SEMESTER I

15S101 CALCULUS AND ITS APPLICATIONS 3 2 0 4

FUNCTIONS AND CONTINUITY: Functions- graphs of standard functions, limits, continuous and discontinuous functions, piecewise continuous functions, periodic functions – Fundamental theorem of Calculus - Application. (11+5)

DIFFERENTIAL CALCULUS: Derivatives, geometrical interpretation - Curvature in Cartesian and polar coordinates – Circle of curvature. (4+3)


INTEGRAL CALCULUS: Double and triple integrals – change of order of integration, Application of double and triple integrals in finding area and volume - Improper integrals - Beta and Gamma functions - Relation connecting Beta and Gamma functions - Evaluation of definite integrals in terms of Beta and Gamma functions – Applications. (12+9)

VECTOR CALCULUS : Differentiation of vectors-Gradient, Divergence, Curl and directional derivatives - Integration of vectors- Line and surface integrals, Statement of Green's, Gauss divergence and Stoke’s theorems- Applications. (12+9)

Total L: 45 + P: 30 = 75

TEXT BOOKS:

REFERENCES:

15S102 C PROGRAMMING 3 0 2 4

BASICS: The C character set, identifiers & keywords, data types, constants, variables, arrays, declarations, expressions, statements, symbolic constants, operators & expressions: arithmetic operators, unary operators, relational & logical operators, assignment operators, conditional operators. Library functions, data input & output functions, Control statements, while statement, do while statement, for nested loops, if else, switch, break, continue, comma operator, go to statement, programs. (10)

ARRAYS: defining an array, processing array, passing array to a function, multi dimensional array, array & strings. (8)

FUNCTIONS: defining a function, accessing a function, passing arguments to functions, specifying arguments data types, function prototypes, storage classes: auto, static, extern and register variables. (10)

POINTERS: Declarations, pointers to a function, pointers and one dimensional arrays, operating a pointer, pointer and multi dimensional arrays, arrays of pointers, passing functions to other functions. (8)

STRUCTURES AND UNIONS: Definitions, processing a structure, user defined data types, structures and pointers, passing structure to functions, self referential structures, union. FILES: open, close, process operations on a file. Preprocessor Directives, Command Line Arguments, Bitwise Operators, Bit Fields. (9)

Total L: 45 + P: 30 = 75

TEXT BOOKS:

REFERENCES:

15S103 PROPERTIES OF MATTER 3 0 0 3

ELASTICITY: Modulus of elasticity - Stress-strain curve - Poisson's ratio - Determination of rigidity modulus using Torsion pendulum - Bending of beams, bending moment, Theory of cantilever, beam supported at its end and loaded in the middle, determination of Young’s modulus by bending, I form girders (10)
VISCOSITY: Coefficient of viscosity - Poiseuille’s method for coefficient of viscosity - Effect of temperature on viscosity - Rotation (Searle’s) viscometer – Lubrication and Lubricants- viscosity of gases (8)

SURFACE TENSION: Cohesive and adhesive forces - Surface tension - Surface energy – Wetting and non-wetting surfaces - Difference of pressure across a curved surface –Liquid drop, bubble, hollow cylindrical film - Theory of capillary rise - Drop weight method- Effect of temperature on surface tension - Applications of surface tension. (9)

FLUID DYNAMICS: Pascal’s principle, Archimede’s principle- Streamline and turbulent motion- Ideal fluids in motion – Equation of continuity - Bernoulli’s theorem - Applications: Venturimeter, Dynamic lifting. (8)


Total L: 45

TEXT BOOKS:

REFERENCES:

15S104 GENERAL CHEMISTRY I 3 0 0 3

ATOMIC STRUCTURE AND PERIODIC PROPERTIES: Atomic orbitals. Quantum numbers - principal, azimuthal, magnetic and spin quantum numbers and their significance. Aufbau principle, Pauli’s exclusion principle, Hund’s rule, (n+l) rule-stability of half-filled and completely filled orbitals. (10)

PERIODIC PROPERTIES: Atomic and ionic radii, ionisation potential, electron affinity and electronegativity along periods and groups factors influencing periodic properties. Electronegativity - Pauling scale, Mulliken scale – Applications of electronegativity. Classification of elements: General characteristics of s, p, d and f block elements, variation of atomic volume, variation of metallic characters. (11)


Total L: 45

TEXT BOOKS:

REFERENCES:
15S105 PHYSICAL CHEMISTRY I

GASEOUS STATE: Kinetic gas equation – gas laws - the gas constant “R” in different units - deviation from ideal behavior - van der Waal’s equation for real gases. Critical Phenomena - PV isotherms of real gases, critical temperature, and continuity of state - relation between critical constants and van der Waal’s constants - determination of critical volume - the law of corresponding states- reduced equation of state. Molecular and root mean square velocities, average and most probable velocities (derivation from Maxwell-Boltzmann distribution equation) - Maxwell-Boltzmann distribution of molecular velocities (no derivation) - collision number and mean free path - collision diameter.

FIRST LAW OF THERMODYNAMICS: Terminology - intensive and extensive properties. Thermodynamic processes, state and path functions, exact and inexact differentials. Work of expansion at constant pressure and free expansion. First law of thermodynamics, statement - definition of internal energy (E), enthalpy (H) and heat capacity. Relation between C_p and C_v. Calculation of w, q, dE and dH for expansion of ideal and real gases under isothermal and adiabatic conditions of reversible and irreversible processes. Joule - Thomson coefficient (μ_{JT}) and its significance - inversion temperature.

Thermochemistry - relation between enthalpy of reaction at constant volume (q_v) and at constant pressure (q_p). Kirchhoff’s equation. Bond energy and its calculation from thermochemical data - integral and differential heats of solution and dilution.

SECOND LAW OF THERMODYNAMICS: Need for second law - different statements. Carnot’s cycle and efficiency of heat engine - Carnot’s theorem - thermodynamic scale of temperature - concept of entropy - definition and physical significance of entropy - entropy as a function of P, V and T - entropy changes during phase changes - entropy of mixing - entropy criterion for spontaneous and equilibrium processes in isolated system - Gibb’s free energy (G) and Helmholtz free energy (A) - variation of A and G with P, V and T - Gibb’s - Helmholtz equation and its applications. Thermodynamic equation of state - Maxwell’s relations - ΔA and ΔG as criteria for spontaneity and equilibrium - advantages of ΔG over entropy change.

CHEMICAL EQUILIBRIUM: Equilibrium constant and free energy change - thermodynamic derivation of law of mass action - equilibrium constants in terms of pressure and concentration - NH_3, PCl_5 - thermodynamic interpretation of Le Chatelier’s principle (concentration, temperature, pressure and addition of inert gases) - partial molar quantities - chemical potential - Gibb’s Duhem equation. Van’t Hoff’s reaction isotherm - Van’t Hoff’s isochore, Clapeyron equation and Clausius-Clapeyron equation - applications. Third law of thermodynamics - Nernst heat theorem statement of third law and concept of residual entropy - Exception to third law (ortho and para hydrogen, CO, N_2O and ice).

REFERENCES:

15S106 ENGLISH

READING: Reading practice using Literary and Non -Literary texts to develop reading skills such as identifying main ideas, language functions and contextual use of vocabulary

FOCUS ON LANGUAGE: Functional Grammar: Tenses and Modals in Context, Prepositions, Phrasal Verbs, Adjectives, Word Order, Subject and Verb Concord

WRITING: Practice in Writing Letters, Personal, Social, and Official, Note - making, Summarizing, Paragraph Writing, Lab Reports and Trip Reports

SPEAKING: Conversation Practice, Short Speeches – Self expression; describing hobbies, daily routine, news reviews, narration of events, special interests

LISTENING ACTIVITIES: Listening to short conversations, Text based listening tasks

TEXT BOOKS:
1. Teaching Material prepared by the Faculty, Department of English.

Total L: 45

Total L: 45
REFERENCES:

15S107 PROPERTIES OF MATTER LABORATORY

2. Determination of Specific Heat of Solids – Calorimeter.
3. Determination of Surface tension - Capillary rise method.
4. Determination of Surface tension - Drop weight method.

Total P: 60

15S108 CHEMISTRY LABORATORY

1. Estimation of Na₂CO₃ by HCl using standard Na₂CO₃ solution.
2. Estimation of HCl by NaOH using standard oxalic acid solution.
3. Estimation of carbonate and hydroxide present together in mixture.
4. Estimation of oxalic acid by KMnO₄ using standard oxalic acid solution.
5. Estimation of FeSO₄ by KMnO₄ using standard Mohr’s salt solution.
6. Estimation of KMnO₄ by thio using standard K₂Cr₂O₇ solution.
7. Estimation of CuSO₄ by thio using standard K₂Cr₂O₇ solution.
8. Estimation of Ca (II) by EDTA method.

Total P: 60

SEMESTER II

15S201 LINEAR ALGEBRA


VECTOR SPACES: Vector spaces and subspaces – Linear combination, Span, Linear independence and dependence - Null space, Column space, and Row space – Basis and dimension of a vector space – Rank and nullity – Dimension theorem. (10+6)

LINEAR TRANSFORMATION: Introduction to linear transformations – General Linear Transformations – Kernel and range – Matrices of Linear Transformations from Rⁿ to Rᵐ – Change of basis. (6+4)


Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:
15S202 OBJECT ORIENTED PROGRAMMING and C++

PRINCIPLES OF OOP: Programming Paradigms, Difference between POP and OOP, basic concepts and benefits of OOP, Applications of OOP.

INTRODUCTION TO C++: History of C++, Structure of C++, Basic Data types, Derived Data types, Symbolic Constants, Dynamic Initialization, Type Modifiers, Type Casting, Operator and Control Statements, Input and Output statements in C++.

CLASSES AND OBJECTS: Class specification, Member function specification, Scope Resolution Operator, Access Qualifiers, Instance creation, Member functions, Function Prototyping, Function components, Passing parameters, Call by Reference, Return by Reference, Inline Functions, Default arguments, Overloaded function, Template function and Template classes.

Array of objects, Pointers to Objects, this pointer, Dynamic allocation Operators Dynamic objects. Constructors, Parameterized constructors, Overloaded constructors, Constructors with default arguments, Copy constructors, Static data members and Static objects, Objects as arguments, Returning objects, Friend function and Friend class, Local classes and Nested class, Empty, static and CONST classes.

OPERATOR OVERLOADING: Operator function Overloading unary and binary operator, Overloading the operator using the Friend function, Stream Operator overloading, Data Conversion.

INHERITANCE: Defining Derived classes, Single Inheritance, Protected data with Private Inheritance, Multiple inheritance, Multi level inheritance, Hierarchical inheritance, Hybrid inheritance, Multipath inheritance, Constructors in derived and base class, Template in inheritance, Abstract classes, Virtual function and Dynamic Polymorphism, Virtual Destructor.

EXCEPTION HANDLING: Principle of Exception handing, Exception handling mechanism, Multiple catch, Nested try, Rethrowing the exception.

STREAMS: Streams in C++, Stream classes, Formatted and Unformatted data, manipulators, User defined manipulators, File streams, File Pointer manipulation, File open and Close, Random file access.

Total L: 45 + P: 30 = 75

TEXT BOOK:

REFERENCES:

15S203 ELECTRICITY AND MAGNETISM


MAGNETOSTATICS: Biot-Savart law, Ampere's law - Applications of Ampere’s law -Magnetic field due to a steady current carrying straight conductor, solenoid and a toroid - Torque on a current loop in an external magnetic field – Application to moving coil galvanometer

CAPACITORS AND CAPACITANCE: Principle of capacitance - Capacitance of parallel plate capacitor, spherical capacitor, cylindrical capacitor – Capacitance in series and parallel connections- Energy stored in a capacitor - Effect of dielectric - Types of capacitors based on dielectrics- Dielectric loss- Quality factor

ELECTROMAGNETIC INDUCTION: Faraday's law - Self and Mutual induction - Determination of self induction by Rayleigh’s and Anderson’s bridge - Principle of transformer - Eddy currents – Applications - Static and dynamic methods of measuring magnetic field

ELECTRON BALLISTICS: Force on an electron moving in an electric field in the direction of the field and perpendicular to the field - Force on an electron moving in a magnetic field in the direction of the field and perpendicular to the field - Motion of electron in parallel electric and magnetic fields - Motion of an electron in perpendicular electric and magnetic fields. Applications: Cathode Ray Oscilloscope and cyclotron


Total L: 30 + T: 30 = 60
TEXT BOOKS:

REFERENCES:

15S204 ATOMIC AND NUCLEAR PHYSICS


IONISATION POTENTIAL AND SPLITTING OF ENERGY LEVELS: Excitation and Ionization potential, Davis and Goucher’s method, Zeeman effect –Larmor’s theorem, Debye’s explanation of normal Zemann Effect, Anamalous Zeeman Effect, Lande’s ‘g’ factor and explanation of splitting of D1 and D2 lines of sodium , Stark effect.


NUCLEAR TRANSFORMATION: Radioactive decay, alpha, beta and gamma decay, half life, radioactive series, nuclear cross section, nuclear reactions, nuclear fission and nuclear fusion, nuclear reactors. Nuclear Detector: G-M counter, scintillation counter.

ELEMENTARY PARTICLES: Interaction of charged particles, leptons and hadrons, elementary particle quantum number, quarks, fundamental interactions.

TEXT BOOKS:

REFERENCES:

15S205 GENERAL CHEMISTRY II


SOLUTIONS: Completely miscible liquid systems- benzene and toluene. Raoult’s law, Henry’s law, deviation from Raoult’s law and Henry’s law. Duhem-Margues equation, theory of fractional distillation - azeotropes - HCl-water, ethanol-water systems. Partially miscible liquid systems, phenol-water, triethanolamine-water and nicotine-water systems, lower and upper CSTs - effect of impurities on CST - completely immiscible liquids - principle and applications of steam distillation. Nernst distribution law, principle of extraction - applications.
TEXT BOOKS:

REFERENCES:

15S206 PHYSICAL CHEMISTRY II


TEXT BOOKS:

REFERENCES:

15S207 ELECTRICITY AND MAGNETISM LABORATORY

1 Determination of resistivity using Carey Foster bridge.
2 Determination of M and B for a bar magnet.
3 Determination of capacitance using LCR bridge.
4 Determination of figure of merit of a galvanometer.
5 Determination of magnetic field along the axis of a coil.
6 Conversion of a galvanometer into an ammeter and a voltmeter.
7 Calibration of an ammeter using potentiometer and Calibration of a voltmeter (low range) using potentiometer.
8 Construction and study of thermoelectric thermometer using potentiometer.

Total P: 60
15S208 PHYSICAL CHEMISTRY LABORATORY

1. Determination of critical solution temperature (CST) of phenol-water system and effect of impurity.
2. Phase diagram – two-component system - simple eutectic system.
3. Determination of rate constant of acid catalysed hydrolysis of an ester.
5. Partition co-efficient of iodine between water and carbon tetrachloride.
6. Potentiometric estimation of ferrous ion.
7. Estimation of a weak acid and determination of its dissociation constant by pH-metry.
8. Study of adsorption of oxalic acid on charcoal.

Total P: 60

SEMESTER III

15S301 COMPLEX VARIABLES AND TRANSFORMS

COMPLEX VARIABLES: Analytic functions , Cauchy - Riemann equations in Cartesian and Polar coordinates , sufficient conditions (Statement only) Properties of analytic functions , Finding analytic function whose real/imaginary part is given. Complex integration , Cauchy's fundamental theorem and formula , Taylor's series , Laurent's series. Singularities , Residues , Residue Theorem , Cauchy's Lemma and Jordan's lemma (Statements only) , Evaluation of real integrals using contour integration along semi-circle and unit circle. (21)

LAPLACE TRANSFORM: Definition , Transforms of standard functions , Transforms of unit step function, Dirac delta function. Transforms of e^{at} f(t) , t^{n} f(t) , t^{n} f(t) , Transforms of derivatives and integrals , Transform of periodic functions , Inverse Laplace transforms , Convolution Theorem , Applications to ordinary linear differential equations with constant coefficients. (19)


Total: L:30 + T:30 = 60

TEXT BOOKS:

REFERENCES:

15S302 DATA STRUCTURES

INTRODUCTION : Data Structures , Abstract Data Types, Primitive Data Structures, Algorithm analysis , Asymptotic Notations. (3)

ARRAYS: Operations , Implementation of Single and Multi dimensional arrays, Sparse and dense Matrices , Applications. (3)


QUEUES: Primitive Operations , Array Implementation , Circular queues , Dequeues, Priority Queues- Applications (4)


TREES : Binary Trees , Operations , Threaded Binary Tree , Tree Traversals. Applications : The expression tree and Huffman Algorithm. (4)

SORTING & SEARCHING: Insertion sort, Selection sort, Bubble sort, Heap sort, Quick sort, Merge sort. Linear search, Binary search. (5)

Total : L 30
DATA STRUCTURES LABORATORY

Implementation of the following Data Structures and their Applications
1. Sparse & dense Matrix operations using arrays
2. Library of string operations - representing strings using arrays
3. Set operations
4. Stacks using array representation
5. Queues using array representation
6. Linked Lists: Singly linked, doubly linked and Circular lists
7. Linked Stacks and Queues
8. Conversion and Manipulation of Expressions
9. Binary trees and Threaded trees (with graphical representation)

Total P : 30

TEXT BOOKS:

REFERENCES:

15S303 ACOUSTICS AND OPTICS

ACOUSTICS:
Musical sound and noise, characteristics of musical sound: Loudness, noise, quality and intensity. Requirements for acoustically perfect hall. Reverberation, time of reverberation, Sabine’s formula for reverberation time. Factors affecting the acoustics of a building, and their remedies. (9)

ULTRASONICS:
Introduction, production, magnetostriction effect, magnetostriction generator, piezoelectric and inverse piezoelectric effect, piezoelectric generator. Detection, properties, cavitation. Applications. Sound ranging, SONAR. Non destructive testing: Pulse echo method, through transmission and resonance method. Industrial applications: drilling, cleaning, welding and cutting. (9)

GEOMETRICAL OPTICS:
Lens aberrations, Chromatic aberration, condition for achromatism: achromatism when lenses are in contact and lenses separated. Spherical aberration-reducing spherical aberration. Defects of images, Coma, astigmatism, distortion and curvature of the field. Methods to eliminate them. (9)

PHYSICAL OPTICS:

FIBER OPTICS:
Principle, modes of propagation, numerical aperture, fabrication techniques: rod and tube method, crucible-crucible method. Classification based on materials, refractive index profile and modes. Splicing. Losses in optical fiber. Fiber optic communication. (9)

Total L : 45

TEXT BOOKS:

REFERENCES:

15S304 MATHEMATICAL PHYSICS

CURVILINEAR COORDINATES:
Orthogonal curvilinear coordinates; concept of a metric, spherical and cylindrical coordinates and their unit vectors. (5+5)

TENSOR ANALYSIS:
Introduction to tensors, Cartesian, covariant and contravariant tensors - contractions and direct-products, pseudo, dual, isotropic, symmetric and anti-symmetric tensors. (4+4)
MATRICES: Hermitian, orthogonal and unitary matrices, inverse of a matrix, similarity transformations, Eigen value problems and diagonalization of matrices - non-degenerate and degenerate cases. (5+5)

DIFFERENTIAL EQUATIONS: Second order homogeneous differential equations and their series solution -Bessel equation, linear independence of two solutions -Wronskian, Integral and power series methods for second solution. (6+6)

SPECIAL FUNCTIONS: Bessel, Legendre -spherical harmonics, Hermite and Laguerre: generating functions and recurrence relations, orthonormality conditions, Dirac delta function. (6+6)

FOURIER ANALYSIS: Fourier theorem, Fourier analysis of square wave, saw-tooth wave, plucked strings, half wave/full wave rectifier wave forms. (4+4)

TEXT BOOKS:

REFERENCES:

15S305 ORGANIC CHEMISTRY I


REACTIONS OF SYNTHETIC SIGNIFICANCE: Malonic ester, acetoacetic ester and cyano acetic ester preparation and synthetic applications. Tautomerism of acetoacetic ester. (6)

TEXT BOOKS:

REFERENCES:


OXYGEN GROUP ELEMENTS: Structure and allotropy of group 16 elements, ozone, oxides - normal oxides, peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides and neutral oxides. Oxides of sulphur - oxoacids of sulphur-thionic acid series, peroxoacid series, oxohalides-thionyl compounds, sulphuryl compounds (methods of preparation and properties).


REFERENCES:

TEXT BOOKS:

15S307 ACOUSTICS AND OPTICS LABORATORY

1. Determination of frequency of the tuning fork - Melde's apparatus.
2. Determination of wavelength and beam divergence of laser.
3. Determination of refractive index - Brewster's law.
4. Determination of thickness of thin wire - Air wedge
5. Determination of refractive index of glass using Laser
6. Determination of resolving power of a grating
7. Study of double refraction - Calcite crystal
8. Determination of velocity of sound - Helmholtz Resonator.
10. Demonstration of ultrasonic cleaning.

Total P: 60

15S308 INORGANIC CHEMISTRY LABORATORY

I. Inorganic qualitative analysis:
Analysis of a mixture containing two cations and two anions (one of which will be an interfering ion). Semi-micro methods using the conventional scheme may be adopted.
Anions: Carbonates, sulphides, sulphates, fluorides, chlorides, bromide, nitrate, oxalate, phosphate, and borate.
Cations: Lead, copper, tin, cadmium, bismuth, aluminium, iron, manganese, zinc, cobalt, nickel, calcium, strontium, barium, magnesium and ammonium.

II. Inorganic quantitative analysis:
 a) Gravimetric analysis
   Estimation of nickel as Ni-DMG.
   Estimation of calcium as calcium oxalate.
 b) Photocalorimetry
   Estimation of iron.
   Estimation of nickel.

III. Preparation of inorganic complexes:
 a) Tetrammine copper (II) sulphate.
 b) Prussian blue.

REFERENCE:
1. Lab manual prepared by the faculty of department of applied science.

SEMESTER IV

15S401 PROBABILITY AND STATISTICS


THEORITICAL DISTRIBUTIONS AND APPLICATIONS: Discrete distributions: Binomial, Poisson and Geometric distribution. Continuous distributions: Uniform, Normal, Exponential and Gamma distributions. (8+8)

CORRELATION AND REGRESSION: Introduction – Linear correlation and regression -Estimation using the regression line -analysis - Multiple correlation and regression - Limitations, errors, and caveats of using regression and correlation analyses. (5+5)

ASSOCIATION OF ATTRIBUTES: Difference between Correlation and Association – Consistency of data- Association and Disassociation – Methods of studying Association. (4+4)


Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:

15S402 MATHEMATICAL STRUCTURES

GROUPS: (Revision - Groups : Axioms, examples, Elementary properties of a group) Subgroups and cyclic groups. Isomorphisms , Cosets and Lagranges theorem , Normal subgroups and quotient groups and homomorphisms , Cayley's theorem , Group Codes. (9+9)

RINGS: Definition and examples , Subrings and simple properties of rings, Simple theorems in rings , fields , examples , Integral domain. (9+9)

MATRICES AND LINEAR TRANSFORMATIONS: Rank of a matrix, Consistency and inconsistency of system of linear algebraic
equations. Eigenvalues and Eigenvectors , Quadratic form , reduction to canonical form by orthogonal reduction. Linear
transformation as matrix. (6+6)

TEXT BOOKS:
2. Trembley J.P. and Manohar R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill,
2008.

REFERENCES:

15S403 MECHANICS, OSCILLATIONS AND WAVES

THE LAWS OF MOTION: Resolution and combination of vectors, concept of force, Newton’s first law and inertial frames, mass,
Newton’s second law, the force of gravity, Newton’s third law, Applications of Newton’s laws. (6+6)

ENERGY OF A SYSTEM: Work done by a constant force and varying force, kinetic energy theorem, potential energy of a system,
conservative and non conservative forces, conservation of mechanical energy, potential energy curves. (6+6)

COLLISIONS AND ROTATIONAL MOTION: centre of mass, Impulse and momentum, collision in 1 & 2 dimension, Angular velocity
and acceleration, Torque, Rotational energy, Angular momentum, Conservation of angular momentum. (6+6)

OSCILLATORY MOTION: Review of simple harmonic motion- Differential equation of SHM. Velocity and acceleration. Restoring
force. Vibration of a spring and mass system. Frequency response, phase response and resonance. Analogy with LCR circuits and
oscillators. Energy and energy loss. Damped oscillations. Significance in control systems, vibration and vibration isolation. (6+6)

Differential equation of a plane progressive wave. Phase velocity. Phase and phase difference. Differential equation of a plane
progressive wave and solution. Introduction to numerical methods for solution of wave equation. Importance of spherical and plane
wave fronts. (6+6)

TEXT BOOKS:

REFERENCES:
2010.

15S404 ANALOG AND DIGITAL ELECTRONICS

P-N JUNCTIONS: Diode theory, forward and reverse-biased junctions, reverse-bias breakdown, load line analysis, diode
applications - Limiters, clippers, clampers, voltage multipliers, half wave & full wave rectification, Zener diode, Zener voltage
regulators. (7)

BIPOLAR JUNCTION TRANSISTORS (BJT):Transistor fundamentals, transistor configurations, DC operating point, BJT
characteristics & parameters, fixed bias, potential divider lines bias with and without emitter bias, analysis of above circuits and their
design, variation of operating point and its stability. (8)

FIELD-EFFECT TRANSISTORS (FET): JFET- current-voltage characteristics, effects in real devices, high-frequency and high-
speed issues. (4)

TRANSISTORS AMPLIFIER: Small Signal BJT amplifiers: AC equivalent circuit, hybrid model and their use in amplifier design.
Multistage amplifiers, frequency response of basic and compound configuration. (7)

NUMBER SYSTEMS: Decimal, binary, octal, hexadecimal number system and conversion, binary weighted codes, signed numbers, 1s and 2s complement codes, binary arithmetic.

BOOLEAN ALGEBRA AND KARNAUGH MAPS: Boolean relations - Laws and theorems - Simplifications - canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps.

TEXT BOOKS:

REFERENCES:

15S405 ORGANIC CHEMISTRY II

HETEROCYCLIC COMPOUNDS: Electrophilic substitution in pyrrole, furan and thiophene – structure and reactions of pyridine – synthesis of indole, quinoline and isoquinoline with reference to Fischer, Skraup and Bischofer-Napieralski methods.


TEXT BOOKS:

REFERENCES:

15S406 INORGANIC CHEMISTRY II


MODERN THEORIES OF COORDINATION COMPOUNDS: Valence bond theory hybridization, geometry, magnetism, drawbacks of VBT. Crystal field theory - crystal field effects, crystal field splitting in octahedral and tetrahedral, high-spin and low-spin complexes, crystal field stabilization energy (CFSE), factors influencing the magnitude of crystal field splitting, spectrochemical series. Applications of crystal field theory - colour and magnetic properties of complexes. (12)


TEXT BOOKS:

REFERENCES:

15S407 ELECTRONICS LABORATORY

1. Diode and Zener characteristics – DC load line analysis.
2. Junction transistor characteristics-Determination of hybrid parameters.
3. FET characteristics – Determination of amplification factor.
4. Unregulated power supply-Determination of ripple factor and regulation factor.
5. Regulated power supply using Zener diode.
6. Regulated power supply using IC regulator.
7. Single stage RC amplifier.
10. Operational amplifier (741) - inverting and non-inverting modes.
11. Operational amplifier (741) - integrator and differentiator.
12. Logic gates-Determination of truth table.
14. Combination of logic gates - half-adder and full-adder.

Total P : 60

15S408 ORGANIC CHEMISTRY LABORATORY

I. Organic qualitative analysis:
   a. Characterization of functional groups
   b. Confirmation by preparation of solid derivatives/characteristic colour reactions.
II. Organic preparation (single stage only):
   a. Preparation of methyl orange.
   b. Preparation of methyl salicylate.
   c. Preparation of picric acid.
III. Chromatographic separation of pigments.
IV. Determination of melting point.

Total P: 60

REFERENCE:
1. Lab manual prepared by the faculty of department of applied science.
SEMESTER V

15S501 OPERATIONS RESEARCH


Duality and Post-Optimal Analysis: Dual and Primal relationships – Economic interpretation of Duality - Dual Simplex Method – Sensitivity Analysis: Change in the right hand side (6+6)

Transportation Model: Transportation problem and its solution by Modi method – Assignment problem and its solution by Hungarian method (6+6)

CPM AND PERT: Calculations of critical path on networks, various floats for activities, critical path, time estimates, earliest expected time, latest allowable occurrence time and slack of events, calculations of critical path on PERT networks, probability of meeting scheduled date of completion of project. (6+6)


Total L: 30 + T:30 = 60

TEXT BOOKS:

REFERENCES:

15S502 GRAPH THEORY

INTRODUCTION: Graphs and digraphs – degree of a vertex , walks, paths, circuits and distance, common families of graphs, graph modeling Applications. (8+8)

MATRIX REPRESENTATION OF GRAPHS: Incidence , Adjacency , Path and Circuit matrices – properties. (4+4)

CONNECTIVITY : Definition, Vertex and edge connectivity , articulation point. Eulerian and Hamiltonian graphs. (4+4)

TREES: Definition, Properties, Spanning trees – matrix tree theorem, Cayley’s formula. Fundamental circuits. (5+5)


Total L: 30 + T:30 = 60

TEXT BOOKS:

REFERENCES:
1. Narasingh Deo, " Graph Theory with Applications to Engineering and Computer Science ", Prentice Hall of India, 2005.

15S503 SOLID STATE PHYSICS

CRYSTALLOGRAPHY: Crystal systems, Lattice parameters, Bravais lattice, Packing factors of cubic and HCP crystal systems. Miller indices, Linear and planar density of atoms. X-Ray diffraction, Debye-Scherrer method to study crystal structure. Crystal imperfections, point, line and surface defects. (9)


DIELECTRIC MATERIALS: Qualitative study of various polarization mechanism. Effect of temperature and frequency on dielectric constant. Dielectric loss. Ferroelectric materials: Classification, piezoelectric materials, applications of ferroelectric and piezoelectric materials. Breakdown mechanisms. (9)

TEXT BOOKS:

REFERENCES:

Total L : 45

15S504 QUANTUM MECHANICS

THE EXPERIMENTAL BASIS OF QUANTUM MECHANICS: Black body radiation, photo electric effect, Bohr’s theory of hydrogen atom, electron diffraction. Heisenberg’s uncertainty principle: Statement and explanation. Matter waves, basic postulates in quantum mechanics, probability, properties of the wave function, the correspondence principle. (5+5)

OPERATORS IN QUANTUM MECHANICS AND THEIR PROPERTIES: Hermitian operators, commutative properties, eigen values, eigen functions, expectation value of physical variable. (5+5)

SCHRODINGER EQUATION: Time dependent Schroedinger equation and time independent Schrödinger equation. Solution of time independent Schrödinger equation for simple quantum mechanical systems; Particle in one and three dimensional box. One dimensional harmonic oscillator (Assuming H_n(y) for various states), discussion of the eigen values and eigen states, Quantum tunneling- transmission and reflection coefficient and Hydrogen atom. (10+10)

ANGULAR MOMENTUM: Orbital angular momentum operators, commutation relations, eigen values from solution of Schrödinger’s equation of Hydrogen atom. spin angular momentum, the spin operators, eigen functions and eigen values. (5+5)


Total L: 30 +T: 30=60

TEXT BOOKS:

REFERENCES:

15S505 APPLIED CHEMISTRY

screening, sedimentation with coagulation and filtration (principles only) – removal of micro-organisms by break point chlorination - desalination process. (9)


**LUBRICANTS AND PAINTS:** Lubricants – mechanism of lubrication – viscosity, viscosity index, flash and fire points – oiliness – cloud and pour points – aniline point (determination not included) – additives for lubricants. Greases – types and uses, solid lubricants – graphite and MoS\textsubscript{2}. Paints – constituents and their functions – emulsion paints – special paints: luminescent paints, water repellent paints, heat resistant paints, fire retardant paints and acid resistant paints. (9)

**OILS, FATS AND SOAPS:** Chemical constitution, distinction between oils and fats, chemical analysis of oils and fats – acid, saponification and iodine values, definitions, determination and significance. (9)

**ELECTROCHEMISTRY:** Chemical and electrochemical corrosion – mechanisms, corrosion prevention and control - material selection and design - cathodic protection - use of inhibitors. Electroplating of metals and alloys – fundamentals of electroplating - electroplating of Cu, Ni, and Cr and its applications. Electroforming - plated through hole PCB’s, electrochemical machining. Anodising – characteristics of anodic film in aluminium - determination of thickness of anodic film. (9)

**TEXT BOOKS:**

**REFERENCES:**

**15S506 PROFESSIONAL ENGLISH**

**COMMUNICATION SKILLS USING LITERARY TEXTS:** Comprehension and critical evaluation of literary essays – Focus on language style, vocabulary, variety of expression, and emphasis techniques – Review of short stories – critical appreciation of poetry - Review of a novel. (12)

**ESSENTIALS OF PROFESSIONAL COMMUNICATION:** Intra and Interpersonal communication, Interview techniques, Group communication, Public speaking, and Presentation techniques - Style and writing techniques, Email writing, and Cross – cultural communication. (10)

**FOCUS ON SOFT SKILLS:** Etiquette, Body language, Telephone conversation, and Team building. (4)

**REPORT WRITING:** Format and different types of formal reports, memos, and proposals. (5)

**PROFESSIONAL SKILLS:** Presentations and reviews – Group discussions – Mock interviews, and Case studies. (14)

**TEXT BOOK:**
1. Monograph prepared by the Faculty, Department of English, 2015.

**REFERENCES:**

**15S507 SOLID STATE PHYSICS LABORATORY**

1. Determination of lattice constant - Analysis of powder diffraction pattern.
2. Determination of thermal conductivity of metallic wire-Weidmann- Franz Law
4. Hall Effect set up - Determination of Hall coefficient.
5. Solar cell - I-V characteristics and determination of efficiency.
8. Determination of dielectric constant and Curie Temperature of Barium Titanate.

Total P: 60

15S508 APPLIED CHEMISTRY LABORATORY

0 0 4 2

1. Estimation of total, temporary, permanent, calcium and magnesium hardness of water.
2. Determination of different types of alkalinites of water sample.
3. Determination the percentage of moisture and ash content of a coal sample.
4. Determination of acid, saponification and iodine values of an oil sample.
5. Study of viscosity of lubricating oil using Saybolt / Redwood viscometer.
6. Determination of corrosion rate and inhibitor efficiency of mild steel in acid media by weight loss method.
7. Anodising of aluminium and determination of thickness of anodic film.
8. Electroplating of nickel and determination of cathodic efficiency.

Total P: 60

REFERENCE:
1. Lab manual prepared by the faculty of department of applied science.

PROFESSIONAL ELECTIVES

Mathematics and Computer Science Cluster

15S001 NUMERICAL METHODS

3 0 0 3

TYPES OF ERRORS: Different types of error. (4)

SOLUTION OF ALGEBRAIC EQUATIONS: Newton Raphson method, Modified Newton Raphson method, Method of false position, Graffe’s root squaring method, Bairstow’s method. (6)


EIGENVALUES AND EIGENVECTORS: Power method for finding dominant eigenvalue and inverse power method for finding smallest eigenvalue, Jacobi method for finding eigen values of symmetric matrices. (8)

NUMERICAL DIFFERENTIATION AND INTEGRATION: Numerical Differentiation: Newton’s forward and backward difference formulas. Numerical Integration: Newton –Cotes formula, Trapezoidal rule, Simpson’s (1/3)rd and (3/8)th rule. Gaussian Quadrature upto two points. (7)


Total L : 45

TEXT BOOKS:

REFERENCES:

15S002 DIFFERENTIAL EQUATIONS

3 0 0 3

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER: Basic concepts, separable ordinary differential equations, exact differential equations, integrating factors, linear differential equations, Bernouli equations. (9)
ORDINARY DIFFERENTIAL EQUATIONS OF SECOND ORDER: Homogeneous linear equations with constant co-efficients linearity principle (statement only), initial value problem, general solution, second order homogeneous equations with variable co-efficient, Euler – Cauchy equation, Method of variation of parameters. (12)

FOURIER ANALYSIS: Periodic functions, trigonometric series, Fourier series- functions of any period, even and odd functions. Half range fourier expansions, Harmonic analysis. (12)

PARTIAL DIFFERENTIAL EQUATIONS: Basic concepts, modeling-Vibrating string, wave equation, D’Alembert’s solution of wave equation, solution by separating variables, solution using Fourier series, one-dimensional heat equation – solution by Fourier series, steady state two-dimensional heat equation. (12)

TEXT BOOKS:

REFERENCES:

15S003 DISCRETE MATHEMATICS

MATHEMATICAL LOGIC: Propositional Logic- propositional equivalences- predicates and quantifiers- rules of inference- normal forms. (10)


SETS, FUNCTIONS AND RELATIONS: Set operations- functions- relations and their properties- representing relations using matrices- representing relations using digraphs- equivalence relations- partial orderings. (10)

COUNTING TECHNIQUES: Basic counting principles- the pigeonhole principle- permutations and combinations- generalized permutations and combinations- generating permutations and combinations. (7)

ADVANCED COUNTING TECHNIQUES: Some Recurrence Relation Models- Solutions of linear homogeneous recurrence relations with constant coefficients- solution of linear non-homogeneous recurrence relations by the method of characteristic roots. (10)

TEXT BOOKS:

REFERENCES:

15S004 MATHEMATICAL ANALYSIS

REAL AND COMPLEX NUMBER SYSTEMS: Finite, countable and uncountable sets, ordered sets, extended real number system, complex field, Archimedean property supremum and infimum. (10)

METRIC SPACES: Definition and examples, open, closed, compact sets, perfect sets, connected sets Heine-Borel theorem, Weistrass theorem. (12)

NUMERICAL SEQUENCES: Definition- Convergent sequences, subsequences, Cauchy sequences, upper and lower limits. (11)

NUMERICAL SERIES – Series of nonnegative terms, the number ‘e’, the root test and ratio test, power series, summation of parts, absolute convergence, addition and multiplication of series. (12)

TEXT BOOKS:

REFERENCES:

15S005 ALGEBRAIC NUMBER THEORY

THE FUNDAMENTAL THEOREM OF ARITHMETIC: Introduction – Divisibility - Greatest common divisor - Prime numbers - The fundamental theorem of arithmetic - The Euclidean algorithm - Least Common Multiple - Linear Diophantine Equations

CONGRUENCES: Definition and basic properties of congruences - Linear Congruences - Congruence Applications - Divisibility Tests - Modular Designs - Check Digits - Simultaneous linear congruences - The Chinese remainder theorem - Wilson’s Theorem - Fermat’s Little Theorem - Euler’s Theorem.

ARITHMETICAL FUNCTIONS: Introduction - The Möbius function \( \mu(n) \) - The Euler totient function \( \varphi(n) \) - A relation connecting \( \varphi \) and \( \mu \) - A product formula for \( \varphi(n) \) - The Dirichlet product of arithmetical functions - Multiplicative functions - Dirichlet multiplication.

QUADRATIC CONGRUENCES: Quadratic Residues - The Legendre Symbol, Quadratic Reciprocity - The Jacobi Symbol

TEXT BOOKS:

REFERENCES:

15S006 STOCHASTIC PROCESSES


TEXT BOOKS:

REFERENCES:

15S007 COMPUTER NETWORKS AND TCP/IP

INTRODUCTION: Network goals - Applications of Networks - OSI Reference Model - Types of Network - Network Topologies - Bandwidth, Bit Rate, Baud Rate


APPLICATION LAYER PROTOCOLS: SMTP - MIME - DNS - HTTP.

TEXT BOOKS:

REFERENCES:

15S008 CYBER SECURITY 3 0 0 3


WEB SECURITY: Overview, various types of web application vulnerabilities, Reconnaissance, Authentication, Authorization (Fuzzing and Privilege Escalation), Session Management, Cross Site Scripting (XSS), Cross Site Request Forgery (CSRF), SQL Injection and Blind SQL Injection.


TEXT BOOKS:

REFERENCES:

15S009 DATABASE MANAGEMENT SYSTEM 3 0 0 3

DATA MODELING: Introduction – Data associations – Entities, attributes, relationships – Type role and structural constraints – Weak and Strong entity types – Design of Entity Relationship data models (ERD) – Generalization – Aggregation – Conversion of ERD into tables – Applications (6)


RELATIONAL MODEL: Introduction to Relational Data Model – Basic concepts – Enforcing Data Integrity constraints – Relational Algebra Operations. (5)

RELATIONAL DATABASE MANIPULATION: Introduction to Structured Query Language (SQL) – SQL Commands for defining Database, Constructing database, Manipulations on database – Basic data retrieval operations – Updates in SQL – Views in SQL. (5)

DATABASE SECURITY, INTEGRITY CONTROL: Security and Integrity threats – Defense mechanisms – Discretionary Access Control and Mandatory Access Control. (3)

TEXT BOOKS:

REFERENCES:

15S010 WEB PROGRAMMING


THE .NET PLATFORM: Introduction to .NET - Featured of .NET – Components of .NET architecture (6)

VB.NET: Elements – Operators – Control Structures – Methods – Classes and Objects – Case Study (8)

VISUAL STUDIO .NET IDE WITH C#: Components – Features – Customizing the IDE – Creating a project – Simple Windows Form Application with C#.NET (8)

ASP.NET: Architecture – Controls - global.asa - Working with Web Forms - Working with ADO.NET - Simple application with SQL (7)

TEXT BOOKS:

REFERENCES:

15S011 ADVANCED DATA STRUCTURES

INTRODUCTION: Algorithm – analysis of algorithms – best case and worst case complexities, analysis of some algorithms using simple data structures. (5)
BINARY SEARCH TREES: Searching – Insertion and deletion of elements – Analysis. (4)

AVL TREES: Definition – Height – searching – insertion and deletion of elements, AVL rotations – Analysis. (8)

MULTIWAY SEARCH TREES: Indexed Sequential Access – m-way search trees – B-Tree – searching, insertion and deletion - B-trees - Tries. (13)

PRIORITY QUEUES: : Minheap, maxheap, heap operations (4)

HASHING: Hash function – Separate chaining – open addressing – Linear probing – quadratic probing – Double hashing. (6)

GRAPHS: Representations – adjacency matrix, linked adjacency list – graph search methods – Breadth First search and Depth First search – Applications. (5)

Total L: 45

TEXT BOOKS:

REFERENCES:

15S012 DESIGN AND ANALYSIS OF ALGORITHMS

INTRODUCTION: Fundamentals of algorithmic problem solving, deciding an appropriate data structure and algorithm design technique – Methods of specifying an algorithm – analyzing an algorithm, Asymptotic notations, Recurrences – Master theorem. (9)

DIVIDE AND CONQUER: Quick sort, Merge sort, Integer multiplication, Strassen’s matrix multiplication. (5)

GREEDY METHOD: Optimal caching, minimum cost spanning tree. (Kruskal and Prim’s algorithms) , topological sorting , Huffman codes and data compression. (7)

DYNAMIC PROGRAMMING: Principles of dynamic programming – 0/1 knapsack problem, all pairs shortest path problem (6)

BACK TRACKING: Method - n- queens problem, Graph coloring problem (6)

BRANCH AND BOUND: Method - Assignment problem, Traveling salesman problem (6)

NP AND COMPUTATIONAL INTRACTABILITY: Basic concepts – Polynomial time reductions, efficient certification and NP, NP hard and NP complete problems (6)

Total L: 45

TEXT BOOKS:

REFERENCES:

Physics Cluster

15S016 LASER TECHNOLOGY

LASER CHARACTERISTICS: Basic characteristics, Spatial and temporal coherence, Beam quality and output characteristics. Beam divergence and focusing using optical system. Types of laser based output beam: continuous, pulsed lasers, ultra short pulses.

SOLID STATE LASERS: Introduction, Nd : Glass, Nd: YAG and semiconductor diode lasers, construction, energy level diagram, excitation mechanisms and output characteristics.

GAS AND LIQUID LASERS: He-Ne, CO₂ Excimer and dye laser, construction, energy level diagram, excitation mechanisms and output characteristics.


TEXT BOOKS:

REFERENCES:

15S017 SEMICONDUCTOR TECHNOLOGY AND DEVICES


OPTO ELECTRONIC DETECTORS AND LASER DIODES: Optical absorption in a semiconductor, Materials for optical detectors, Avalanche photo detector, Photo transistor, Laser diode, Quantum well lasers and quantum dot lasers.

TEXT BOOKS:

REFERENCES:

15S018 CERAMICS AND COMPOSITES

CERAMIC STRUCTURES: Introduction – Ax type, Ax₂ type, AₓBₙXₚ type – Crystal structures – Factors affecting structures. Binary structures based on close packing of anions – Hexagonal close packed fluorite and antifluorite, rutile structure – Structure of covalent ceramics.

CERAMIC PROCESSING: Sintering, Hot isostatic pressing, sol-gel process, chemical vapour deposition, injection moulding.


TEXT BOOKS:

REFERENCES:

15S019 SCIENCE OF COLOUR


COLOUR PERCEPTION: The nature of colour-The physical basis of colour, The human colour vision system. Theories of colour vision, Hue, Luminosity, Lightness, Saturation, Reducing power and Opacity.

COLOUR DESCRIPTION: Arrangement of colour, visual attribution of colour, Beer-Lambert's law, colour primaries and colour mixing, additive and subtractive colour mixing, colour specification, colour order systems – Munsell colour order system and Ostwald colour order system.

COLOUR MEASUREMENT: Principles of colour measurement, Tristimulus values, CIE diagram, standard Illuminant, standard observer, spectral reflectance, graphic representation, numeric representation.


COMPUTER COLOUR MATCHING: Concept of computer colour matching (CCM) system. Application of CCM system to Textile processing. Advantages of CCM system. Limitations of CCM system. Colour constancy and materialism.

TEXT BOOKS:

REFERENCES:

15S020 NANOMATERIALS AND APPLICATIONS

INTRODUCTION AND CLASSIFICATION: Classification of nanostructures, nanoscale architecture – effects of the nanometer length scale – effects of nanoscale dimensions on various properties – structural, chemical, mechanical, magnetic, optical and electronic properties.

**3003 15S021 PLASMA TECHNOLOGY**

**GASES:** Masses and Numbers of Atoms, kinetic energy and temperature, mean speed Maxwell – Boltzmann distribution, pressure, Avagadro’s Laws, number density of gasses, impingement flux monolayer formation time mean free path, probability of collision, collision frequency, energy transfer during collision, gas flow, types.  

**GAS PHASE COLLISION PROCESS:** Collision cross section, elastic and inelastic collision ionization, excitation, relaxation, recombination, dissociation, electron attachment, Ion-Neutral collision, Metastable collision.  


**ARC DISCHARGE:** Definition and characteristics - features of arc discharge. High intensity arcs, classification of arcs, free burning arc, wall, vortex, - Non thermal arcs; low pressure and low intensity arcs.  

**LABORATORY PLASMA SOURCES/DEVICES:** Low temperature plasma generation, transferred and non-transferred arc torches and their characteristics, vacuum plasma torches.  

**PLASMA DIAGNOSTICS:** Electrical probe techniques - spectroscopic methods - charged particle methods.  

**Total L:** 45

**TEXT BOOKS:**

**REFERENCES:**

**3003 15S022 LINEAR INTEGRATED CIRCUITS**

**OPERATIONAL AMPLIFIER BASICS:** Open-loop voltage gain, input offset, slew rate, inverting, non-inverting amplifiers, unity gain voltage follower.  

**CIRCUITS FOR MATHEMATICAL OPERATIONS:** Inverting summing amplifier, logarithmic amplifier, differentiators, integrators, applications.  

**AMPLIFIERS FOR MEASUREMENTS:** Differential amplifier, common mode rejection ratio, bridge amplifier, considerations. Instrumentation amplifier – working, principle, expression for voltage gain, characteristics and applications.  

**SPECIAL PURPOSE AMPLIFIERS:** Input impedance, inputs offset and drift. FET input amplifiers, applications to high impedance measurements. Isolation amplifiers, Chopper stabilized amplifiers – principle, characteristics and applications.  

**Total L:** 45
ACTIVE FILTERS: First-order Low pass, high pass, band pass and band reject filters. Frequency response and cut-off frequencies, applications.

TEXT BOOKS:

REFERENCES:

13S023 EXPERIMENTAL TECHNIQUES IN MATERIALS SCIENCE


SCANNING PROBE MICROSCOPY : Instrumentation, Scanning Tunneling Microscopy, Tunneling current, probe tips and working environments, operational modes, typical applications, atomic force microscopy, near field forces, force sensors, operational modes, applications, image artifacts


TEXT BOOKS:

REFERENCES:

15S024 CRYSTAL GROWTH TECHNIQUES


SOLUTION GROWTH TECHNIQUES: Growth from low temperature solutions: Selection of solvents and solubility – Meir’s solubility diagram – Saturation and supersaturation – Metastable zone width – Growth by restricted evaporation of solvent, slow cooling of solution and temperature gradient methods

TEXT BOOKS:

REFERENCE:

15S025 FERROELECTRIC MATERIALS AND DEVICES


FERROELECTRIC MEMORY DEVICES: DRAM – Ferroelectric DRAM – Non volatile ferroelectric memory – FRAM (inversion current type) – MFSFET


TEXT BOOKS:

REFERENCES:

15S026 MEASUREMENTS AND INSTRUMENTATION


TRANSUCERS: Transducer classification: Variable resistance transducer, capacitative and piezoelectric transducer, photodiode, photomultiplier tube. Hall effect transducer,

SIGNAL CONDITIONING AND DATA TRANSMISSION: Mechanical amplifiers (lever only), fluid amplifiers, optical amplifiers-optic levers. Mechanical transmission, hydraulic transmission, magnetic transmission, electrical transmission.

FLOW AND STRAIN MEASUREMENTS: Classification of fluid flow measurement techniques- Nutating disc meter, rotary vane flow meter, hot wire anemometer, electromagnetic flow meter. Strain measurement: Resistance strain gauge, bonded and un bonded strain gauges, metal foil gauge, wire strain gauge, strain measurement using bridge. Four active strain gauge bridge (Null method and deflection method).

Total L : 45

TEXT BOOKS:

REFERENCES:

Chemistry Cluster

15S031 POLYMER CHEMISTRY

3003


Total L : 45

TEXT BOOKS:

REFERENCES:

15S032 ENVIRONMENTAL CHEMISTRY

3003


ENVIRONMENTAL MONITORING: Indian standards for pollution levels (concentrations) with respect to air and water. Measurement techniques for water quality: pH, conductivity, temperature, turbidity, chlorides, sulphates, sulphides, nitrates, nitrites, phosphates, fluoride and phenolic compounds. Measurement techniques for air quality: particulate matter, oxides of sulphur and nitrogen, unburnt hydrocarbons, carbon dioxide, carbon monoxide and ozone. (9)

TEXT BOOKS:

REFERENCES:

15S033 APPLIED ELECTROCHEMISTRY
3 0 0 3

ELECTROCHEMICAL ENERGY SOURCES: Batteries – characteristics - voltage, current, capacity, electricity storage density, power, discharge rate, cycle life, energy efficiency, shelf life. Primary and secondary batteries – dry cell, lead- acid battery, Ni - Cd and lithium ion batteries - applications. (9)

FUEL CELLS: Classification, working principle, components and environmental aspects of solid oxide, molten carbonate, direct methanol and proton exchange membrane fuel cells. Hydrogen as a fuel – the role of chemistry in overcoming the challenges in the production, storage and utilization of hydrogen. (9)


INDUSTRIAL ELECTROCHEMICAL PROCESSES: Plated through hole PCB’s, electroforming - fabrication of CD stampers and wave guides. Electropolishing, electrochemical machining, electrochemical etching of Cu from PCBs, electrochemical etching of semiconductors. (9)

TEXT BOOKS:

REFERENCES:

15S034 ANALYTICAL CHEMISTRY
3 0 0 3

INTRODUCTION TO ANALYTICAL CHEMISTRY: Evaluation of analytical data: Idea of significant figures - its importance. Accuracy – methods of expressing accuracy - error analysis - types of errors - minimizing errors. Precision - methods of expressing precision - mean, median, mean deviation, standard deviation and confidence limit. Method of least squares - problems involving straight line graphs, student’s t-test, F-test and Chi-square distribution. (9)

QUANTITATIVE ANALYSIS : Estimations of commercial samples - determination of percentage purity of samples - pyrolusite, iron ore, washing soda and bleaching power - estimation of glucose and phenol. Gravimetric analysis - principle - theories of precipitation - solubility product and precipitation - conditions of precipitations - types of precipitants - specific and selective precipitants - organic and inorganic precipitants - types of precipitation - purity of precipitates - co precipitation - post precipitation - precipitation from homogeneous solution - use of sequestering agent. (9)
CHEMISTRY OF NANOMATERIALS

15S035

INTRODUCTION TO NANOMATERIALS: Colloids - concepts of nanomaterials, size and confinement effects. Quantum dots, wires and wells. Size induced metal to insulator transition, fraction of surface atoms, specific surface energy and surface stress, effect on the lattice parameter, effect on the phonon density of states. Properties - electronic, optical, magnetic, thermal, mechanical and electrochemical properties.

TYPES OF NANOMATERIALS: Metal, semiconductor, oxide nanoparticles, polymer nanoparticles, micro, meso and nanoporous materials. Organic-inorganic hybrids, intercalation compounds, zeolites, nanocomposites, mueller systems - self-assembled monolayers, gas phase clusters, semiconductor quantum dots, magnetic nanoparticles, core-shell structures, nanoshells, nanofibers, supramolecular nanostructures - molecular nanomachines.


SOL-GEL TECHNIQUES: Aqueous sol-gel synthesis, nonaqueous sol-gel synthesis - surfactant directed approaches - hot-injection method, heating-up method, solvothermal synthesis, microwave technique, seed-mediated growth, solvent-controlled approaches - reaction of metal halides with alcohols, reaction of metal alkoxides, acetates and acetylacetonates with alcohols, reaction of metal alkoxides with aldehydes and ketones, reaction of metal acetyl acetonates with amines and nitriles.

NANOMATERIALS IN ELECTRONIC DEVICES: Organic thin film transistors, organic light-emitting diodes, conducting polymer based electrochemical transistors, electroluminescent devices, electrochromic devices, photoelectrochromic devices, printed and flexible devices.

REFERENCES:

Total L: 45
15S036 CORROSION SCIENCE AND ENGINEERING  

THERMODYNAMICS OF AQUEOUS CORROSION: Electrode processes – electrode potential, free energy, emf series, potential measurements with reference electrodes, three electrode systems, computation and construction of Pourbaix diagrams of Fe. Practical use of E-pH diagrams. Chemical Vs electrochemical mechanisms of corrosion reactions, corrosion rate expressions. (9)

KINETICS OF AQUEOUS CORROSION: Corrosion current density and corrosion rate, exchange current density. Polarization – activation control, Tafel equation, mass transport control, mixed potential theory and behavior of galvanic couples in acidic environments, effect of oxidizer, combined polarization, factors affecting polarizations and rate of corrosion. Passivity, potentiostatic polarization curves, factors affecting passivity, mechanism of action of passivators. (9)


TEXT BOOKS:

REFERENCES:

15S037 PHARMACEUTICAL CHEMISTRY  

INTRODUCTION TO PHARMACEUTICAL CHEMISTRY: Definition - drug, pharmacophore, pharmacology, pharmacopeia, pharmacodynamics, bacteria, virus and vaccine. Causes, symptoms and drugs for anemia, jaundice, cholera, malaria and filarial Indian medicinal plants and uses – tulasi, neem, kizhanelli, mango, semparuthi, adadodai and thothuvalai. Blood-grouping, composition, Rh-factor, blood - pressure, hypertension and hypotension. (9)


CHEMOTHERAPY: Introduction, chemotherapeutic agents: phenyl butazone, β-lactam pencilin, ampicillin and chloramphenicol and streptomycin. (9)

Total L : 45
TEXT BOOKS:

REFERENCES:

15S038 TEXTILE CHEMISTRY AND TEXTILE CHEMICAL PROCESSING

CHEMISTRY OF TEXTILE FIBRES: Molecular structure, polymeric aspects, reactivity and morphology of natural, regenerated and synthetic fibres – cotton, jute, wool, silk, viscose, lyocell, polyester, nylon, acrylic, lycra, polypropylene, and micro fibres. Physical and chemical properties of textile fibres and their uses. Texturization – types, properties and uses.


COLOURATION ON TEXTILES: Types of dyes used for cellulosic, protein and synthetic textiles – methods of dyeing of these fibres, machineries used for dyeing. Methods and styles of printing, printing of cellulosic fabric with reactive dyes, protein fabric with acid dyes and polyester fabric with disperse dyes, pigment printing, transfer printing, flock printing, tie and dye – screen printing, rotary screen printing, roller printing – steaming and curing – colour estimation.


EFFLUENTS AND ECO-FRIENDLY PROCESSING: Effluents from different wet processing units, chemicals and dyes creating pollution, causes of pollution, criteria in effluent treatment plant (ETP), methods followed in ETP to avoid pollution; German ban on listed dyes and chemicals; Natural dyes - history, background and application techniques – eco-friendly processing, eco-label.

Total L : 45

TEXT BOOKS

REFERENCES:

15S039 INDUSTRIAL CHEMISTRY

ABRASIVES & ADHESIVES: Moh’s scale of hardness, types of abrasives, properties and applications. Adhesives, mechanism, factors influencing adhesives – physical and chemical, bonding process, classification - significance.


CERAMICS: Classification, traditional ceramics, whitewares, refractories, glasses – manufacture and types, ceramic composites, cermets, advanced ceramics.


COMPOSITE MATERIALS: Classification – constituents of composites, roll of interface in composite performance and durability, fibre reinforced composites (FRC), failure of FRC, short fibre reinforced composites, particle reinforced composites, particulate
15S040 BIOCHEMISTRY

3 0 0 3


PROTEINS AND NUCLEIC ACIDS: Classification, structure and synthesis of amino acids and peptides- peptide sequence. Primary, secondary, tertiary and quaternary structures of proteins. Nucleic acids – structure and functions of DNA and RNA. Co-enzyme – NAD*, NADH, FAD, ATP, ADP, AMP – structure and functional activities, co-enzyme a universal carrier of acyl groups.

VITAMINS: Structure, synthesis and biological importance of vitamins A, B1, B2, C, D, E and K.

METABOLISM: Bioenergetics, thermodynamic considerations, redox potentials. Catabolism and anabolism; enzymes involved, catalytic mechanism and regulatory steps in glycolysis, mitochondrial electron transport and oxidative phosphorylation.


15S041 ORGANIC SPECTROSCOPY

3 0 0 3


REFERENCES:  

15S042 ENVIRONMENTAL SCIENCE  


ECOSYSTEM AND BIODIVERSITY: Concept of ecosystem – food chain and food web – energy flow – characteristic features, structure and function of the forest, grassland and aquatic ecosystem. Biodiversity – types, values and threats to biodiversity – conservation of biodiversity.  


REFERENCES:  

TEXT BOOKS:  

Total L: 45
15S043  GREEN CHEMISTRY  3 0 0 3


GREEN TECHNOLOGY FOR ENERGY PRODUCTION: Green and brown energy resources – solar energy – wind energy – hydropower energy – tidal energy – ocean thermal energy – geothermal energy. Fuel cells - hydrogen as a fuel.  (09)

GOING GREEN: Green dyeing – building the green house – eating green – drinking green – green office – green resources. Global environmental issues and green computing methods.  (09)

TEXT BOOKS:

REFERENCES:

TOTAL L: 45

OPEN ELECTIVES

15OS01 PYTHON PROGRAMMING LABORATORY  2 2 0 3

FUNDAMENTALS: Introduction, Data and Expressions, Conditionals, Functions, Loops, Strings, Lists, Tuples, Maps, Sets.  (7+7)

OBJECT ORIENTED PROGRAMMING IN PYTHON: Classes, Objects, Polymorphism, Inheritance, Abstract classes and interfaces.  (8+8)

ADVANCED PYTHON : Python CGI, Multithreading, Networking, Python GUI, Files and databases.  (8+8)

LIBRARIES AND FRAMEWORKS: Tkinter, Django framework, matplotlib, numpy, and pygal.  (7+7)

Total: L: 30 + T:30=60

TEXT BOOKS:

REFERENCES


TEXT BOOKS:

REFERENCES:

15OS03 UNIX ARCHITECTURE

INTRODUCTION: Introduction to system concepts – Kernel Architecture - File System architecture

FILE SYSTEM STRUCTURE: Kernel data structure - Buffer Cache - Structure of Buffer pool - Scenarios for buffer retrieval - Reading and Writing disk blocks - Advantages and Disadvantages of buffer cache.

INTERNAL REPRESENTATION OF FILES: Inode - Structure of regular file - Conversion of a pathname to an inode - Inode assignment to a new file - allocation of disk blocks.


REFERENCES:

15OS04 MOBILE COMPUTING


GSM: Mobile services - System architecture -- Handover – GPRS – Mobile services – System Architecture. (5+5)


BUILDING SMART CLIENT APPLICATIONS: Mobile Operating systems – Client development process – Design, Development, implementation, testing and deployment phase. Thin client development process – design, development, implementation, testing and deployment phase. (5+5)

TEXT BOOKS:

REFERENCES:

15OS05 ENGINEERING GRAPHICS

INTRODUCTION: Introduction to Engineering Drawing. BIS. Principles of dimensioning. (5+5)

ORTHOGRAPHIC PROJECTION: Principles of orthographic projection-projection of points, straight lines, planes and solids. Orthographic projection of simple engineering components – missing view exercises. Drawing orthographic projections of computer components, crystal structures. (10+10)

PICTORIAL PROJECTIONS: Principles of pictorial views, isometric view of simple engineering components. Orthographic views from given pictorial views. Isometric views from given two or three views. Drawing isometric views of typical electronic components, Body centered, Face centered and hexagonal close packed crystal structures. (5+5)

SECTION OF SOLIDS: Section of regular solids, types of sections, selection of section views. Sectional views of simple engineering components. Drawing sectional views of assemblies like electric motor, mobile phone, blast furnace, induction furnace. (5+5)

DEVELOPMENT OF SURFACES: Development of lateral surfaces of regular solids and truncated solids. Preparing parts like tray, funnel, CPU housing using cardboard material. (5+5)

TEXT BOOKS:

REFERENCES:

15OS06 VIRTUAL INSTRUMENTATION

INTRODUCTION: Graphical system design (GSD) model, virtual instrumentation, virtual instruments and traditional instruments, hardware and software in virtual instrumentation, virtual instrumentation for test, control and design, graphical programming and textual programming. (6+6)

VI PROGRAMMING TECHNIQUES: Software environment, modular programming, repetition and loops, arrays, clusters, plotting data, structures, strings and file I/O. (6+6)
DATA ACQUISITION: Transducer, signals, signal conditioning, DAQ hardware configuration, DAQ hardware-analog I/O, digital I/O, counter/timer, DAQ software architecture. (6+6)


GSD APPLICATIONS: Machine vision, motion control, remote data management – data sockets, web server, data logging and supervisory control, control design and simulation tools – control design tool, simulation interface tool. (6+6)

TEXT BOOKS:

REFERENCES:

15OS07 VACUUM SCIENCE AND THIN FILM PHYSICS


PRESSURE MEASUREMENT IN VACUUM SYSTEMS: Classification of gauges: Bourden gauge, McLeod gauge, Thermocouple gauge, Pirani and Penning gauges. (5+5)

EVAPORATION THEORY OF THIN FILMS: Introduction. Emission from a point source, mass of material condensing on the substrate. Vapour sources: Wire, wire baskets, foil and boat, crucible. Substrate and its characteristics. (5+5)

PREPARATION OF THIN FILMS THICKNESS MEASUREMENT: Chemical methods: Electroplating and anodisation. Physical methods: Study of thin film vacuum coating unit. Evaporation: Resistive heating, electron beam gun, DC and RF sputtering Multiple beam interferometer, (Tolansky), Quartz crystal microbalance (8+8)

APPLICATIONS OF THIN FILMS: Interference filters, antireflection coating, solar cells and optical disks. (5+5)

TEXT BOOKS:

REFERENCES:

15OS08 CORROSION PROTECTION BY ORGANIC COATINGS

INTRODUCTION: Diffusion of water and oxygen, electrolytic resistance, adhesion, passivation with pigments, cathodic protection, composition of the anticorrosion coatings: coating composition and design, binder types, epoxides, acrylics, polyurethanes, polyesters, alkyds, chlorinated rubber, other binders. (6+6)

CORROSION PROTECTIVE PIGMENTS: Types of pigments: lead based pigments, phosphates, ferrites, zinc dust, chromates, other inhibitive pigments, choosing a pigment. Additives: Flow and dispersion controllers, thixotropic agents, surfactants, dispersing agents, reactive agents, contra-environmental chemicals, special effect inducers. (6+6)

WATER BORNE COATINGS: Technology for polymers in water: water reducible coatings and water soluble polymers, aqueous emulsion coatings, aqueous dispersion coatings, comparative study of water and organic solvents, latex film formation: driving forces for film formation, humidity and latex cure. Minimum film formation temperature (MFFT), wet MFFT and dry MFFT, flash rusting. (6+6)
WEATHERING AND AGEING OF PAINT: UV breakdown: reflectance, transmittance, absorption, chemical breakdown, weathering interaction, hydroscopic stress, blistering and adhesion loss, temperature and chemical degradation, (6+6)

CORROSION TESTING: Goal of accelerated testing, UV exposure, moisture, drying, temperature, chemical stress, abrasion and other mechanical stresses, implications for accelerated testing, scanning vibrating electrode technique, SEM, AFM, FTIR, salt spray test. (6+6)

TEXT BOOKS:

REFERENCES:

15OS09 DYE CHEMISTRY 2 2 0 3

INTRODUCTION TO DYE: Colour and constitution - relationship of colour observed-to wave length of light absorbed-terms used in colour chemistry - chromophores, auxochromes, bathochromic shift, hypsochromic shift. Colour of a substance - quinonoid theory and molecular orbital approach. (6+6)

CLASSIFICATION OF DYES: Chemical classification - classification according to their applications - acid dyes - basic dyes. Azoic dyes, mordant dyes, vat dyes, sulphur dyes, disperse dyes, nitro dyes - process of dyeing (simple treatment). Azo dyes - principles governing azo coupling - mechanism of diazotization - coupling with amines, coupling with phenols - classification according to the number of azo group & application - tautomerism in azo dyes. (6+6)

SYNTHETIC REACTIONS AND APPLICATIONS: Di and triphenyl methane dyes - phthalein dyes - xanthen dyes - acidine dyes - sulphur dyes. Phthalocyanines - cyanine dyes. Malachite green, para-rosaniline, crystal violet, azine, oxazine and triazine dyes. Synthesis and applications of quinonoid dyes including vat dyes based on anthraquinone. (6+6)

PIGMENTS: Requirements of a pigment: Typical Organic and Inorganic pigments- appliation and their uses in paints. Reaction of dyes with fibres and water-Fluorescent Brightening agents. Application of dyes in other areas-medicine, chemical analysis, cosmetics, colouring agents, food and beverages. (6+6)

REMOVAL OF DYES FROM EFFLUENT: Technologies for dyes removal – physical, chemical and biological methods. Removal of dyes by adsorption, advanced oxidation and photocatalytic processes. (6+6)

TEXT BOOKS

REFERENCES

15OS10 MATERIALS CHEMISTRY 2 2 0 3


corrosion resistance – magnetism in metals and alloys – hydrogen storage metals. (6+6)


SEMICONDUCTING AND NANO MATERIALS: Types, properties and importance of semiconducting materials – thermoelectric materials. Nanotechnology and nanomaterials – synthesis and fabrication of nanostructures – applications. (6+6)


TEXT BOOKS:

REFERENCES:

15OS11 ENGLISH AND SOFT SKILLS FOR EMPLOYABILITY

SELF MANAGEMENT AND ATTITUDES: Self Concept, Stress management, Positive attitude, Influential Skills, Initiative, Empathy, Social Etiquette (3+3)

COMMUNICATION STYLES: Presentation Skills, Interpersonal Communication Skills, Interviewing Skills, Verbal and Nonverbal (body language) skills, Active Listening, Professional Writing, Effective email writing. (10 +10)

TEAM WORK: Inter team cooperation, Intra team cooperation, Diversity, Productivity, Goal Setting and action. (3+3)

LEADERSHIP SKILLS: Empowerment, Planning, Establishing Credibility, Vision & direction, Supervision, Mentoring, Decision-making, Creativity, Flexibility, Team problem solving (4+4)

MANAGING TIME AND PRESSURES: Managing Change, Time management, Effective meetings (3+3)

EFFECTIVE AND EXCELLENT CUSTOMER SERVICE: Communication with the customer- telephonic and online services, Managing conflicts or Challenging communication, Setting and resetting customer expectations, Building customer confidence, Growing customer relationship, Opportunity management, Developing team approach to meet customer needs. (7+7)

Total L : 30 + T : 30 = 60

TEXTBOOK:
Monograph prepared by the Faculty, Department of English, 2016

REFERENCES:
15OS12 MATHEMATICAL FINANCE

A SIMPLE MARKET MODEL: Basic Notions and Assumptions-No-Arbitrage Principle-One-Step Binomial Model-Risk and Return-Forward Contracts -Call and Put Options-Managing Risk with Options. (10+10)


RISKY ASSETS: Dynamics of Stock Prices-Return, Expected Return, Binomial Tree Model-Risk-Neutral Probability, Martingale Property, Trinomial Tree Model, Continuous-Time Limit.. (10+10)

REFERENCES:

SKILL ENHANCEMENT COURSES

Physics Cluster

15S058 MEASUREMENTS FOR SCIENCE AND ENGINEERING WITH OPEN SOURCE TOOLS

EXPEYES PLATFORM: Block diagram of the ExpEYES platform and its functional description. Fundamental building blocks of the ExpEYES user library in C and Python. Details of the libraries. (7)


PYTHON PROGRAMMING BASICS: Introduction to the MinGW IDE. Experiment development using Python or C. Programming examples -temperature measurement using PT100 and LM35. (7)


TEXT BOOK:
1. Python for Education, Ajith Kumar B.P  IUAC publications New Delhi 110067

REFERENCES:
1. Expeyes User Manual , BP ajith kumar, IUAC publications New Delhi
2. Expeyes Programmers manual, BP ajith kumar, IUAC publications, New Delhi
3. System hardware and software source files and other resources available online under OGL at http://expeyes.in

15S059 THERMAL PROPERTIES


**Thermoelectrics:** Thermoelectric phenomena, Conversion efficiency and figure of merit. Thermoelectric transport theory. Calculation of Peltier device performance, measurement of electrical and thermal properties. Methodology for testing thermoelectric materials and devices. (8)

**TEXT BOOK:**

**REFERENCES:**

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**15S060 OPTICAL MEASUREMENTS** 2002


**PULSE TECHNIQUES**: Non-contact dimension measurements. Laser ranging. Astronomical measurements. Correction of atmospheric turbulence effects using adaptive optics. (6)

**FIBRE OPTIC MEASUREMENTS**: Fibre-optic transducers. Fibre-optic Interferometry. Fibre optic sensors for temperature, pressure, magnetic field and electric field measurements. (5)


**TEXT BOOKS:**

**REFERENCE:**

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**15S061 ELECTRICAL MEASUREMENTS** 2002

**ANALOG MEASUREMENT OF ELECTRICAL QUANTITIES**: Electrodynamic, Thermocouple, Electrostatic & Rectifier type Ammeters and Voltmeters, Electrodynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, errors & remedies in wattmeter and energy meter. (9)

**DIGITAL MEASUREMENT OF ELECTRICAL QUANTITIES**: Digital Multi-meter: Block diagram, principle of operation, Accuracy of measurement, Electronic Voltmeter: Transistor Voltmeter, Block diagram, principle of operation, various types of electronic voltmeter, Digital Frequency meter: Block diagram, principle of operation. CRO: Block diagram, Sweep generation, vertical amplifiers, use of CRG in measurement of frequency, phase, Amplitude and rise time of a pulse. (12)

**MEASUREMENT OF PARAMETERS**: Includes the modern methods of measuring current, resistance by two probe and four probe method, electromotive force, capacity, inductance and hysteresis of iron and losses for different kinds of steel. (9)

**TEXT BOOKS:**

**REFERENCES:**
15S062 MAGNETIC MEASUREMENTS

INTRODUCTION TO MAGNETISM: Basic concepts- Magnetic field, Magnetic field strength, Boit- Savart law, Ampere’s circuital law, Magnetic flux, Magnetic induction, Laws of electromagnetic induction, Magnetic dipole, magnetic moment, magnetization, unit systems in magnetism. 

PRODUCTION OF MAGNETIC FIELDS: Magnetic field at the centre of a long thin solenoid, magnetic field due to circular coil: field on the axis and off the axis, Magnetic field due to two coaxial coils: in superposition and in opposition, Magnetic field due to thin finite and thick finite solenoids. 

MAGNETIC FIELD AND MAGNETIZATION MEASUREMENTS: Induction methods- Stationary coil method moving coil (extraction method), Rotating coil method. Principle of working, design and method of measurement of Vibrating coil magnetometer, Vibrating sample magnetometer (VSM), Fluxgate magnetometer, and Super Conducting Quantum Interference Device (SQUID) magnetometer, AC susceptibility and Hall magnetometer.

MAGNETIC METHODS FOR MATERIALS EVALUATION: Methods for evaluation of intrinsic properties- Magnetic Barkhausen effect (MBE), Magneto acoustic emission (MAE), Magnetic hysteresis, Residual field and remanent magnetization. Magnetic method for detection of flaws and inhomogeneities: Magnetic particle inspection (MPI), Magnetic flux leakage, Eddy current inspection.

TEXT BOOK:

15S063 SURFACE PHYSICS AND MODIFICATION


TEXT BOOKS:

Chemistry Cluster

15S068 CHEMISTRY OF WATER TECHNOLOGY

WATER QUALITY PARAMETERS: Determination of pH, TDS, dissolved oxygen, biological oxygen demand, chemical oxygen demand, chloride, sulphate, acidity and alkalinity - significance. Water quality standards IS 10500. 

DETERMINATION OF HARDNESS: Ion-exchange, soap titration and complexometric methods.


Total L: 30
TEXT BOOKS:

REFERENCES:

15S069 INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

UV-VISIBLE SPECTROSCOPY: Introduction to spectroscopy - electromagnetic spectrum, interaction of electromagnetic radiation with molecules - electronic excitation, Beer- Lambert law, molar extinction coefficient, chromophores and auxochromes, absorption of simple chromophores. Instrumentation - applications. (10)

IR SPECTROSCOPY: Modes of vibrations, instrument, sampling techniques, selection rules, absorption frequencies of common functional groups, application to structure determination and reactions monitoring. (10)

FLAME PHOTOMETRY: Introduction, principle, instrumentation - determination of sodium, detection limits, sensitivity, interferences, comparison of flame photometry with AAS - applications. (10)

Total L: 30

TEXT BOOKS:

REFERENCES:

15S070 POLYMER SCIENCE AND TECHNOLOGY

POLYMERS: Classification and nomenclature of polymers, distinction among plastics, elastomers, fibers, thermosets and thermoplastics. (10)

IDENTIFICATION AND TESTING OF POLYMERS: Natural rubber, synthetic rubber, chlorine containing polymers, nitrogen containing polymers. FTIR, X-ray, thermal analysis, flammability and chemical resistance. (10)

MOLECULAR WEIGHT OF POLYMERS: Number average and weight average. Determination of molecular weight of polymer by viscometry method. (10)

Total L: 30

TEXT BOOKS:

REFERENCES:

15S071 FOOD CHEMISTRY


TEXTBOOKS:  

REFERENCES:  

15S072 CHEMISTRY OF INDUSTRIALLY IMPORTANT MATERIALS  
2 0 0 2


IONIC CONDUCTORS: Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkel); vacancy mechanism, diffusion superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.


TEXT BOOKS:  

REFERENCES:  

15S073 SYNTHESIS OF CORROSION INHIBITORS AND APPLICATIONS  
2 0 0 2


INDUSTRIAL APPLICATION OF CORROSION INHIBITORS: Corrosion inhibition in RCC, cold-water slurries, cooling water system, acid solutions. Oxygen scavengers, determination of corrosion rate and inhibition efficiency of an inhibitor by weight loss method, indicator test for pitting corrosion.

ENVIRONMENTALLY FRIENDLY INHIBITORS: Standardized environmental testing, summary of PARCOM guidelines, macrocyclic compounds in corrosion inhibitors. Ecofriendly inhibitors.

TEXT BOOKS:  
REFERENCES:

15S074 CERAMIC MATERIALS

CERAMICS: Definition & scope of ceramics and ceramic materials, classification of ceramic materials – conventional and advanced, areas of applications. (8)

CERAMIC COATINGS: Types of glazes and enamels, elementary ideas on compositions, process of enameling & glazing and their properties. (6)

GLASS: Definition of glass, basic concepts of glass structure, types of glasses – raw materials. Batch materials and minor ingredients and their functions, Elementary concept of glass manufacturing process - applications. (8)

CEMENT AND CONCRETE: Classification of cement - concept of hydraulic materials, basic raw materials, manufacturing process, basic compositions of OPC. compound formation, setting and hardening. Tests of cement and concrete. (8)

Total L: 30

TEXT BOOKS:

REFERENCES:

Mathematics and Computer Science Cluster

15S078 APPLIED STATISTICS


STATISTICAL INFERENCE: Sampling distribution - Estimation: Point estimation, interval estimation - Criteria of a good estimator – Interval estimation of mean, proportion, and variance (single sample and two samples) - Maximum likelihood estimator. Hypothesis Testing: General concepts - Errors in Hypothesis testing - One-and two-tailed tests - Tests concerning mean, proportion, and variance - Tests for Goodness of fit and independence of attributes. (15)

ANALYSIS OF VARIANCE: Introduction to design of experiments, Analysis of variance - Completely Randomized Design and Randomized Block Design. (5)

Total L: 30

TEXT BOOKS:

REFERENCES:

15S079 STATISTICAL QUALITY CONTROL AND RELIABILITY

CONTROL CHARTS : Introduction to statistical Quality control, control charts for attributes : p, np, c and U chart., control charts for variables: $\bar{X}$, R and moving range charts. (7)


TEXT BOOKS:

REFERENCES:

15S080 OPEN SOURCE SYSTEMS


OPEN SOURCE OPERATING SYSTEM LINUX: Kernel configuration, compilation, and installation.

OPEN SOURCE DATABASE MYSQL: Web application using MySQL and PHP.

OPEN SOURCE PROGRAMMING LANGUAGES - PHP: Introduction, Programming in web environment, variables, constants, data types, operators, statements, functions, arrays, Object oriented features, String manipulation and regular expression, File handling and data storage, PHP and SQL database connectivity, PHP and LDAP, Sending and receiving e-mails, Debugging and error handling, Security, Templates.


RUBY ON RAILS: Ruby basics, Rails framework, Installing and configuring Rails, Rails application.


TEXT BOOKS:

REFERENCES:

15S081 JAVA PROGRAMMING


EXCEPTION HANDLING: Fundamentals - Exception types - Uncaught Exception - Using Try and Catch - Multiple catch clauses - Nested Try statements - Throw - Throws - Java Built-in Exception - Creating user defined exceptions.

MULTI THREADED PROGRAMMING: Java thread model - Priorities - Synchronization - Messaging - Thread class and Runnable Interface - Main thread - Creating the Thread - Synchronization - Interthread Communication.

I/O, APPLETS: I/O basics - Stream - Stream Classes - Predefined stream - Reading/Writing console input - Applet fundamentals - GUI Components - Applets.

TEXT BOOKS:

REFERENCES:

TOTAL L: 30
TEXT BOOKS:

REFERENCES:

15S082 LINUX PROGRAMMING 2002

LINUX UTILITIES - File handling utilities, Security by file permissions, Networking commands, Filters, Sed-Scripts, Operation, Addresses, Commands, awk-Execution, Fields and Records, Scripts, Operation, Patterns, Actions, Associative Arrays, String and Mathematical functions, System commands in awk, Applications. Shell programming with Bourne again shell(bash): Introduction, shell responsibilities, pipes and Redirection, quoting, test command, control structures, arithmetic in shell, shell script examples (8)

FILES AND DIRECTORIES - File Concept, File types, File System Structure, file metadata-Inodes, system calls for file I/O operations, file status information, file and record locking, file permissions, links (2)

DIRECTORIES - mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions. (3)

PROCESS - Process environment-environment list, environment variables, process control, system call interface for process management-fork, vfork, exit, wait, waitpid, exec family, Process Groups, Sessions and Controlling Terminal, Differences between threads and processes, Signals - Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals (6)

INTERPROCESS COMMUNICATION- IPC between processes on a single computer system, IPC between processes on different systems, IPC between related processes using unnamed pipes, FIFO, IPC between unrelated processes using FIFOs, Message Queues, Semaphores, Shared Memory. (8)

SOCKETS- Client-Server model, Socket address structures, Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs-Single Server-Client connection, Multiple simultaneous clients, Socket options-setsockopt and fcntl system calls. (3)

TEXT BOOKS:
1. T. Chan, Unix System Programming using C++, PHI, 2011

REFERENCES:

15S083 SOFTWARE ENGINEERING 2002


SOFTWARE PLANNING : Software Project Estimation - different techniques of project cost estimation - COCOMO model . (4)


SOFTWARE IMPLEMENTATION : System Documentation Manuals - Document review - Software Training - Review - Maintenance issues. (2)
TEXT BOOKS:

REFERENCES:

15S084 COMPUTER ARCHITECTURE

INTRODUCTION: Data Representation-Register Transfer Language- Register Transfer—Arithmetic, Logic and Shift Micro Operations- Bus and Memory Transfer. (4)

BASIC COMPUTER ORGANIZATION and DESIGN: Register and Stack Organization- Instruction Set – Instruction code –General Instruction Format- Addressing Modes - Instruction - Timing and control- Instruction cycle- Memory reference instructions- Input/Output and Interrupt. (8)

ARITHMETIC PROCESSOR: Addition, Subtraction, Multiplication and Division Algorithms (4)

MEMORY ORGANIZATION: Memory Hierarchy- Main Memory- Auxiliary Memory- Associative Memory- Cache Memory- Virtual Memory. (6)

INPUT/OUTPUT ORGANIZATION: Peripheral Devices – Input / Output Interface- Asynchronous Data Transfer- Modes of Transfer- DMA - IOP. (5)

MULTIPROCESSORS: Characteristics – Interconnection Structures. (3)

Total L: 30

TEXT BOOK:

REFERENCES:

15S085 OPTIMIZATION TECHNIQUES


Total L: 30

TEXT BOOKS:

REFERENCES: