



# Takshashila University

(State Private University)

Established under Tamilnadu Private Universities Act 2019

Ongur, Tindivanam, Villupuram District, Tamilnadu - 604305

## Department of Physics

### **I. Mathematical Methods of Physics & Quantum Mechanics**

Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

#### **Quantum Mechanics**

Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule, selection rules. Identical particles, Pauli exclusion principle, spin-statistics connection.

### **II. Classical Mechanics & Electromagnetic Theory**

Newton's laws. Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics moment of inertia tensor. Non-inertial frames and pseudoforces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity Lorentz transformations, relativistic kinematics and mass-energy equivalence.

#### **Electromagnetic Theory**

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Magnetostatics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces.

### **III. Electronics and Experimental Methods**

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits). A/D and D/A converters. Microprocessor and microcontroller basics. Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting.

#### **IV. Atomic & Molecular Physics**

Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

#### **V. Condensed Matter Physics & Nuclear and Particle Physics**

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity: Meissner effect, type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

##### **Nuclear and Particle Physics**

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semiempirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra.

## **Department of English**

### **I. Contemporary Literary Theory:**

Structuralism, Deconstruction, Psychoanalytic Theory

### **II. Literary Criticism:**

Aristotle: Poetics

Dryden: Essay of Dramatic Poesie

Wordsworth: Preface to The Lyrical Ballads (1800 Edition)

Coleridge: Biographia Literaria,

T.S. Eliot: Tradition and Individual Talent

The Metaphysical Poets

### **III. Indian Writing in English**

Mahesh Dattani: Dance Like a Man

Raja Rao: Kanthapura

Rohinton Mistry: A Fine Balance

### **IV. Literary tools: Literary forms & genres**

### **V. English Language Teaching:**

English for Academic and Specific Purposes

Teaching Methods, Techniques and Approaches

Basic Concepts of Language Testing and Assessment

## Department of Mathematics

### I. Algebra

Vector spaces, subspaces, linear dependence, basis and dimension. Linear transformation, range space, null space, rank and nullity. Matrix representation of a linear transformation. Change of basis. Eigenvalues and eigenvectors. Inner product, orthogonality, Gram-Schmidt process, orthogonal expansion. Quadratic forms, reduction to normal form. Definition of Groups, Subgroups and Factor Groups, Lagrange's Theorem, Homomorphisms, Normal Subgroups. Quotients of Groups. Basic Examples of Groups including Symmetric Groups, Matrix Groups.

### II. Analysis

The real number system. Sequences, series and uniform convergence. Continuity and differentiability of functions of real variables. Riemann and Lebesgue integrals. Metric spaces. Cauchy sequences and convergence. Completeness. Normed space. Banach space. Inner product space, Hilbert space.

Analytic function, Mobius Transformation, Cauchy Riemann equations, Cauchy's theorem and integral formula, singularities, Taylor's and Laurant's series. Cauchy's residue theorem.

### III. Differential Equations

**ODE:** General solution of homogeneous equations, non-homogeneous equations, Wronskian, method of variation of parameters.

**PDE:** Linear and quasilinear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification.

### IV. Numerical Methods

Bisection method, fixed-point iteration, Newton's method. Error analysis for Iterative Methods. Computing roots of polynomials. Interpolation: Lagrange Polynomial. Divided Differences. Numerical differentiation; numerical integration: Trapezoidal and Simpson rules; numerical solution of systems of linear equations: direct methods (Gauss elimination, LU decomposition); iterative methods (Jacobi and Gauss-Seidel); numerical solution of ordinary differential equations: initial value problems: Euler's method, Runge-Kutta methods of order 2

### V. Probability and Statistics

Sample space, events and probability axioms. Random variable and probability distributions. Mean and Variance. Binomial, normal and Poisson distributions. Random sampling, confidence intervals, testing hypotheses, goodness of fit, Regression.

## **Department of Economics**

### **I. Demand and Supply**

Law of Demand – Elasticity of demand- types of elasticity of demand – law of supply – types of supply

### **II. Inflation and poverty**

Characteristics of inflation- effects of inflation- poverty in India- causes for Poverty – Measures to reduce poverty in India.

### **III. National Income**

National income- Methods of calculating National Income- difficulties of calculating national income- Human Development index in India.

### **IV. Agricultural Policy**

Agricultural Price policy - Objectives, instruments and impact. - Economic Reforms and Agricultural policy – WTO and Agriculture - Agricultural Taxation and its relevance.

### **V. Fiscal policy in India**

objectives of Monetary policy – Instruments of monetary policy-objectives of fiscal policy - Fiscal Policy in Developing Countries.

## Department of Chemistry

### **I. Inorganic Chemistry**

Compounds of p-block Elements, Transition metal compounds, EAN Rule, d-d transitions, High spin-Low spin complexes, Nuclear Chemistry

### **II. Organic Chemistry**

Pericyclic Reactions, Oxidation and Reduction, Addition Reactions, Rearrangement, Elimination Reactions, Substitution Reactions, Stereochemistry, Optical activity, Bio-organic compounds

### **III. Physical Chemistry**

Thermodynamics, Gibb's free energy, Electrochemistry, Chemical Kinetics, Rate law, Half-life, Rate constants

### **IV. Quantum Chemistry and Group Theory**

Wave functions, Atomic Orbitals, Radial Plots, Character Table, Mulliken Symbols, Transition Moment Integrals, Selection Rules

### **V. Chemical Bonding and Spectroscopy**

VSEPR Theory, Molecular Orbital Theory, Isolobal Analogy, NMR spectroscopy, Basic principles

## Department of Computer Science

### **I. Data Structures**

Abstract Data Types (ADTs) – List ADT-Stack ADT – Operations – Applications-Tree ADT – Tree Traversals – Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees-Graph Definition – Representation of Graphs – Types of Graph – Breadth-first traversal – Depth-first traversal -- Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's Algorithm-Searching- Sorting-Hashing

### **II. Design and Analysis of Algorithms**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. – Mathematical analysis for Recursive and Non-Recursive Algorithms-Brute Force and Divide-And-Conquer-String Matching – Closest-Pair and Convex-Hull Problems -Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort

### **III. Operating Systems**

Operating System Structures - Simple Batch, Multiprogrammed, Parallel, Distributed Systems, Real-Time Systems, System components, Process and CPU Scheduling - Process concepts and scheduling, Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms. File System Interface and Operations -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management.

### **IV. Software Engineering Concepts**

Introduction to Software Engineering: Process models: Software Requirements: Functional and non-functional requirements, user requirements, system requirements, Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams. Testing Strategies: Metrics for Process and Products: Software measurement, metrics for software Quality-Risk management

### **V. Database Design**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies –Normal forms-ACID Properties-Concurrency Control-Deadlock Handling-RAID – File Organization-Distributed Databases-Database Security: Security issues – Access control based on privileges – Role Based access control

## **Department of Commerce**

### **I: Economics and Business Environment**

Business Environment Meaning and Elements of Business Environment Economic environment, Economic Policies, Economic Planning, Legal environment of Business in India. Competition policy, Consumer protection, Environment protection. Policy Environment: Liberalization, Privatization and globalization. Second generation reforms, Industrial policy and implementation. Industrial growth and structural changes. Concept of Profit and Wealth maximization. Demand Analysis and Elasticity of Demand, Curve Analysis Law. Utility Analysis and Indifference of Returns and Law of variable proportion Cost, Revenue, Price determination in different market situation: Perfect competition, Monopolistic competition, Monopoly, Price discrimination and Oligopoly, Pricing Strategies.

### **II: Accounting and Financial Management**

Basic Accounting concepts, Capital and Revenue, Financial statements Partnership Accounts : Admission, Retirement, Death, Dissolution and Cash Distribution Advanced Company Accounts : Issue, forfeiture, Purchase of Business Liquidation, Valuation of shares, Amalgamation, Absorption Reconstruction, Holding Company Accounts Cost and Management Accounting : Ratio Analysis, Funds Analysis, Cash Flow Analysis, Marginal costing and Break-even analysis, Standard costing Budgetary control, Costing for decision-making Responsibility accounting. Financial Management Capital Structure, Financial and Operating leverage Cost of capital, Capital budgeting Working capital management Dividend Policy. Banking and Financial Institutions, Importance of Banking to Business, Types of Banks and Their Functions, Reserve Bank of India, NABARD and Rural Banking, Banking Sector Reforms in India, NPA, Capital adequacy norms E-banking Development Banking: IDBI, IFCI, SFCs, UTI, SIDBI

### **III: Statistics & Data Processing**

Business Statistics & Data Processing Data types, Data collection and analysis, sampling, need, errors and methods of sampling, Normal distribution, Hypothesis testing, Analysis and Interpretation of Data Correlation and Regression, small sample T-test, F-test and chi-square test Data processing - Elements. Data entry, Data processing and Computer applications, Computer Application to Functional Areas Accounting, Inventory control, Marketing.

### **IV: Management Principles & Marketing**

Business Management Principles of Management Planning - Objectives, Strategies, Planning Process, Decision-making Organising, Organisational structure, Formal and informal organisations, Organisational culture Staffing Leading: Motivation, Leadership, Committees, Communication Controlling Corporate Governance and Business Ethics. Marketing Management The evolution of marketing, Concepts, Concept of marketing, Marketing mix, Marketing environment Elements of consumer behaviour, Market segmentation Product Decisions Pricing Decisions Distribution Decisions Promotion



Decisions Marketing planning, Organizing and Control.

**V: Human Resources Management & International Business**

Human Resources Management Concepts, Role and Functions of Human Resource management, Human Resource Planning, Recruitment and Selection Training and Development, Succession Planning Compensation: Wage and Salary Administration, Incentive and Fringe benefits. Morale and Productivity Performance Appraisal Industrial Relations in India, Health, Safety, Welfare and Social security, Workers' Participation in Management. Theoretical foundations of international business, Balance of payments International liquidity, EXIM Bank EXIM Policy of India, Regulation and Promotion of Foreign Trade.