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 dynamicsmoment 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: Meisner 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, Mobious Tranformation, 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 Psychology

I: Fundamentals of Psychology

Attention, Perception, Motivation, Learning, Memory and Forgetting, Emotion, Personality, Thinking, Intelligence, Creativity, Pro social behaviour, social influence, aggression, Piaget's Cognitive Development theory.

II: Schools of Psychology

Beginning of Experimental psychology, Schools of psychology (structuralism, functionalism, etc;), Psychodynamic: Freudian and Neo Freudian, Gestalt Psychology, Humanistic Psychology, Existential Psychology.

III: Biological basis of behaviour

Nervous system, Central Nervous system, Peripheral Nervous System, Visual system, Auditory system, Biological basis of emotion, and motivation, stress and coping, Pain and Illness, Health compromising and enhancing behaviours.

IV: Psychopathology

Approaches to Psychopathology, Diagnostic and Statistical Manual of Mental Disorders (DSM) and International Classification of Diseases (ICD), Mental Status Examination, Classification Psychotherapy and Counseling: Approaches, Types of psychotherapies, Individual counseling, Group counseling, process, skills and techniques

V: Psychological testing

Psychometry, Historical Sketch, WAIS, WISC, Raven's progressive Test, Projective Technique, Test standardization Areas of testing, Attitude scales, and its applications in various settings: Education, Industry, Clinical Settings.

Department of Commerce

I: Business Environment and International Business

- Theories of international trade; Government intervention in international trade; Tariff and non-tariff barriers; India's foreign trade policy
- Foreign direct investment (FDI) and Foreign portfolio investment (FPI); Types of FDI, Costs and benefits of FDI to home and host countries; Trends in FDI; India's FDI policy
- Regional Economic Integration: Levels of Regional Economic Integration; Trade creation and diversion effects; Regional Trade Agreements: European Union (EU), ASEAN, SAARC, NAFTA
- World Trade Organization (WTO): Functions and objectives of WTO; Agriculture Agreement; GATS; TRIPS; TRIMS

II: Business Economics

- Meaning and scope of business economics
- Objectives of business firms
- Demand analysis: Law of demand; Elasticity of demand and its measurement; Relationship between AR and MR
- Consumer behavior: Utility analysis; Indifference curve analysis
- Law of Variable Proportions: Law of Returns to Scale
- Price determination under different market forms: Perfect competition; Monopolistic competition; Oligopoly- Price leadership model; Monopoly; Price discrimination

III: Banking and Financial Institutions

- Types of banks
- Reserve Bank of India: Functions; Role and monetary policy management
- Banking sector reforms in India: Basel norms; Risk management; NPA management
- Financial markets: Money market; Capital market; Government securities market
- Financial Institutions: Development Finance Institutions (DFIs); Non-Banking Financial Companies (NBFCs); Mutual Funds; Pension Funds
- Financial Regulators in India
- Digitization of banking and other financial services: Internet banking; mobile banking; Digital payments systems

IV: Legal Aspects of Business

- Indian Contract Act, 1872: Elements of a valid contract; Capacity of parties; Free consent; Discharge of a contract; Breach of contract and remedies against breach; Quasi contracts;
- The Companies Act, 2013: Nature and kinds of companies; Company formation; Management, meetings and winding up of a joint stock company
- The RTI Act, 2005: Objectives and main provisions
- Goods and Services Tax (GST): Objectives and main provisions; Benefits of GST; Implementation mechanism; Working of dual GST

V: Income-tax and Corporate Tax Planning

- Income-tax: Basic concepts; Residential status and tax incidence; Exempted incomes; Agricultural income; Computation of taxable income under various heads; Deductions from Gross total income; Assessment of Individuals; Clubbing of incomes
- Corporate Tax Planning: Concepts and significance of corporate tax planning Techniques Tax considerations in specific business situations
- Deduction and collection of tax at source; Advance payment of tax; E-filing of income-tax returns.

தமிழ்த்துறை

அலகு - 1:

சங் இலக்கியம் - சங்கம் மருவிய இலக்கியங்கள்

சங்க காலம் பற்றிய குறிப்புகள் – சங்க இலக்கியங்கள் பற்றிய செய்திகள் – பாட்டும் தொகையும்: தொகுப்பு முறைகள் – சங்க காலச் சிறப்புகள் – இலக்கியங்களின் வழி வெளிப்படும் பண்பாட்டுப் படிநிலைக் கூறுகள் – சங்கம் மருவிய காலம் பற்றிய குறிப்புகள் – சங்க மருவிய கால இலக்கியங்கள் பற்றிய குறிப்புகள் – இலக்கிய வகைமைகளின் மாற்றங்கள் – அகம் புறம் பிரிவுகளின் வளர்ச்சி நிலைகள் – அற நூல்களின் நோக்கம் – சிறப்பு – இலக்கியங்களின் பின்னணியும் அரசியலும் – சமயப் பின்னணியும் இலக்கியங்களும்.

அலகு - 2:

மொழியும் இலக்கணமும் - உரைகளும்

மொழியின் தோற்றம் - வளர்ச்சி நிலைகள் – மொழி இனங்கள் – தமிழ் மொழியின் வரலாற்றுப் பின்னணி – தோற்றம் வளர்ச்சி நிலைகள் - மொழிக் குடும்பம் – சிறப்புகள் – மொழி நூல்கள் – இலக்கண நூல்கள் – வளர்ச்சி – கால வரையறைகள் – உரைகளின் தோற்றம், வளர்ச்சி, நோக்கம் – உரையாசிரியர்கள் – காலம் - வளர்ச்சி – இலக்கிய உரையாசிரியர்கள் – இலக்கண உரையாசிரியர்கள் – உரையாசிரியர்களின் கோட்பாடுகள்.

அலகு - 3:

காப்பியங்கள்: காப்பியம் – விளக்கம் – வரையறை – காப்பியங்களின் காலம் - வளர்ச்சி – ஐம்பெரும் காப்பியங்கள் – ஐஞ்சிறு காப்பியங்கள் – காப்பியங்களின் தனிச் சிறப்புகள் – பெருங்கதை – கம்பராமாயணம் – சீறாப்புராணம் – பிற காப்பியங்கள்.

அலகு - 4:

பக்தி இலக்கியங்கள் – சிற்றிலக்கியங்கள்

பக்தி இலக்கியம் தோற்றம் – வளர்ச்சி – பன்னிரு திருமுறைகள் – நாலாயிரத் திவ்விய பிரபந்தம் – பெரிய புராணம் – பொருள் விளக்கம் – வகைமைகள் – வளர்ச்சி – சைவக் கோட்பாடுகள் – வைணவக் கோட்பாடுகள் – **சிற்றிலக்கியம் :** காலம் – வளர்ச்சி – 96 வகை சிற்றிலக்கியங்கள் – வகைமைகள் – வளர்ச்சி நிலைகள் – கலம்பகம் – தூது

– உலா- பிள்ளைத்தமிழ் – பள்ளு – குறவஞ்சி – அந்தாதி – கோவை – சதகம் – மடல் – மாலை – பரணி – ஊசல் – ஆற்றுப்படை – தாண்டகம் – இன்னபிற.

அலகு - 5:

இக்கால இலக்கியங்கள் – திறனாய்வு நெறிகள்

ஐரோப்பியரின் வருகை –அச்சு இந்திரம் வருகை – பதிப்புகள் உருவாதல் - மொழிமாற்றம் – மேற்கத்திய இலக்கியங்களின் தாக்கம் – கவிதை - சிறுகதை, நவீனம், நாடகங்களின் தோற்றம் – கட்டுரை இலக்கியம் - இலக்கிய தோற்றம் பற்றிய கொள்கை – திறனாய்வு நெறிகள் – வகைமைகள் – நவீனத் திறனாய்வ நெறிகள் - அணுகுமுறைகள்