banwell, G.C., " *Fundamentals of molecular spectroscopy* ", TMH, 1992.
5. Vogel A.I., " *Quantitative Inorganic analysis* ", V.Edition.
6. Day R.A., Underwood A.L., " *Qualitative Inorganic analysis* ", (A.I.Vogel), V.Edition, Prentice-Hall of India (P) Ltd., New Delhi, 1991.
7. Sharma, B.K., " *Instrumental Methods of Analysis* ", Goel publishing House, 1995.
8. Robert de Levie, " *Principles of Quantitative Chemical Analysis* ", I Edition, Tata McGraw Hill, 1998.
9. Rouessac, F., " *Chemical Analysis-Modern instrumental methods and techniques* ", Wiley-Publishers 1999.

1. PROBABILITY AND RANDOM VARIABLES 7

Probability concepts, Random variables, Moments, Moment Generating function, Binomial Posson, Geometric, Negative binomial, Exponential Gamma, Weibull distributions, Functions of random variable, Chebycnev inequality.

2. TWO -DIMENSIONAL RANDOM VARIABLES 10

Marginal and conditional distributions, Covariance, Correlation and regression, Transformation of random variables, Central limit theorem.

3. DESIGN OF EXPERIMENTS AND QUALITY CONTROL 10

Completely randomized design, Randomized block design Latin square design, Process control, Control chairs of measurements and attributes, Tolerance limits.

4. LINEAR PROGRAMMING 10

Formulation of linear programming problem graphical solution simplex algorithm artificial variable and the M-method, degeneracy, alternative optima and unbounded solution.

5. FURTHER TOPICS IN LINEAR PROGRAMMING 8

Duality, primal-dual computations, transportation model and algorithm, Assignment model and Hungarian technique of solution, imbalance, cost Maximization alternative optima in transportation and assignment method.

6. TUTORIAL 15**Total No of periods: 60**

References:

1. *Miller and Freund, J.E., " Probability and Statistics for Engineers ", Prentice Hall of India, New Delhi, 1977.*
2. *Kapur, J.N. and Saxena, H.C., " Mathematical statistics ", S.Chand & Company Ltd.,*
3. *Taha, H.A., " Operations Research, An Introduction ", Macmillan , New York, 1976.*
4. *Kanti Swarup, Guptha.P.K. and Man Mohan, " Operations Research ", Sultan Chand and Sons, New Delhi, 1982.*

1. LIST OF EXPERIMENTS

60

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator
3. Load characteristics of D.C. compound generator
4. Load test of D.C.Shunt motor
5. Study of D.C.Motor starters
6. O.C. and S.C. tests on single phase transformer
7. Load test on single phase transformer.
8. Load test on 3 phase squirrel cage induction motor
9. Study of 3 phase induction motor starters
10. Load test on 3 phase slip ring induction motor
11. O.C. and S.C. tests on 3 phase alternator
12. Synchronization and V-curves of alternator

Total No of periods: 60

LIST OF EXPERIMENTS**60**

1. Identification of organic compounds (aliphatic or aromatic, saturated or unsaturated)
2. Characteristic reaction of functional groups (aldehydes, ketones, acids, phenols, nitro compounds, amino compounds and amides).
3. Characterisation of unknown organic compounds by their functional groups and confirmation of their derivatives.

4. ORGANIC ESTIMATION

- (a) Phenol
- (b) Glucose

5. ORGANIC PREPARATIONS

- (a) Oxidation of benzaldehyde to benzoic acid
- (b) Hydrolysis of ethyl benzoate to benzoic acid
- (c) Acetylation of aniline to acetanilide
- (d) Nitration of nitrobenzene to meta dinitro benzene

Total No of periods: 60*References:*

1. Dey, B.B., Seetharaman, M.V., "Laboratory Manual of Organic Chemistry", Viswanathan and Company, 1989.
2. Agarwal, O.P., "Advanced practical Organic Chemistry", Goel Publishing House, 1991.