SEMIESTER I

21S101 CALCULUS AND ITS APPLICATIONS

FUNCTIONS, LIMITS AND CONTINUITY: Basic concepts - Functions and their graphs - Combining functions; shifting and scaling graphs – Limit of a function and limit laws – The precise definition of a limit - One – sided limits - Continuity - The derivative as a function - Functions of several variables - Partial derivatives (9+6)

DIFFERENTIALCALCULUS: Curvature - Radius of curvature - Circle of curvature - Evolute - Envelope - Extreme values and saddle points - Lagrange multipliers - Taylor’s formula for two variables. (9+6)

INTEGRALCALCULUS: Double and iterated integrals – Double integral over general regions – Area by double integration - double integrals in polar form - Triple integrals in rectangular coordinates – Triple integrals in cylindrical and spherical coordinates (9+6)

IMPROPERINTEGRALS: Beta and Gamma functions-Relation connecting Beta and Gamma functions- Evaluation of definite integrals in terms of Beta and Gamma functions–Applications. (6+3)

VECTORCALCULUS: Vector and scalar functions and their fields - Gradient of a scalar field, directional derivative - Divergence of a vector field - Curl of a vector field- Line integrals of scalar functions - Vector fields and line integrals: work, circulation, and flux - Path independence, conservative fields and potential functions - Green’s theorem in the plane - Surfaces and area- surface integrals - Stoke’s theorem - The divergence theorem. (12+9)

Total: L45+T: 30=75

TEXT BOOKS:
1. Joel Hass, Christopher Heil, Maurice D. Weir, “Thomas’ Calculus”, Pearson, 2018

REFERENCES:

21S102 DIFFERENTIAL EQUATIONS


Application of second order differential equations:Euler-Cauchy equations –Method of variation of parameters– Applications second order differential equations – Electric circuits, Mass spring system. (6+6)


Total: L30+T30 =60

Text Book:

References:
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


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.


REFERENCES:

21S104 GENERAL CHEMISTRY


TEXT BOOKS:

REFERENCES:

21S105 PHYSICAL CHEMISTRY I


PHASE EQUILIBRIA: Terminology – phase, components, and degree of freedom. Derivation of the phase rule. One component system. Phase diagrams, polymorphism. Experimental determination of transition point – the water system, the sulphur system. Two-component system – the silver-lead system, the zinc-cadmium system, the potassium iodide-water system, the magnesium-zinc system, the ferric chloride-water system, the sodium sulphate-water system.

TEXT BOOKS:

REFERENCES:

21S106 ENGLISH

VOCABULARY BUILDING: The concept of Word Formation: Compounding, Backformation, Clipping, Blending - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives - Synonyms, antonyms, and standard abbreviations: Acronyms

READING COMPREHENSION: Developing Reading Skills like Skimming and Scanning for information, Critical Reading, Inferential, Cognition, and analytical Skills- appropriate reading texts to be used from general, scientific, and literary genres. (6)


LISTENING SKILLS: Understanding listening - Listening Techniques - Listening short comprehension passages - Conversational practice in both social and professional contexts (6)

PRACTICALS: Oral presentation - Short speeches and conversation practice - Listening integrated tasks (10)

TOTAL HOURS: 45

TEXT BOOK:

REFERENCES:

21S107 PROPERTIES OF MATTER AND ACOUSTICS LABORATORY

2. Determination of Young’s modulus - Uniform bending.
3. Determination of Surface tension - Capillary rise method.
4. Determination of Surface tension - Drop weight method.
7. Determination of frequency of the tuning fork - Melde's apparatus
8. Determination of velocity of sound - Helmholtz Resonator

TOTALP: 60

TEXT BOOKS

REFERENCE BOOKS
4. Lab Manual Physics Department of Applied Science

21S108 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 a 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.
9. Preparation of primary, secondary standards, indicatorand special solutions/reagents used in volumetric titrations.
10. Determination of strength of commercial/laboratory samples (Acids/ bases/ hydrogen peroxide).
TEXT BOOKS:
2. Laboratory manual prepared by the department of applied science. 2021.

REFERENCES:

SEMMESTER II
21S201 LINEARALGEBRA


VECTOR SPACES: Real vector spaces – Subspaces - Linear independence - Coordinates and basis - Dimension – Change of basis - Row space, column space, and null space – Rank and nullity. (6+6)

INNER PRODUCT SPACES: Inner products - Angle and orthogonality in inner product spaces - Gram-Schmidt process; QR-decomposition - Best approximation; Least squares. (6+6)

LINEAR TRANSFORMATIONS: Matrix transformations from \( \mathbb{R}^n \) to \( \mathbb{R}^m \) - Properties of matrix transformations – Geometry of matrix operators on \( \mathbb{R}^n \) - General linear transformations - Matrices for general linear transformations. (6+6)


TEXT BOOKS:

REFERENCES:

21S202 C PROGRAMMING

PROBLEM SOLVING AND C LANGUAGE FUNDAMENTALS: Analyzing and Defining the Problem- Modular Design – Algorithm - Flow Chart - Types of programming language- Program Development Environment - C character set - Identifiers and Keywords - Data Types - Constants - Variables - Arrays - Declarations - Expressions - Statements - Symbolic constants - Operators and Expressions - Library Functions - Data Input and Output Functions. (9)

CONTROL STATEMENTS: AND FUNCTIONS While Statement - Do While Statement – For Loop – Nested Loop - If Else - Switch - Break - Continue - Comma Operator – Goto Statement - Defining Function - Accessing a Function - Passing Arguments to Functions - Specifying Arguments Data Types - Function Prototypes - Storage Classes - Auto - Static - External and Register Variables. (9)

ARRAYS AND POINTERS: Defining Array – Processing array - Passing array to a function - Multi dimensional array - Array and strings- Pointer Declaration - 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. (9)

STRUCTURES AND UNIONS: Definition of Structure and Union - Processing a structure – Bit field representations - Structures and pointers - Passing structure to functions - Self referential structures – Nested structure. (9)

FILES AND PREPROCESSOR DIRECTIVES: File Structure concepts introduction - Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files – Operations on Files – Types of Files, Various input and output functions on Files - #include Preprocessor Directive - #define Preprocessor Directive - Symbolic Constants, Macros and Conditional Compilation. (9)
21S203 MATHEMATICAL PHYSICS

CURVILINEAR COORDINATES: Orthogonal coordinates $\mathbb{R}^3$; concept of a metric, spherical and cylindrical coordinates and their unit vectors

TENSOR ANALYSIS: Covariant and contravariant vectors, contraction, covariant, contravariant, and mixed tensors of rank-2, transformation properties. The metric tensor (flat space-time only). Raising and lowering of indices with metric tensors. (Consistent use of any one convention --- $\text{diag}(-1,1,1,1)$ or $\text{diag}(1,-1,-1,-1)$.) Example of common four-vectors: position, momentum, derivative, current density, four-velocity.

MATRICES: Hermitian, adjoint and inverse of a matrix; Hermitian, orthogonal, and unitary matrices; Eigenvalue and eigenvector (for both degenerate and non-degenerate cases); Similarity transformation; diagonalisation of real symmetric matrices.

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


TOTAL L:30 + T:30= 60

21S204 OSCILLATIONS, WAVES AND OPTICS

OSCILLATORY MOTION-I: Review of simple harmonic motion- Differential equation and graphical representation of SHM – Average kinetic energy of a vibrating particle – Total energy of a vibrating particle – Oscillation with one degree of freedom – Linearity and superposition principle – SHM of a mass between two springs –SHM of a loaded spring.


GEOMETRICAL OPTICS: Convex lens - Principal foci and principal points - Thick lens formula - Power of a thick lens - Optic centre of a lens - Spherical aberration and lenses - Methods of minimizing spherical aberration - Condition for minimum spherical aberration in the case of two lenses separated by a distance - Chromatic aberration in lenses - Condition for achromatism of two thin lenses (in contact and out of contact) - coma - astigmatism - Curvature of the field - Huygen’s and Ramsden’s eye pieces.

ELECTROCHEMISTRY II:
21S205 PHYSICAL CHEMISTRY II


TEXT BOOKS:

REFERENCES:

Total L: 45

TEXT BOOKS:

REFERENCES:

Total L: 60
21S206 PROFESSIONAL ENGLISH

SOFT SKILLS: Process of Communication - Types: Intra & Interpersonal Communication, Cross – Cultural Communication - Barriers (6)
Verbal and Non-verbal Communication- Body language, Etiquette -Telephone conversation (4)
PRESENTATION SKILLS: Professional Presentation - Public Speaking - Group Communication -Case Study based Presentation- - Meetings - Interview Techniques (8)
READING SKILLS: Comprehension and Techniques for Good Comprehension – Focus on Syntax, Vocabulary use, Discourse Markers, and Variety of expression (6)
WRITING SKILLS: Professional Reports: Characteristics - Categories - Format and style and writing techniques, The 7Cs of Writing letters - Official and Business letters - Effective Email writing - Resume Writing practices (9)
PRACTICALS: Professional Presentations - Group Discussions and Meetings - Mock Interviews (12)

TOTAL HOURS: 45

TEXT BOOK

REFERENCES

21S207 OSCILLATIONS, WAVES AND OPTICS LABORATORY

1. Study of frequency of oscillation and determination of spring constant of spring-mass system.
2. Damped oscillations and resonance in RLC circuits – estimation of decay constant and damped oscillation frequency.
3. Determination of thickness of thin wire – air wedge.
4. Determination of resolving power of a plane diffraction grating.
5. Determination of refractive index – Brewster’s law
7. Determination of refractive index of glass using diffraction grating.
8. Determination of wavelength and beam divergence of laser.

Total= P; 60

REFERENCE:
1. Laboratory manuals prepared by Department of Applied Science, PSG college of Technology, Coimbatore
Arora C L, "Practical Physics", S. Chand, India

21S208 PHYSICAL CHEMISTRY LABORATORY

1. Determination of heat of neutralization of hydrochloric acid with sodium hydroxide.
2. Study of adsorption of oxalic acid on charcoal
3. Construction of phase diagram for two-component simple eutectic system.
4. Determination of partition co-efficient of iodine between carbon tetrachloride and water.
5. Estimation of mixture of acids by conductometric method.
7. Estimation of a weak acid and determination of its dissociation constant by pH-metry.
8. Determination of cell constant of conductivity cell and solubility of a sparingly soluble salt by conductance measurements.
9. Determination of critical solution temperature (CST) of phenol-water system and study of effect of impurity.
10. Determination of rate constant of acid catalyzed hydrolysis of an ester.

Total P: 60

TEXT BOOKS:
2. Laboratory manual prepared by the department of applied science, 2021.
REFERENCES:

21S209 C PROGRAMMING LABORATORY

1. Simple programs to understand the concepts of data types.
2. Familiarizing conditional, control and repetition statements.
3. Usage of single and double dimensional arrays including storage operations.
4. Implementation of functions, recursive functions.
5. Defining and handling structures, array of structures and union.
6. Implementation of pointers, operation on pointers dynamic storage allocation.
7. Creating and processing data files.

REFERENCES:

SEMESTER III

21S301 REAL ANALYSIS

2203

SEQUENCE: Sequence of real numbers, convergence of sequences, bounded and monotone sequences, convergence criteria for sequences of real numbers, Cauchy sequences, subsequences ,Bolzano-Weierstrass theorem. (6+6)

SERIES: Series of real numbers, absolute convergence, tests of convergence for series of positive terms – comparison test, ratio test, root test; Leibniz test for convergence of alternating series. (6+6)


Continuity: Continuity of functions – Continuity of compositions of functions – Equivalent conditions for continuity – Algebra of continuous functions – homeomorphism – uniform continuity – connected subsets of R – Connectedness and continuity – Intermediate value theorem (6+6)

Compact: Compactness – open cover – compact metric spaces – Henri-Borel theorem - Compactness and continuity – continuous image of compact metric space is compact –Continuous function on a compact metric space in uniformly continuous – Equivalent forms of compactness – Every compact metric space is totally bounded – Bolzano – Weierstrass property (6+6)

Total: L30+T30 =60

TEXT BOOKS:

REFERENCES:

21S302 PROBABILITY AND STATISTICS

3003

PROBABILITY AND RANDOM VARIABLES: Sample spaces and events - Interpretations and axioms of probability, Addition rules, Conditional probability, Multiplication and total probability rules, independence, Baye’s theorem, Random variables - Discrete random variables, Probability distributions and probability mass functions, cumulative distribution functions, Mean and variance of a discrete random variable (9)

PROBABILITY DISTRIBUTIONS: Binomial, Poisson and Geometric distributions - Continuous random variables – Probability distributions and probability density functions, Cumulative distribution functions, Mean and variance of continuous random variable, uniform, normal, and exponential distributions. (9)

Bivariate Distributions: Joint Probability mass functions - Joint probability density functions - Independence of discrete
random variables - Independence of continuous random variables - Conditional Bi-variate Distributions

ES**T**IMATION** AND TESTS OF HYPOTHESES: Point estimation, Sampling distributions and the central limit theorem, General concepts of point estimation- Hypothesis testing, – testing of hypotheses for means – large, small samples and matched pairs tests – testing of hypotheses for proportions, chi square test for goodness of fit and independence of attributes.

THE ANALYSIS OF VARIANCE: Designing engineering experiments, Completely randomized single-factor experiment, Randomized complete block design.

**Total L: L:45**

**TEXT BOOKS:**

**REFERENCES:**

21S303 ATOMIC AND NUCLEAR PHYSICS

**TOTAL L: 45**

**TEXT BOOKS:**

**REFERENCES:**

21S304 ELECTRICITY AND MAGNETISM

**TOTAL L: 45**

**TEXT BOOKS:**

**REFERENCES:**
in an electric field - Capacitor with a Dielectric -Medical defibrillator- Electric current – Current density – Resistance and resistivity- Electric power- Electrical safety- Series and parallel resistors - Power in electric circuits


TEXT BOOKS:

REFERENCES:

21S305 ORGANIC CHEMISTRY I

BASIC CONCEPTS: Nomenclature of organic compound, IUPAC recommendations for naming simple aliphatic, alicyclic and aromatic compounds. Inductive, resonance, mesomeric, conjugation, electronegmic and hypercojugative effects. Reactive intermediates: hemolytic and heterolytic cleavages-carbocations, carbanions, free radicals, nitrenes, benzynes, carbenes-stability, generation and fate. Aromatacity-huckel’s rule-benzene and heterocyclic compounds.

STEROCHEmISTRY-OPtICAL ISoMERiSM: Stereoisomerism-definition-classification. Optical isomerism-optical activity- optical and specific rotations-methods of distinguishing optical isomers using melting point, dipole moment, dehydrazation, cyclisation and heat of hydrogenation. Conformational analysis-introduction-formers, configuration, dihedral angle, torsional strain-conformational analysis of ethane and n-butane including energy diagrams-conformers of cyclohexane (chair boat and skew boat forms)-axial and equatorial. Bonds-ring flipping showing axial equatorial inter-conformers-conformers of mono and substituted cyclohexanes-1,2 and 1,3 interactions.


Text Books:

Total L: 30 + T: 30 = 60
REFERENCES:
1. Bhal A and Bhal BS “Advanced Organic chemistry” S. Chand& company Ltd., New Delhi, 2019.

21S306 INORGANIC CHEMISTRY I

THEORIES OF CHEMICAL BONDINGS: Valence bond theory: Hybridization of atomic orbitals and molecular structure of the polyatomic molecules (sp, sp², sp³, sp³d, sp³d² and sp³d³). Molecular orbital theory: Bonding and antibonding orbitals. MO diagrams of H₂, H₂⁺, He₂, O₂, N₂, O₂⁻, O₂²⁻, N₂, F₂, CO and NO molecules and determination of bond order, magnetic and reactivity of molecules. Comparison of VB and MO bonding models. (9)


COMPOUNDS OF OXYGEN AND HALOGEN GROUP ELEMENTS: Types of oxides – oxygen and ozone. Important oxides and oxoacids of sulphur. Types of halides – important hydrides, oxides and oxoacids of halogens. Chemistry of bleaching powder and bleaching action. Interhalogen compounds (ClF₃ & ICl) preparation, properties, structure and uses only) and poly halides – pseudo halogens and pseudo halides. (9)

Total L: 45

TEXT BOOKS:

REFERENCES:

21S307 MATHEMATICAL COMPUTING LABORATORY

1. Plot 2D and 3D functions.
2. Programs on differentiation and integration.
3. Solving system of Linear equations.
4. Determination of Vector space under given operation.
5. Determination of linear independence and basis.
6. Finding Row space, Column space and nullspace.
7. Programs for Linear transformations R2.
8. Convert a standard basis into an orthonormal basis.
9. Compute Eigen values and Eigen bases for a given system.
10. Apply the orthogonal Diagonalization technique to reducing a Quadratic form.
11. Programs for solving differential equation by using Laplace transform.
12. Finding Fourier series and Fourier transform for the given functions.

REFERENCES:
21S308 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.
7. Calibration of an ammeter and voltmeter (low range) using potentiometer.

Total P: 60

Reference books:
2. Department manual, Department of Applied Science.

21S309 INORGANIC CHEMISTRY LABORATORY

I. Inorganic qualitative analysis:
Semi-micro analysis of inorganic mixture containing two cations and two anions (one of which will be an interfering ion).
Cations: Lead, copper, tin, cadmium, bismuth, aluminum, iron, manganese, zinc, cobalt, nickel, calcium, strontium, barium, magnesium and ammonium.

II. Preparation of inorganic compounds:
a) Mohr’s salt  
b) Tetramine copper (II) sulphate  
c) Calcium tartrate tetrahydrate

III. Inorganic quantitative analysis: Estimation of nickel as Ni-DMG by gravimetric method.

Total P: 60

TEXT BOOKS:
2. Lab manual prepared by department of applied science 2021.

REFERENCE:

SEMESTER IV

21S401 COMPLEX VARIABLES AND TRANSFORMS

COMPLEX VARIABLES: Derivative – Analytic function - Cauchy - Riemann equations – Laplaces equations (6+6)

COMPLEX INTEGRATION: Line integral in the complex plane - Cauchy’s integral theorem - Cauchy’s integral formula - Laurent series - Singularities and zeros - Residue integration method. (6+6)


FOURIER ANALYSIS: Fourier series – Arbitrary period – Even and odd functions - Half range expansions. Fourier integral - Fourier cosine and sine transforms- Fourier transform. (6+6)

Z-TRANSFORM: Introduction of Z-transform, Inverse transform, difference equation, application of Z-transform to solve difference equations. (6+6)

Total L: 30+ T:30 =60
21S402 DATA STRUCTURES

2 2 0 3


TREES: Binary Trees, Operations, Threaded Binary Tree, Tree Traversals. Applications: The expression tree and Huffman Algorithm. (6+6)

SORTING & SEARCHING: Insertion sort, Selection sort, Bubble sort, Heap sort, Quick sort, Merge sort. Linear search, Binary search. (6+6)

Total: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:

21S403 ANALOG AND DIGITAL ELECTRONICS

3 0 0 3

P-N JUNCTIONS: Semiconductor basics, Diode theory, forward and reverse-biased junctions, reverse-bias breakdown, applications of pn junction diode - Limiters, clippers, clampers, voltage multipliers, rectifiers, half wave & full wave rectification, Zener diode, Zener voltage regulators, IC regulators. (9)

BIPOLAR JUNCTION TRANSISTORS (BJT): Transistor fundamentals and its types, transistor configurations, characteristics in CB, CE, CC modes, DC operating point, Bipolar Junction Transistor characteristics & parameters, fixed bias, potential divider lines bias with and without emitter bias, Single stage RC coupled amplifier, Transistor Oscillator, Astable Multivibrator. (9)


DIGITAL ELECTRONICS: Number systems - Decimal, binary, octal, hexadecimal and interconversion, excess three codes, Gray codes, 1st and 2nd complement codes, binary arithmetic, Boolean relations - Laws and theorems - Simplifications – Sum of Products, Product of Sum, Karnaugh maps, two, three and four variable, Logic gates, Combinational logics circuits. (9)

Total L : 45
TEXT BOOKS:
2. V.K Mehta&Rohit Mehta * Principles of Electronics* S.Chand & Company., 2010.

REFERENCES:

21S404 MECHANICS AND THEORY OF RELATIVITY


(6+6)

ANGULAR MOMENTUM AND FIXED AXIS ROTATION:Introduction, Angular momentum of a particle, sliding block and conical pendulum, Fixed axis rotation - moment of inertia, parallel axis theorem, Torque, torque and angular momentum, dynamics of fixed axis rotation, pendulum motion and fixed axis rotation, motion involving translation and rotation, torque on a moving body, work energy theorem and rotational motion.

(6+6)

RIGID BODY MOTION:Introduction, vector nature of angular velocity and angular momentum, Gyroscope – examples of rigid body motion, conservation of angular momentum, angular momentum and the tensor of inertia, rotational kinetic energy of a rigid body, rotation about a fixed point, torque-free precession – the earth wobbles.

(6+6)


(6+6)


(6+6)

Total L:30 +T:30=60

TEXT BOOKS:

REFERENCES:

21S405 ORGANIC CHEMISTRY II


(6+6)


(6+6)


75
21S406 INORGANIC CHEMISTRY II

3 0 0 3

COORDINATION CHEMISTRY: Introduction - Double salts and coordination compounds. Ligands types and chelation effect. IUPAC nomenclature of coordination complexes. Theories of the coordination complexes: Werner theory and Sidgwick’s theory – EAN rule and stability of complex. Valence bond theory-hybridization and geometry of inner and outer orbitals complexes. 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. John-Teller theorem.


BIOINORGANIC CHEMISTRY AND METAL CARBONYL - METAL NITROSYL CHEMISTRY: Essentials and trace elements of life; basic reactions in the biological systems and the role of metal ions, especially Fe++, Fe+, Cu++, and Zn++. Structure and functions of Hemoglobin and myoglobin–carbon monoxide poisoning. Metal enzyme: structure and function of carbonic anhydrase. Synthesis, structure and bonding of Ni (CO)4, Fe(CO)5 and sodium nitroprusside.

SOLID STATE CHEMISTRY: Crystalline and amorphous solids. crystal system, Bravais lattice, unit cell. law of rational indices (Weiss indices) Miller indices, Symmetry elements in crystals (for cubic system only in detail). X-ray diffraction by crystals - derivation of Bragg’s equation - Bragg method - powder method. Crystal structure of NaCl, CsCl, Wurzite, CaF2 and TiO2. radius ratio rules and packing in crystals.


TOTAL L: 45

21S407 ANALOG AND DIGITAL ELECTRONICS LABORATORY

0 0 4 2

1. Diode and Zener characteristics – DC load line analysis.
2. Regulated power supply using Zener diode and IC regulator.
3. BJT and FET characteristics.
5. Multivibrator – Astable using BJT.
6. UJT and its characteristics.
7. SCR and its characteristics.
8. Operational amplifier (741) - inverting and non-inverting modes, integrator and differentiator.
9. Study of basic Logic gates and realization of logic gates using universal gates.

TEXT BOOKS / MANUAL:
1. Analog and Digital Electronic Laboratory manuals, Department of Applied Science, PSG college of Technology, Coimbatore

21S408 ORGANIC CHEMISTRY LABORATORY

I. Qualitative analysis of an organic compounds:
   a. Characterization of functional groups
   b. Confirmation by preparation of solid derivatives/characteristic colour reactions.

II. Preparation of organic compounds (single stage only):
   a. Preparation of methyl orange.
   b. Preparation of aspirin.
   c. Preparation of soap/hand rub sanitizer.

III. Determination of melting point of organic compounds.

Total P: 60

TEXT BOOKS:
2. Lab manual prepared by the department of applied science, 2021.

REFERENCE:

SEMESTER V

21S501 OPERATIONS RESEARCH


Transportation Model: Definition of the Transportation model - Transportation problem and its solution by Modi method – Assignment problem and its solution by Hungarianmethod. (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. - Linear programming formulationofCPM. (6+6)

DYNAMIC PROGRAMMING: Introduction- Recursive nature of computations in dynamic programming- Forward and Backward recursion - Tabular method of solution, for deterministic dynamic programming problem – Short route in network- Cargo loading problems - linear programmingproblems. (6+6)

Total L: 30 + T:30 = 60

TEXT BOOKS:

REFERENCES:
21S502 ABSTRACT ALGEBRA

GROUP THEORY: Definition of a group – Some examples of groups – Some preliminary lemmas – Subgroups – A counting principle. (6+6)

GROUP HOMOMORPHISM: Normal subgroups – Quotient groups – Homomorphism – Automorphism – Cayley’s theorem – permutation groups. (6+6)

GROUPS AND CODING: Coding of Binary information and error detection – Group codes – Deciding and error correction (6+6)

RING THEORY: Definition and examples of Rings – Some special classes of Rings – Homomorphisms – Ideals and Quotient Rings - Ring of Quaternions (6+6)

EUCLIDEAN RING: Euclidean rings – A particular Euclidean ring - Polynomials Rings – Polynomials over the Rational field – Polynomial Rings over commutative Rings. (6+6)

TEXT BOOKS:

REFERENCES:

21S503 SOLID STATE PHYSICS

CRYSTAL PHYSICS: Distinction Lattice points and Space lattice, Basis and Crystal structure, Unit cell and Primitive cell, Lattice parameters, Crystal systems and Crystal symmetry, Space groups, Bravais space lattice, packing density, relation between density of materials and lattice constants in a cubic lattice, Directions, Planes and Miller Indices,Linear and Planar density, Imperfections in crystals, (9)

MECHANICAL PROPERTIES: Atomic model of elastic behaviour, Rubber like elasticity, Viscoelastic behaviour- Spring and Dashpot model, Plastic deformation- Tensile stress strain curve, Plastic deformation by slip, Shear strength of perfect and real crystals, Stress to move a dislocation, Factors affecting strength of a material, Strengthening Mechanisms, Creep-Mechanism, creep resistant materials, Fatigue fracture (9)

ELECTRICAL PROPERTIES OF METALS: Classical free electron theory, drawbacks. Quantum free electron theory. Fermi-Dirac statistics and electronic distribution in solids, Density of energy states and Fermi energy, Fermi distribution function, Electrical conductivity from quantum mechanical considerations, electron scattering and sources of resistance in metals, Band theory of solids, Electron in a periodic field of a crystal ( Kronig-Penney model -rigorous derivation not included), Brillouin zones, Distinction between metals, Insulators and Intrinsic Semiconductors. Hall Effect. (9)

MAGNETIC MATERIALS AND SUPERCONDUCTIVITY: Origin of magnetism, Diamagnetism and Paramagnetism, Susceptibilities of dia and para magnetic materials, Ferromagnetism, Spontaneous magnetization in ferromagnetic materials, Curie-Weiss law, Internal field and exchange interaction, Domain theory, Hysteresis, Hard and soft magnetic materials and applications, Antiferromagnetism, Ferrimagnetism- structure and applications. Superconductors, BCS theory, Effects of magnetic field, Critical currents, Isotope effect, Mechanical effect, Josephson Tunnelling, Applications. (9)


TEXT BOOKS:

REFERENCES:
21S504 QUANTUM MECHANICS

2 2 0 3


SCHRÖDINGER WAVE EQUATION: Time dependent Schrödinger equation and time independent Schrödinger equation. Solution of time independent Schrödinger equation for simple quantum mechanical systems: Particle in one, two and three dimensional box, One dimensional harmonic oscillator (Assuming H_{1D}(y) for various states), discussion of the eigenvalues and eigenstates, Quantum tunneling- transmission and reflection coefficient. (5+6)


TEXT BOOKS:

REFERENCES:

21S505 APPLIED CHEMISTRY

3 0 0 3


TEXT BOOKS:

REFERENCES:

21S506 ANALYTICAL CHEMISTRY


NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY: Nuclear spin states, nuclear magnetic moments, absorption of energy – the mechanism of absorption – population densities of nuclear spin states – the chemical shift and shielding. The nuclear magnetic resonance spectrometer – the continuous wave (CW) instrument, the pulsed Fourier Transform (FT) instrument. Chemical equivalence, integrals and integration. Chemical environment and chemical shift. Local diamagnetic shielding – electronegativity effects, hybridization effects, acidic and exchangeable protons: hydrogen binding. Magnetic anisotropy, spin-spin splitting (n+1) rule – origin of spin-spin splitting – the ethyl group. Pascal’s triangle, the coupling constant. A comparison of NMR spectra at low and high field strengths. 1H NMR absorption spectra – hydrocarbons, alkyl halides, alcohols, ethers, amines, aldehydes, ketones, esters, carboxylic acids, amides, nitro alkanes. (6+6)

MASS SPECTROMETRY: The mass spectrometer, gas chromatography-mass spectrometry, the mass spectrum, determination of molecular weight. Determination of molecular formulas – metastable ion peak – precise mass determination – nitrogen rule, isotope ratio data. Fragmentation patterns – alkanes, cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, ethers, aldehydes, ketones, esters, carboxylic acids, amines. (6+6)


Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:

21S507 SOLID STATE PHYSICS LABORATORY

1. Determination of lattice constant - Analysis of powder diffraction pattern.
2. Determination of Hall Coefficient of a semiconductor crystal
3. Determination of resistivity of metallic and alloy wire-Carey Foster's Bridge.
7. Determination of dielectric constant of a dielectric solid.
8. Determination of dielectric constant of a dielectric liquid.
9. Determination of tensile strength of a material
10. Determination of shear strength of a material

Total = P: 60

REFERENCE:

21S0508 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 alkalities, TDS, pH and conductivity of water sample.
3. Determination of available chlorine in commercial bleaching powder.
4. Determination of percentage of moisture and ash content of a coal sample.
5. Determination of acid, saponification and iodine values of an oil sample.
7. Determination of corrosion rate and inhibitor efficiency of mild steel in acid media by weight loss method.
8. Industrial electrochemical processes:
   i. Anodising of aluminium and determination of thickness of anodic film.
   ii. Electroplating of nickel and determination of cathodic efficiency.
9. Estimation of iron by photocolorimetry and sodium by flame photometry.
10. Chromatographic separation of plant pigments.

Total P: 60

TEXT BOOKS:
2. Laboratory manual prepared by the department of applied science. 2021.

REFERENCES:

SEMESTER VI

21S601 ENVIRONMENTAL SCIENCE

3 0 0 3


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. (9)


(12)

TEXT BOOKS:

REFERENCES:

PROFESSIONAL ELECTIVES (PE)

MATHEMATICS AND COMPUTER SCIENCE CLUSTER

21S001 NUMERICAL METHODS

3 0 0 3


NONLINEAR EQUATIONS: False-position method, Newton-Raphson method, Bairstow's method. (9)

INTERPOLATION, DIFFERENTIATION AND INTEGRATION: Lagrange interpolating polynomials, equally spaced data – Newton's forward and backward interpolating polynomials, numerical differentiation – evenly spaced data, numerical integration – Newton-Cotes formulae, Trapezoidal rule, Simpson's rules. (9)


NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Finite difference: elliptic equations - Laplace equation, Poisson equation – Liebnmann’s method, parabolic equations – heat conduction equation – Crank Nicolson's method, hyperbolic equations – vibrating string. (9)

Total L = 45

TEXT BOOKS

REFERENCES

21S002 GRAPH THEORY

3 0 0 3

INTRODUCTION TO GRAPH MODELS: Graphs and digraphs - degree sequence, handshaking lemma, Havel-Hakimi theorem (statement and concepts) - Common families of graphs - Graph modeling applications - Walks and distance – paths cycles and trees - Graph isomorphism – Subgraphs - Matrix Representations – adjacency and incidence matrices. (9)


EULERIAN AND HAMILTONIAN GRAPHS: Eulerian graphs – Konigsberg bridge problem; Eulerian tour algorithm, characterization of Eulerian graph, optimal postman tour. Hamiltonian graphs - non Hamiltonian graphs, sufficient conditions for Hamiltonian graphs (only statements and concepts), Travelling salesman problem - nearest neighbor algorithm. (9)

GRAPH COLORING: Vertex-colorings – minimization problem for vertex-colorings – modeling applications as vertex-coloring problems - sequential vertex coloring algorithm - chromatic number of a graph, Brooks’s theorem - largest degree first algorithm, applications - scheduling problem, assignment of radio frequencies, fast register allocation for computer
programming.

**NETWORK FLOWS AND APPLICATIONS:** Flows and cuts in networks, solving the maximum flow problem – characterization of maximum flow (Max-flow Min-cut Theorem), algorithms – outline for maximum flow, finding an augmenting path, FFEK – maximum flow and examples.

**TEXTBOOKS**

**REFERENCES**
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, New Delhi, 2018.

### 21S003 DISCRETE MATHEMATICS

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

**PROOF TECHNIQUES:** Introduction to proofs – Proof methods and strategy, Mathematical induction – Strong induction and well ordering.

**RELATIONS:** Relations and their properties – n-ary relations and their properties - representing relations - equivalence relations- partial orderings.

**COUNTING TECHNIQUES:** The basis of counting - The pigeonhole principle - Permutations and combinations Binomial coefficients, Generalized permutations and combinations - Generating permutations and combinations.

**ADVANCED COUNTING TECHNIQUES:** Recurrence Relations - Solving linear recurrence relations – Divide and conquer algorithms and recurrence relations.

**TEXT BOOKS:**

**REFERENCES:**

### 21S004 OPTIMIZATION TECHNIQUES


**NONLINEAR PROGRAMMING ONE-DIMENSIONAL MINIMIZATION METHOD:** Introduction - Unimodal Function – Elimination methods: Unrestricted Search - Exhaustive Search - Interval Halving Method - Fibonacci Method - Golden Section Method.


**Integer Linear programming:**Introduction – types of integer programming problems - Integer programming algorithms; Branch and bound algorithm, Cutting Plane algorithm – Traveling Salesperson problem: Branch and bound algorithm, Cutting Plane algorithm

**DECISION ANALYSIS AND GAME THEORY:** Decision making under Risk: Decision Tree based expected value criterion, Variations of the expectedvaluecriterion—Decisionunderuncertainty – Gametheory:Optimalsolutionoftwo-personzero-sum games, solutions of mixed strategy games.
**TEXT BOOKS:**

**REFERENCES:**

### 21S005 STOCHASTIC PROCESSES

<table>
<thead>
<tr>
<th>Total L: 45</th>
</tr>
</thead>
</table>


**GENERAL QUEUEING MODELS:** Single and Multiserver Poisson Queues - Single Server Queue with Poisson input and general service M / G/1 – General input and exponential service – G/M/1 Queueing model. (9)

**Brownian motion:** First passage time distribution – The maximum of a Brownian motion – The zeros of Brownian motion – Brownian motion with drift – GeometricBrownianmotion. (9)

### 21S005 MACHINE LEARNING

<table>
<thead>
<tr>
<th>Total L: 45</th>
</tr>
</thead>
</table>

**INTRODUCTION:** Machine learning – Types – Supervised learning, unsupervised, Reinforcement learning, semi supervised learning - Regression – Linear – Polynomial – Multiple regression – Evaluation measures – Bias – variance – under fitting – Regularization (9)


**DECISION TREES:** Introduction – Purity measures – Entropy, cross entropy, information gain, gain ratio, Gini Index – ID3 – Regression trees - Pruning – Model selection – Bootstrapping and cross validation – Model evaluation – Performance Measures –Receiver operating characteristic curve (ROC) (9)

**UNSUPERVISED LEARNING:** Clustering –Types - K-means – EM - Mixture of Gaussians – Cluster validity measures – Applications : image segmentation – Image compression –Outlier analysis (9)

**NEURAL NETWORKS:** Multilayer perceptron - Back propagation – Training - DIMENSIONALITY REDUCTION: Classification-linear discriminant analysis – Unsupervised learning: Principal components analysis (9)

### TEXT BOOKS:
REFERENCES:

21S007 ARTIFICIAL INTELLIGENCE


TEXT BOOKS:

REFERENCES:

21S008 CYBER SECURITY


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:

21S009 NUMBER THEORY

3 0 0 3


CONGRUENCES: Definition and basic properties of congruences – Linear Congruences – Congruence Applications – Divisibility Tests – Modular Designs – CheckDigits. (9)

SIMULTANEOUS LINEAR CONGRUENCES: The Chinese remainder theorem – Wilson’s theorem – Fermat’s Little Theorem – Euler’s Theorem. (9)

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. (9)

QUADRATIC CONGRUENCES: Quadratic Residues – The Legendre Symbol – Quadratic Reciprocity – The Jacobi Symbol. (9)

TEXT BOOKS:

REFERENCES:

PHYSICS CLUSTER

21S016 LASER PHYSICS AND APPLICATIONS

3 0 0 3


LASER CHARACTERISTICS: Basic characteristics, Spatial and temporal coherence, Beam quality and output characteristics. Beam divergence and focusing using optical system. Types of laser based on output beam: continuous, pulsed lasers, ultra short pulses. (10)

GAS AND LIQUID LASERS: He-Ne Laser, CO₂ laser, Excimer and dye laser, construction, energy level diagram, excitation mechanisms and output characteristics. (8)

SOLID STATE LASERS: Introduction, Nd: Glass, Nd: YAG laser and semiconductor diode lasers, construction, energy level diagram, excitation mechanisms and output characteristics. (8)


TEXT BOOKS:

REFERENCES:
21S017 SEMICONDUCTOR PHYSICS AND DEVICES


TEXT BOOKS

REFERENCES:

21S018 HEAT AND THERMODYNAMICS


TEXT BOOKS:

REFERENCES:

Total L : 45
21S019 CHARACTERIZATION TECHNIQUES IN MATERIALS SCIENCE

3 0 0 3


VIBRATIONAL SPECTROSCOPY: Raman spectroscopy – Basic principles – Instrumentation- Raman spectroscopic analysis. Fourier transform Infrared spectroscopy (FTIR)- Basic principles- Instrumentation-qualitative and quantitative analysis. (9)


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. (9)

ELECTRON EMISSION SPECTROSCOPY: X ray photoelectron spectroscopy – Basic principle – photoelectron process of spectrum- elemental analysis-Instrumentation and applications- Auger electron spectroscopy- Basic principle- Auger electron spectrum - Information in Auger spectrum. (9)

REFERENCES:

21S020 LINEAR INTEGRATED CIRCUITS

3 0 0 3

OPERATIONAL AMPLIFIER BASICS: Ideal OP-AMP characteristics, Open-loop voltage gain, input offset, slew rate, unity gain voltage follower, DC characteristics, AC characteristics differential amplifier, frequency response of OP-AMP, Inverting and Non-inverting Amplifiers-V to I and I to V converters (10)

CIRCUITS FOR MATHEMATICAL OPERATIONS: Inverting summing amplifier, solving simultaneous equation, logarithmic and anti-logarithmic amplifier. (7)

AMPLIFIERS FOR MEASUREMENTS: Common mode rejection ratio, bridge amplifier, considerations. Instrumentation amplifier – working, principle, expression for voltage gain, characteristics and applications. (8)

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. (12)

ACTIVE FILTERS: First-order Low pass, high pass, band pass and band reject filters. Frequency response and cut-off frequencies, applications. (8)

REFERENCES:

TEXT BOOKS:
INTRODUCTION AND CLASSIFICATION OF NANOMATERIALS: 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.


REFERENCES:

TEXT BOOKS:


COLOUR VISION AND VISUAL SPECIFICATION: Trichromacy, Light and chromatic adaptation, compression, opponency, spatial vision observer variability. Colour specification-one-dimensional scale, hue, lightness, chromatic intensity. Three dimensional systems -geometrics, natural colour systems, Munsell colour system other colour order systems. Colour mixing systems.


TEXT BOOKS:
1. Roy S. Berns , Principles Of Color Technology, Fourth edition, 2015, John Wiley and sons, USA

REFERENCES:
CHEMISTRY CLUSTER  
21S031 POLYMER CHEMISTRY  

3 0 0 3  


MECHANISM AND KINETICS OF POLYMERISATION: Chain polymerisation – mechanisms of free radical, ionic and coordination polymerization - kinetics of free radical polymerization. Step growth polymerisation – kinetics of polyestertification. Mechanism of ring opening polymerisation. Controlled radical polymerization-reversible addition fragmentation chain transfer(RAFT) and atom transfer radical (ATR) polymerizations  


MOLECULAR WEIGHT: Number and weight average molecular weights- molecular weight distribution-significance- Poly Disperisty Index - degree of polymerization. Determination of molecular weight – end group analysis, osmometry, light scattering, viscometry and Gel Permeation Chromatography.  


REFERENCES:  

Total L: 45  

TEXT BOOKS:  

21S032 ENVIRONMENTAL CHEMISTRY  

3 0 0 3  


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, nitrides, phosphates, fluoride and phenolic compounds. Measurement techniques for air quality: Particulate matter, oxides of sulphur and nitrogen, un-burnt hydrocarbons, carbon dioxide, carbon monoxide and ozone.  

Total L: 45
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, applications 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:

CHEMICAL SYNTHESSES: Nucleation – mechanism of homogeneous and heterogeneous nucleation. Synthesis of metallic nano particles - Turkevich reduction, ligand stabilized nanoparticles - thiol-stabilized nanoparticles, phosphine-stabilized nanoparticles, electrochemical synthesis, reactions in micelles, emulsions, dendrimers, photochemical and radiation chemical reduction, ionic liquids, sonochemical synthesis, biological synthesis - shape control with biomolecules and microbial synthesis. (9)

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. (9)

APPLICATIONS OF NANOMATERIALS: Organic thin film transistors, organic light-emitting diodes, conducting polymer based electrochemical transistors, electroluminescent devices, electrochromic devices, photoelectrochromic devices, printed and

TEXT BOOKS:

REFERENCES:

21S035 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, adadodi and thoothuvalai. Blood-grouping, composition, Rh-factor, blood - pressure, hypertension and hypotension. (9)


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

TEXT BOOKS:

REFERENCES:

21S036 TEXTILE CHEMISTRY AND TEXTILE CHEMICAL PROCESSING

CHEMISTRY OF TEXTILE FIBRES: Molecular structure, polymeric aspects, reactivity and morphology of natural, regenerated and synthetic fibers – cotton, jute, wool, silk, viscose, lyocell, polyester, nylon, acrylic, lyca, and polypropylene fibers. Physical and chemical properties of textile fibers and their uses. (9)


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. (9)
FINISHING ON TEXTILES: Object of finishing, types of finishing – methods of application for cotton, silk, wool and synthetics. Water repellent/proof, fire repellent, mildew/moth proof, anti-static, soil release, miscellaneous finishes. Wrinkle free finish, wash-n-wear, denim finish, stone wash and acid wash. Stain removal techniques. (9)

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 and eco-label. (9)

TEXT BOOKS:

REFERENCES:

21S037 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. (9)


CERAMICS: Classification, traditional ceramics, white wares, refractories, glasses – manufacture and types, ceramic composites, cermet’s, advanced ceramics. (9)

CEMENT: Classification, chemical composition, setting and hardening. Plaster of paris - applications. Special cements - high alumina cement, sored cement, white Portland cement and water proof cement - manufacture of Portland cement, concrete and RCC, decay of concrete. (9)

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 composite and structural composites - advantages and applications. (9)

REFERENCES:

CHEMISTRY OF CARBOHYDRATES: Carbohydrates – definition. Monosaccharides – occurrence, structures, physical and chemical properties, linear and ring forms (Haworth formula) for pentose and hexose. Disaccharides – occurrence, structure, physical and chemical properties of sucrose and lactose. Polysaccharides – occurrence, structure, physical and chemical properties of starch, cellulose. Carbohydrate metabolism – glycolysis and citric acid cycle. (9)

CHEMISTRY OF LIPIDS: Definition, classification and functions of lipids. Occurrence, chemistry and biological functions of simple lipids, compound lipids (e.g. phospholipids) and derived lipids. Steroids (e.g. cholesterol). Physical property – emulsification. Chemical property – saponification. Functions of bile acids and bile salts.


REFERENCES:

TEXT BOOKS:

REFERENCES:

21S039 INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS


TEXT BOOKS:

REFERENCES:

REFERENCES:
21S040 GREEN CHEMISTRY


GREEN TECHNOLOGY FOR ENERGY PRODUCTION: Growing energy needs – renewable and non-renewable energy sources from unsustainable to sustainable development, urban problems related to energy, Rain water harvesting, watershed management. Green and brown energy resources – solar energy, wind energy, hydropower – tidal energy – ocean thermal energy – geothermal energy. Fuel cells - hydrogen as a fuel.


REFERENCES:

Total L: 45

TEXT BOOKS:

SKILL ENHANCEMENT COURSES (SEC)
MATHEMATICS AND COMPUTER SCIENCE CLUSTER
21S055 MATHEMATICAL MODELLING


Model Fitting:Introduction — Fitting models to data graphically – Analytic methods of model fitting – Least-square method – Higher order polynomial models – low order polynomials – cubic spline models


Economic models: Production and supply functions, price-elasticities, utility of consumption and consumer surplus, pure competition, competitive equilibrium , monopoly versus competition, duopoly, oligopoly, conjectural variation, theory of production, production function , Cobb- Douglas production function and its properties , Costs of production and related models.
TEXT BOOKS
2. Frank R Giordano; William P Fox; Steven B Horton, A First Course in Mathematical Modeling, Cengage Learning, 2014.

REFERENCES
3. Seyed M. Moghadas, Majid Jaberi-Douraki, Mathematical Modelling, Wiley, 2018

21S056 ANALYTICAL GEOMETRY

2 2 0 3

Coordinates in space: Direction cosines of a line in space-angle between lines in space – equation of a plane in normal form - Angle between planes – Distance of a plane from a point. (6+6)

Straight lines in space: Line of intersection of planes – plane containing a line. Coplanar lines – skew lines and shortest distance between skew lines- length of the perpendicular from point to line. (6+6)

Sphere: General equation of a sphere-Section of sphere by plane-tangent planes –condition of tangency-system of spheres generated by two spheres - System of spheres generated by a sphere and plane. (6+6)

Cone: The equation of surface – cone – intersection of straight line and quadric cone – tangent plane and normal (6+6)

Plane: Condition for plane to touch the quadric cone - angle between the lines in which the plane cuts the cone - Condition that the cone has three mutually perpendicular generators- Central quadrics – intersection of a line and quadric – tangents and tangent planes – condition for the plane to touch the concord. (6+6)

TEXT BOOKS

REFERENCES
1. Joel Hass, Christopher Heil, Maurice D. Weir, “Thomas’ Calculus”, Pearson, 2018

21S057 BUSINESS STATISTICS

3 0 0 3

FREQUENCY DISTRIBUTION: Grouping and displaying data to convey meaning: Raw data, arranging data, constructing a frequency distribution, graphing a frequency distribution, Measures of central tendency, measures of dispersion. (9)

SAMPLING AND SAMPLING DISTRIBUTIONS: Sampling, random sampling, design of experiments, sampling distributions, sample size and standard error. (9)

ESTIMATION: Introduction, point estimates, interval estimates: basic concepts, interval estimates and confidence intervals, calculating interval estimates of the mean from large samples, calculating interval estimates of the proportion from large samples. (9)

REGRESSION AND CORRELATION: Estimation using the regression line, correlation analysis, making inferences about population parameters, limitations, errors, and caveats, multiple regression and correlation analysis, finding the multiple regression equation, the computer and multiple regression, making inferences about population parameters, modeling techniques. (9)

TIME SERIES AND FORECASTING: Variations in time series, trend analysis, cyclical variation, seasonal variation, irregular variation, a problem involving all four components of a time series, time series analysis in forecasting. (9)

Total L: 45

TEXT BOOKS

REFERENCES

**21S058 STATISTICAL QUALITY CONTROL AND RELIABILITY**

**STATISTICAL PROCESS CONTROL:** Chance and assignable causes of quality variation, statistical basis of the control charts - basic principles, choice of control limits, analysis of patterns on control charts. (6+6)

**CONTROL CHARTS:** X chart, R chart, s2 chart, p chart, np chart, c chart, and u chart. (6+6)

**ACCEPTANCE SAMPLING:** Types of sampling plans, lot formation, single sampling plans for attributes, double, multiple and sequential sampling plans, acceptance sampling by variables, chain sampling, continuous sampling, skip lot sampling plans. (6+6)

**BASIC RELIABILITY MODELS:** The failure distribution, the reliability function, mean time to failure, Hazard rate function, bathtub curve, conditional reliability. Constant failure rate model: Exponential reliability function. Time-dependent Weibull failure model. Time - dependent normal failure model. (6+6)

**RELIABILITY OF SYSTEMS:** Serial configuration, parallel configuration, combined series, parallel systems - k out of n: system -system structure function, minimal cuts, minimal paths, common mode failures, three state devices. (6+6)

**REFERENCES:**

**TEXT BOOKS**

**21S059 OBJECT ORIENTED PROGRAMMING**


**INTERFACES:** Defining interface - Implementing Interface –runtime polymorphism using interface. Exception Handling: Fundamentals - Exception types - Using Try and Catch - Multiple catch blocks - Nested Try statements - Throw - Throws - built-in exceptions–user defined exceptions. (6+6)

**MULTI THREADED PROGRAMMING:** Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface - Main thread - Creating the Thread - Synchronization – Inter-thread Communication - Deadlock (6+6)

**I/O STREAMS:** I/O basics - Stream - Stream Classes - Reading / Writing into a file. Applets: Applet fundamentals - GUI Components – Layouts – Event handling. (6+6)

**REFERENCES:**

**TEXT BOOKS**

**REFERENCES:**
21S60 DATABASE MANAGEMENT SYSTEM


**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+6)

**FILE ORGANIZATION AND RELATIONAL DATA MODEL:** Storage device characteristics – Constituents of a file – Operations on file – Serial files – Sequential files – Index sequential files – Direct files – Introduction to Relational Data Model – Basic concepts – Enforcing Data Integrity constraints – Relational Algebra Operations. (6+6)

**SQL:** 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. (6+6)


**REFERENCES:**

Total L: 30 + T:30 = 60

21S061 WEB DESIGNING

**INTRODUCTION:** WWW – presentation / business logic layer-Browser architecture – HTTP architecture, Methods, Web Server Architecture – Basic Structure of HTML – HTML tags – Tables – Forms – Links – Frames – DOM – Styling Tags. (6+6)

**CSS:** Introduction – Types (Where to place CSS) – Rules – Selectors – Styling Fonts – Layouts – Positioning – Boot Strap. (6+6)


**WEB PUBLISHING / HOSTING:** Host Registration – Domain Registering – Server FTP Upload – AJAX – JSON - MySQL (6+6)

Total L: 30 + T:30 = 60

**TEXT BOOKS:**

**REFERENCES:**
3. Robin Nixon, Learning PHP, MySQL & Java Script, O’Reily, 2018
21S062 ENTERPRISE COMPUTING

2203


TEXT BOOKS:

REFERENCES:

21S063 MOBILE APPLICATION DEVELOPMENT

2203

INTRODUCTION: Introduction to mobile applications - Importance of mobile applications – Strategies and challenges – Software and hardware requirements for developing mobile applications – Types of mobile applications – Benefits of creating mobile applications – Marketing and advertising mobile applications – Mobile devices overviewandclassification. (6+6)

MOBILE USER INTERFACE DESIGN: Mobile application users – Social aspect of mobile interfaces - Accessibility - Design patterns – Designing for the various mobile platform - Adaptive Mobile Websites – DedicatedMobileWebsites. (6+6)

MOBILE APPLICATIONS ARCHITECTURE: Smart Client – Smart Client Architecture – Messaging Architecture – The Model-View-Controller Model- Delegate Pattern- Building Smart Client Applications-Design, Development, implementation, testing and deployment phase- MVVM mobilearchitecturedesign. (6+6)


DATABASE: Files and database – SQLite on Android – Loading asynchronous data - Map API to RunTracker – Showing user’s location on Map. (6+6)

TEXT BOOKS:

REFERENCES:
21S064 OPERATING SYSTEMS


Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:

21S065 ADVANCED DATA STRUCTURES

INTRODUCTION: Algorithm – analysis of algorithms – best case and worst case complexities, analysis of recursive algorithm – Masters theorem (8+6)


MULTIWAY SEARCH TREES: Indexed Sequential Access – m-way search trees – B-Tree – searching, insertion and deletion - B+ trees -Tries. (6+6)

HAS HING: Hashfunction – Separate chaining – open addressing – Linear probing – quadratic probing – Double hashing. (6+6)

GRAPHS: Representations – adjacency matrix, linked adjacency list – graph search methods – Breadth First search and Depth First search – Applications. (6+6)

Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:
PHYSICS CLUSTER

21S070 COMPUTERISED MEASUREMENTS WITH OPEN SOURCE TOOLS

2 2 0 3

THE ExpEYES SYSTEM: Open source hardware and software measurement platform. Hardware- block diagram, input and output terminals and their functions, classification into digital and analog sections. The Graphical User Interface (GUI) – options for text input and output display. Analog voltage input and output using the GUI and the hardware terminals. ExpEYES17 oscilloscope interface and context based help system and manual . (7+7)

EXPERIMENTS USING THE ExpEYES SYSTEM: Temperature measurement using PT100 resistive sensor and LM35 electronic temperature sensor. Differential equation of a capacitor charge and discharge through a resistor- study of the RC charge and discharge characteristics using ExpEYES and ExpEYES17 system system. Fourier analysis of waveforms. (7+7)

ExpEYES HARDWARE: Commands- one byte, two byte and three byte commands. Communicating the commands from PC to the microcontroller- text based communication over the USB physical interface- the virtual serial port. Generating commands using a PC – software requirements. Flow chart of the software for identifying the ExpEYES hardware signature code (7+7)

PYTHON PROGRAMMING FOR THE ExpEYES INTERFACE: Special packages required and their purpose - expeyes, scipy, numpy, pyserial. Importing expeyes and other functions into the python environment. Basic python library for generating ExpEYES commands over the USB interface. Python commands for the ExpEYES17 system. Display of measured outputs in text format. (7+7)

ExpEYES17 Oscilloscope : Hardware, terminals and functions- performance improvements. The oscilloscope interface- python library for basic functions. Measurement of voltages and display of waveforms- waveform analysis experiments using the oscilloscope interface. (2+2)

Total L:30 + T:30 = 60

TEXT BOOK:
1. Python for Education, Ajith Kumar B.P. IUAC publications New Delhi,110067 – 2010

REFERENCES:
2. Expeyes17 User Manual , BP ajith kumar, IUAC publications New Delhi, 2017
3. Expeyes Programmers manual, BP ajith kumar, IUAC publications, New Delhi, 2011
4. System hardware and software source files and other resources available online under OGL at http://expeyes.in

21S071 THERMAL PROPERTIES

2 2 0 3


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. (6+6)


Total L : 30+t:30 =60

TEXT BOOK:

REFERENCES:

**21S072 OPTICAL MEASUREMENTS**


**ANEMOMETRY**: Fluid flow velocity measurements by flow seeding. Laser Doppler anemometry. Shadowgraphy and Schlieren Photography. Interferometric flow measurement Mach-Zehnder interferometer . (6+6)

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


**TEXT BOOKS**:

**REFERENCE**:

**21S073 ELECTRICAL MEASUREMENTS**

**PHILOSOPHY OF MEASUREMENT**: Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis. (6+6)

**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. (6+6)

**INSTRUMENT TRANSFORMERS**: Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor. (6+6)

**DIGITAL MEASUREMENT OF ELECTRICAL QUANTITIES**: Digital Multi-meter: Block diagram, Accuracy of measurement, Electronic Voltmeter: Transistor Voltmeter, Block diagram, various types of electronic voltmeter. Digital Frequency meter: Block diagram, principle of operation. (6+6)

**MEASUREMENT OF PARAMETERS**: Includes the modern methods of measuring current, resistance by two probe and four probe method, electromotive force, capacity, and hysteresis of iron and losses for different kinds of steel. (6+6)

**TEXT BOOKS**:

**REFERENCES**:
21S074 MAGNETIC MEASUREMENTS

ODUCTION TO MAGNETISM: Basic concepts- Magnetic field, Magnetic field strength, Magnetic force, Biot - Savart law, Ampere’s circuital law, Magnetic flux, Magnetic induction, Magnetic dipole, magnetic moment, magnetization, Laws of electromagnetic induction, Self and mutual induction, unit systems in magnetism. (6+6)

MAGNETIC MATERIALS: Types of magnetic materials such as dia-, para-, ferro-, antiferro and ferromagnetic materials. Magnetic domains and hysteresis loops - Demagnetization effects, magneto-static, magnetic anisotropy and exchange energies. Magnetostriiction and magnetoelastic energy. Soft and hard magnetic materials. (6+6)

PRODUCTION OF MAGNETIC FIELDS: Permanent and electromagnets- 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. (6+6)

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 susceptometer and hall magnetometer. (6+6)

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 magnetism. Magnetic method for detection of flaws and inhomogeneities: Magnetic particle inspection (MPI), Magnetic flux leakage, Eddy current inspection. (6+6)

TEXT BOOKS:

REFERENCE BOOKS:

21S075 PLASMA PHYSICS AND APPLICATIONS

GASES AND COLLISION PROCESS: Masses and Number of atoms, kinetic energy and temperature, mean speed , pressure, Avogadro’s Laws, number density of gases, impingement flux, monolayer formation time, mean free path, probability of collision, energy transfer and collision frequency, Gas flow types. Ionization, excitation, relaxation, recombination, dissociation, electron attachment, lon-neutral collisions, Metastable collisions. (7+7)

GLOW DISCHARGE: Plasma species, Electron and ion temperature, plasma potential. Glow discharges: DC discharges, RF discharges, Microwave discharges, Dielectric barrier discharges. Low temperature plasma generation sources. (6+6)

PLASMA DIAGNOSTICS: Plasma diagnostics: Electrical probe techniques, spectroscopic methods, Optical emission Spectroscopy, Magnetic diagnostics. (6+6)

SUBSTRATE SURFACE INTERACTION WITH PLASMA: Etching effects of Plasma on Substrate Surface, Radical Formation on Substrate Surface, Chain Scission of Surface Molecules on Polymer Substrate, Cross-linking Formation, Functionalization on Polymer Surface by Gas Plasma Treatment, (7+7)

PLASMA ASSISTED DEPOSITION TECHNIQUES: Physical vapor deposition. Plasma enhanced chemical vapor deposition. Process optimization. (4+4)

TEXT BOOKS:

REFERENCES:
21S076 CRYSTAL GROWTH TECHNIQUES


THEORIES OF CRYSTAL GROWTH: Surface energy theory, Diffusion theory and Adsorption layer theory – concepts of Volmer theory, Bravais theory, Kossel theory and Stranski’s treatment – nucleation – Mononuclear, Polynuclear and Modified Birth and Spread models. (6+6)


Total L: 30 + T: 30 =60

TEXT BOOKS:

21S077 CERAMICS AND COMPOSITES

CERAMIC STRUCTURES: Introduction, properties, type of bonds in ceramics, applications of ceramics, advanced and traditional ceramics, refractories, cement, glass and glass ceramics, types of ceramics, classification by composition, processing technique, properties and applications, crystal structure structural rules, common ceramic structures, rocksalt structure, zinc blend structure, corundum, silicate structures, glass, etc., ceramic raw materials, synthesis of powders, powder characteristics, effect of impurities (6+6)


COMPOSITES: Particle reinforced composites, fiber reinforced composites – influence of fiber length, orientation and concentration. Fiber phase, matrix phase, metal matrix composites, polymer matrix composites, ceramic matrix composites, carbon – carbon composites, hybrid composites and structural composites. (3+3)


Total L : 30 + T :30 = 60

TEXT BOOKS:
REFERENCES:

CHEMISTRY CLUSTER
21S085 CHEMISTRY OF WATER TECHNOLOGY


WATER QUALITY REQUIREMENT FOR BOILERS AND TURBINES: Boiler types – water quality limits for boiler feed water – chemical regimes for boiler feed water, boiler water and condensate. High pressure turbines – quality of steam.

Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:

21S086 POLYMER SCIENCE AND TECHNOLOGY


IDENTIFICATION AND TESTING OF POLYMERS: Natural rubber, synthetic rubber, chlorine containing polymers, nitrogen containing polymers. FTIR, X-ray, thermal analysis, flammability and chemical resistance.
21S087 FOOD CHEMISTRY


2 2 0 3


6+6)


6+6)


6+6)


6+6)

Total L: 30 + T: 30 = 60

TEXTBOOKS:

REFERENCES:

21S088 CHEMISTRY OF INDUSTRIALLY IMPORTANT MATERIALS


6+6)


6+6)
**LIQUID CRYSTALS:** Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases, smectic – nematic transition and clearing temperature - homeotropic, planar and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic B phases, optical properties of liquid crystals, dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals. 

**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. 

**ORGANIC SOLIDS, FULLERENES AND MOLECULAR DEVICES:** Organic conductors, organic superconductors, magnetism in organic materials. Fullerenes - doped, fullerenes as superconductors. Molecular rectifiers and transistors, artificial photosynthetic devices, optical storage memory and switches - sensors. Nonlinear optical materials; nonlinear optical effects, second and third order - molecular hyperpolarisability and second order electric susceptibility, materials for second and third harmonic generation. 

**REFERENCES:**

**TEXT BOOKS:**

**REFERENCES:**

**21S089 CORROSION SCIENCE AND ENGINEERING**

**CORROSION THERMODYNAMICS:** Need for corrosion education, corrosion electrochemistry, corrosion thermodynamics – free energy, standard electrode potentials, Nernst equation. Three electrode system. Potential-pH diagram – E-pH diagram of water. E-pH diagrams of Fe and Al.

**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.


**REFERENCES:**
21S090 CERAMIC MATERIALS


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. (6+6)

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. (6+6)


Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:

OPEN ELECTIVES

MATHEMATICS AND COMPUTER SCIENCE

21OS01 PYTHON PROGRAMMING

INTRODUCTION: Development Tools (IDE) – Python shell - Python Basics - Data types - Control flow. (9)

CORE PYTHON LANGUAGE: Lists - Tuples - Dictionaries - Strings – Regular expressions - Functions - File input/output – Exception handling. (9)

OBJECT-ORIENTED DESIGN: Inheritance – Polymorphism. (9)

PACKAGING AND DISTRIBUTION: Modules – Packages – Python standard libraries - pip. (9)

STANDARD PACKAGES: NumPy – Matplotlib – Pandas. (9)

Total L: 45

TEXTBOOKS:

REFERENCES:
4. Zachary Radtka and Donald Miner, Hadoop with python, O’Reilly Media, 2015

LAB PROGRAMS:
1. Exercises to test basic coding skills in Python using data types, control statements and iteration.
2. Programs to implement Python data structures like lists, tuples, dictionaries, and sets.
3. Programs covering general programming concepts such as functions, strings, regular expressions, reading / writing files and exceptions.
4. Standalone programs to implement object oriented concepts.
5. Packaging their programs into reusable libraries.
6. Write programs to use libraries for numerical programming and data visualization.

**21OS02 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, Recursive algorithms

**DIVIDE AND CONQUER STRATEGY AND GREEDY METHOD:** Quicksort, Merge sort, Strassen’s matrix multiplication, Minimum cost spanning tree (Kruskal and Prim’s algorithms), Topological sorting, Huffman codes and data compression.

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

**BACK TRACKING:** Method - n-queens problem, Graph coloring problem

**BRANCH AND BOUND AND NP PROBLEMS:** Method - Assignment problem, Traveling salesman problem - NP Problems - Basic concepts – Polynomial time reductions, Efficient certification and NP, NP-hard and NP-complete problems

Total L: 45

**TEXT BOOKS:**

**REFERENCES:**

**21OS03 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.


**RISKY ASSETS:** Dynamics of Stock Prices - Return - Expected Return - Binomial Tree Model - Risk-Neutral Probability - Martingale Property - Trinomial Tree Model.

**DISCRETE TIME MARKET MODELS:** Stock and Money Market Models - Investment Strategies - The Principle of No Arbitrage - Application to the Binomial Tree Model - Fundamental Theorem of Asset Pricing.

**PORTFOLIO MANAGEMENT:** Risk - Two Securities - Risk and Expected Return on a Portfolio - Several Securities - Risk and Expected Return on a Portfolio - Efficient Frontier - Capital Asset Pricing Model.

**TEXT BOOKS:**

**REFERENCES:**
PHYSICS

21OS11 CONDENSED MATTER PHYSICS

3003


LATTICE VIBRATIONS AND PHONONS: Concept of lattice mode of vibration. Phase and group velocities. Vibrations of one dimensional monoatomic linear lattice. Concept of phonons. Momentum of phonons. Inelastic scattering of photons, X-rays and neutrons by phonons. (9)

THERMAL PROPERTIES OF SOLIDS: Specific heat of gases and solids - Einstein and Debye theories of specific heat of solid - Gruneisen's constant - Anharmonicity - Thermal expansion - Thermal conductivity of solids. (9)

FERROELECTRICITY: Basic properties of ferroelectric materials. Classification of ferroelectric crystals. Changes in crystal structure during polarization - Ferroelectric domains - Antiferroelectricity. (9)

LIQUID CRYSTALS: Introduction - Fundamental characteristics - Liquid crystal phases - Characterization of liquid crystals - Anisotropy. (9)

TEXT BOOKS:
1. Elements of Solid State Physics, J.P. Srivastava, Prentice Hall of India, New Delhi, 2014

REFERENCE BOOKS:

21OS12 CLASSICAL MECHANICS AND STATISTICAL PHYSICS

3003

BASIC CONCEPTS OF CLASSICAL MECHANICS: Mechanics of single and system of particles, conversion law of linear momentum, angular momentum and mechanical energy for a particle and a system of particles, centre of Mass and equation of motion, constrained Motion, degrees of freedom and generalized coordinates, transformation equations, generalized displacement, velocity, acceleration, momentum, force and potential. (9)

LAGRANGIAN FORMULATION: Generalized coordinates, Principle of virtual work, D'Alembert's principle and Lagrangian equations, applications of Lagrangian formulation: linear harmonic oscillator, simple pendulum, particle moving under central force, Atwood machine, electrical circuits. (9)

HAMILTONIAN FORMULATION: Hamilton's principle, Lagrange's and Hamilton's equations from Hamilton's principle, physical significance of Hamiltonian, principle of least action, applications - linear harmonic oscillator, simple pendulum, particle moving under central force, Atwood machine, Poisson bracket. (9)

CLASSICAL STATISTICAL MECHANICS: Link between entropy and probability - Boltzmann's equation - elementary ideas about three different statistics - classical statistics - Maxwell - Boltzmann statistics - classical Ideal gas equation – equipartition theorem. (9)

QUANTUM STATISTICAL MECHANICS: Basics for quantum statistics, system of identical indistinguishable particles, symmetry of wave functions, bosons, fermions - Bose-Einstein statistics, Fermi-Dirac statistics. (9)

Total L: 45

TEXT BOOKS:

REFERENCES:

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

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

PRESSURE AND TEMPERATURE MEASUREMENTS: Pressure units. Measuring instruments: Bourdon gauge, Pirani gauge, thermocouple gauge, Ionization gauge- cold and hot cathode types. Temperature measurement: Temperature scales-Temperature measuring instrument: Liquid in glass thermometers, thermocouples, resistance thermometers, thermistors and pyrometers.

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 unbonded strain gauges, metal foil gauge, wire strain gauge.

TEXT BOOKS:

REFERENCES:

CHEMISTRY

METALS AND NON-METALS IN BIOLOGICAL SYSTEMS: Essential and trace elements- role of different metal ions in biological systems - biological ligands, structural models; siderophores, porphyrins, corrin and chlorin. General classifications of metallobiomolecules. Sodium-potassium pumps. Functional role of elements Ca, Mg, P and F in biological systems.


ELECTRON TRANSFER IN BIOLOGICAL SYSTEMS: Structure and functions of electron transfer proteins; Iron-sulphur proteins (Ferredoxins, rubredoxin) and cytochromes (classification and oxygen activation using cytochrome C oxidase) – synthetic models. Blue copper proteins [azurin and plastocyanin].


APPLICATIONS IN MEDICINE: Chemotherapy: cis-platin, - mode of action, side effects, gold containing drugs as anti- rheumatic agents and their mode of action. Lithium in psychopharmacological drugs -radio diagnostic agents- MRI scanning - chelating agents (with special reference to EDTA) and therapy based on in vivo chelation of radio nucleotides - dosage and toxicity.

TEXT BOOKS

REFERENCE BOOKS
21OS22 SURFACE FINISHING AND COATING TECHNOLOGY


Functional Coatings: Hydrodynamics of a free surface- Wetting and dewetting- Analysis of surface morphology by AFM and XPS- Introduction to superhydrophobicity and self cleaning surfaces.-methods of fabrication of super hydrophobic polymers and binders- self-healing coating-based active corrosion protection, conductive polymer coatings, active anticorrosion conversion coatings, protective coatings with inhibitor doped matrix, cladding and calendaring.


Total L : 45

TEXT BOOKS

REFERENCES

21OS23 CHEMICAL SENSORS AND BIOSENSORS


MATERIALS FOR ADVANCED SENSOR APPLICATIONS: Semiconductor metal oxides, hydrogel, dendrimeric
materials, carbon nanotubes, graphene, metal nanoparticles, polymers and nanocomposites, Nanoparticle based sensors - antibody in nano particle conjugates, Nucleotides and DNA. Nanowire based electrical detection of single viruses and biomolecules - ultrasensitive detection of pathogenic biomarkers and single bacteria. Transdermal and wearable sensors.

**REFERENCES:**

**21OS24 CHEMISTRY OF CONCRETE**


**SUPPLEMENTARY CEMENTING MATERIALS (SCMs):** Need for new materials, ASTM specifications for SCMs - physical and chemical requirements. Source and compositions of fly ash, Ground Granulated Blast furnace Slag (GGBS), silica fume, and rice husk ash. Cementing efficiency, chemical reactions of SCMs in concrete – pozzolanic reactions, hydration of slag, effect on hydration of Portland cement, pore solution composition. Effect of SCMs on concrete – microstructure, properties, durability - standard tests- bulk diffusivity and rapid chloride permeability test, de-icer salt scaling test, accelerated mortar bar tests.

**CHEMICAL ADMIXTURES:** Water reducing agents, super plasticizers, air entraining agents, concrete damp proofers, accelerators, special purpose admixtures – alkali-aggregate expansion reducing, anti-freeze, anti-washout, corrosion inhibiting, calcium sulfoaluminate based expanding, shotcrete and shrinkage reducing admixtures. Effect of admixtures on properties of plastic and hardened concrete. Applications of admixtures.


**TEXT BOOKS:**

**REFERENCE:**

**21OS25 BIOMATERIALS**

**INTRODUCTION TO BIO-MATERIALS:** Definition, sources and classification of bio-materials, biocompatibility. Mechanical, visco-elasticity, electrical and thermal properties of biomaterials.
METALLIC AND CERAMIC BIOMATERIALS: Metallic implants - stainless steels, Co-based alloys, Ti-based alloys, nickel-titanium alloy, and magnesium based biodegradable alloys, nanostructured metallic implants, degradation and corrosion. Bio ceramics – alumina, zirconia, calcium phosphate ceramics, bio inert, bioactive glasses, nanostructured bio ceramics. (9)

POLYMERIC BIOMATERIALS: Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Biopolymers: collagen, elastin and chitin. Medical textiles, materials for ophthalmology: contact lenses, intraocular lens. Membranes for plasma separation and blood oxygenation. Carbon biomaterial – carbon products as coating materials. (9)


TESTING OF BIOMATERIALS: Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagenicity tests, In-vitro and In-vivo testing; Sterilizations of implants and devices, effects of sterilization. (9)

TOTAL L: 45

TEXT BOOKS

REFERENCES

21OS26 COMPOSITE MATERIALS

INTRODUCTION TO COMPOSITE MATERIALS: Definitions, classification. Role of matrix and reinforcements. Matrix-polymers, metals and ceramics. Reinforcements – fibre, flake and particulate. (9)

CERAMIC AND METAL MATRIX COMPOSITES: Ceramics- SiC/Alumina, zirconia-toughened alumina, LiAl-SiO2/Alumina. Properties and applications of CMCs. MMCs-particle, whisker and continuous fiber reinforced. Metallic matrices-aluminum, titanium, magnesium and copper alloys. Properties and applications of MMCs. (9)


TOTAL L: 45

TEXT BOOKS

REFERENCES
21OS27 PRINCIPLES OF CERAMIC TECHNOLOGY

WHITEWARE: Introduction - raw materials, body composition, preparation, forming - slip casting, plastic forming, pressing, finishing, drying, firing, glazing and decoration. White wares at home - tableware, kitchenware, flame resistant ware, art ware, containers, construction - floor tile, wall tiles, sanitary ware, electrical - low tension insulators, high tension insulators, high frequency low loss insulators, industrial use - abrasion resistance, chemical resistance, heat resistance.


Total L: 45

TEXT BOOKS

REFERENCE BOOKS

21OS28 ADVANCED OXIDATION PROCESSES FOR WASTEWATER TREATMENT


PHOTO-INITIATED OXIDATIONS: Radiant sources and their characteristics-types of lamps used in AOP - specific properties of mercury arc lamps development of incoherent excimer lamps - typical photon flow of VUV or UV lamps - the sun as radiation source. Methods of hydroxyl radical production - photooxidation reactions - photocatalytic reactions - general reaction schemes- photolyis of water.


TEXT BOOKS:

REFERENCE BOOKS:

ENGLISH

21OS31 ENGLISH AND SOFT SKILLS FOR EMPLOYABILITY

3 0 0 3

SELF MANAGEMENT AND ATTITUDES: Intrapersonal Communication - Self Concept, Stress management, Positive attitude, Influential Skills, Initiative, Empathy, Social Etiquette (8)

COMMUNICATION STYLES : Presentation Skills, Interpersonal Communication Skills, Interviewing Skills, Verbal and Nonverbal (body language) skills, Active Listening, Professional Writing, Effective email writing (12)

TEAM WORK AND TEAM BUILDING: Working in groups and Teams, Exploring Team Roles and Processes, Building and developing teams, Leading a team and Managing meetings (5)

LEADERSHIP SKILLS: Empowerment, Planning, Establishing Credibility, Vision & direction, Supervision, Mentoring, Decision-making, Creativity and Flexibility (5)

MANAGING TIME AND PRESSURES: Managing Change and Time management (5)

EFFECTIVE AND EXCELLENT CUSTOMER SERVICE: Understanding customer service basics - Communication with the customer empathetically- telephonic and online services, Managing conflicts or Challenging communication, Building customer confidence, Growing customer relationship, Opportunity management, Developing team approach to meet customer needs, Working with customers with disabilities, Technology @ work: Internet Monitoring. (10)

TOTAL HOURS: 45

TEXTBOOK

REFERENCES

21OS32 ENGLISH FOR COMPETITIVE EXAMINATIONS

3 0 0 3

ENGLISH GRAMMAR: Tenses, Parts of Speech - Auxiliaries, Subject Verb agreement, Modifiers, Parallelism, Redundancy, Active and Passive Voice, Attitude, Question Tag, Phrases and Clauses (10)

VOCABULARY: Synonyms and Antonyms, One word substitute, Words often misspelled, Commonly confused words, Idioms and Phrases (10)

READING: Structure and Organization of a text, Reading Techniques: skimming for main idea(s), Distinguishing facts from opinions, Distinguishing main ideas from specific details, Scan for details, Making use of contextual clues to infer meanings of unfamiliar words from context, Cloze test, Reading Comprehension passages (10)


LISTENING: Listening and Note-taking, Identifying and distinguishing the main ideas from supporting details, infer meanings of unfamiliar words from context, Discussing about and responding to the content of a lecture or listening passage orally and/or in writing (6)
SPEAKING: Spoken discourse markers of familiar topics - Conversation practice - Oral Presentation techniques - Short speeches and Informal discussions

TOTAL HOURS: 45

TEXT BOOK

REFERENCES