Department of Mechanical Engineering
Syllabus for Ph. D Entrance Examinations

Module 1 - Research Methodology

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling –Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis – Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2 - Applied Mechanics

Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.
Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Module 3 - Machine Design

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts. Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Module 4 - Fluid Mechanics and Thermal Sciences

Fluid Mechanics: Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary
turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.
Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Applications: Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.

Module 5 - Materials, Manufacturing and Industrial Engineering

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming. Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools; additive manufacturing. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.

Inventory Control: Deterministic models; safety stock inventory control systems. Operations Research: Linear programming, simplex method, transportation, assignment, net work flow models, simple queuing models, PERT and CPM.

Note: Equal distribution of questions and marks in all the modules.

Department of Civil Engineering

Syllabus for Ph. D Entrance Examination

Module 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2 - STRUCTURAL ENGINEERING

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses.

Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Concrete Structures: Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams.

Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames.

Construction Materials and Management: Construction Materials: Structural Steel - Composition, material properties and behavior; Concrete - Constituents, mix design, short-term and long-term properties. Construction Management: Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation.

Module 3 - GEOTECHNICAL ENGINEERING

Soil Mechanics: Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One- dimensional consolidation, time rate of consolidation; Shear Strength, Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.

Foundation Engineering: Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils – Boussinesq's theory; Pressure bulbs, Shallow foundations – Terzaghi's and Meyerhoff's bearing, capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction. unlined canals, Design of weirs on permeable foundation; cross drainage structures.

Module 4 - ENVIRONMENTAL ENGINEERING

Water and Waste Water Quality and Treatment: Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment.

Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

Air Pollution: Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal). Water Resources Engineering.

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum and energy equations and their applications; Potential flow, Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth; Concept of lift and drag.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, Evapo-transpiration; Gravity Dams and Spillways.

Module 5 - TRANSPORTATION ENGINEERING

Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments. Geometric design of railway Track – Speed and Cant. Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.

Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes.

Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity.

Geomatics Engineering

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves. Photogrammetry and Remote Sensing - Scale, flying height; Basics of remote sensing and GIS.

Note: Equal distribution of questions and marks in all the modules.

Department of Electronics and Communication Engineering

Syllabus for Ph. D Entrance Examinations

Module 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2 – NETWORKS AND ELECTRON DEVICES

Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks

Electronic Devices:

Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASERs. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process

Module 3 – ANALOG AND DIGITAL CIRCUITS

Analog Circuits:

Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.

Digital Circuits:

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift- registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor (8085): architecture, programming, memory and I/O interfacing.

Module 4 – COMMUNICATION SYSTEMS

Electromagnetics:

Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain

Communications:

Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM),digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK),matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM

Module 5 – SIGNALS AND SYSTEMS

Signals And Systems:

Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, groupdelay, phase delay. Signal transmission through LTI systems

Control Systems:

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral- Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

Note: Equal distribution of questions and marks in all the modules.

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution & Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Electrical and Electronics Engineering

Syllabus for Ph. D Entrance Examinations

Module 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2 - ELECTRICAL AND ELECTRONIC CIRCUITS

Mesh and nodal analysis for D.C and A.C. circuits, star delta conversion. Network Theorems, Self and mutual inductance – Coefficient of coupling, Transient response of RL, RC and RLC Circuits, two port networks, analysis of three phase circuits.

Characteristics of diodes, BJT, MOSFET; Amplifiers: Biasing, Equivalent circuit and Frequency response; Oscillators; Operational amplifiers: Characteristics and applications; Combinational and Sequential logic circuits, A/D and D/A converters, 8085 Microprocessor.

Module 3 - ELECTRICAL MACHINES AND DRIVES

DC machines – separately excited, series and compound machines. Induction machines – squirrel cage and wound rotor. Synchronous machines. Methods of speed control of dc machines - Methods of speed control of single and three phase induction machines. Theory and operation of single and three phase transformers, equivalent circuit, Testing of machines. Servo and stepper motor- performance, regulation and parallel operation of generators

Characteristics of semiconductor power devices: Diode, Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost converters, PWM control of DC-DC converters; Single and three phase configuration of uncontrolled and controlled rectifiers, Bidirectional AC to DC voltage source converters, Issues of harmonics, Power factor, Distortion factor of AC to DC converters, Single phase and three phase inverters, Sinusoidal pulse width modulation. Methods of conventional controls, application of static controls and microprocessor based controls for AC and DC machines. Basic concepts of adjustable speed DC and AC drives.

Module 4 - POWER SYSTEMS

Power generation concepts, ac and dc transmission concepts, Models and performance of cables, Transmission line parameters; Representation of short, medium, and long transmission lines – ABCD parameters; Circle Diagram, Distribution systems, Utilization of electrical energy. Series and shunt compensation, Per unit quantities, Bus admittance matrix, Gauss- Seidel and Newton Raphson load flow methods, Symmetrical components, Symmetrical and unsymmetrical fault analysis. Voltage and Frequency control, Power factor correction, Protection Schemes for Transformer, Generators and Transmission Lines, Principles of overcurrent, differential and distance protection; Circuit breakers, System stability concepts, Equal area criterion. Introduction to Solar Photovoltaic Systems, Wind power systems.

Module 5 - CONTROL SYSTEMS AND INSTRUMENTATION

Principles of feedback, transfer function, Mathematical modelling, block diagrams and representation of systems, Signal flow graphs, Transient and Steady state analysis of linear time invariant systems, Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Stability analysis, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, State transition matrix.

Classification of Instruments, Moving iron, Moving Coil, Permanent magnet, and Dynamometer types. Thermal, Electrostatic Rectifier Instruments, Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis. General Transducers voltage, current, phase angle, optical, Hall effect and Industrial transducers.

Note: Equal distribution of questions and marks in all the modules.

Department of Computer Science and Engineering
&
Information Technology

Common Syllabus for Ph. D Entrance

ExaminationsModule 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling –Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis – Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2 - DIGITAL LOGIC, COMPUTER ORGANIZATION AND ARCHITECTURE

Boolean algebra and Minimization of Boolean functions, Flip-flops-types, Race condition and comparison. Design of combinational and sequential circuits. Representation of Integers: Octal, Hex, Decimal, and Binary. 2's complement and 1's complement arithmetic. Floating point representation. Combinational Circuit Design, Sequential Circuit Design. Hardwired and Micro-programmed processor design, Instruction formats, Addressing modes, memory types and organizations, interfacing peripheral devices, Interrupts.

Module 3: PROGRAMMING, DATA STRUCTURES AND ALGORITHMS

Programming in C- Fundamentals- Functions- Arrays- Pointers- Structures- Unions, Recursion, Data Structures - stacks, queues, linked lists, trees, binary search trees, binary heaps, AVL trees, Graphs, Sets, Tables. Files- Sequential, Direct, index-sequential and relative files. Hashing, Inverted lists and multi-lists, Searching, sorting, hashing. Asymptotic notations – big oh, omega and theta, time and space complexity. Algorithm design techniques: Divide and Conquer, greedy, dynamic programming, Backtracking, Branch and Bound. Lower bound theory, nondeterministic algorithm, non-deterministic programming constructs. NP-hard and NP-complete problems.

Module 4: OPERATING SYSTEMS, COMPUTER NETWORKS

Operating Systems: Basic concepts, processes, threads, inter-process communication, concurrency and synchronization. Deadlock, CPU and I/O scheduling. Memory management and virtual memory. File systems, I/O systems.

Computer Networks: Concept of layering: OSI and TCP/IP Protocol Stacks; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4; Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

Module 5: DATABASE SYSTEMS, SOFTWARE ENGINEERING

Database Systems: Database and DBMS, ER model, DDL, DML, JOINS, Nested Sub queries, Integrity Constraints, Normalization File Organization, RAID, Indexing, Transaction, ACID Properties, Serializability, Concurrency Control, Failure Classification.

Requirement and Feasibility, Analysis, Data Flow Diagrams, Process Specifications, Input/ Output Design, Process Life Cycle, Planning and Managing the Project, Software Architecture and Design Patterns, Software Reliability and Advanced Testing Techniques, Implementation, Maintenance, Aspect Oriented Programming.

And recent trends in computer science and information technology related domains.

Note: Equal distribution of questions and marks in all the modules.

Department of Physics

Syllabus for Ph. D Entrance Examination

Module 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2 - MECHANICS

Classical Mechanics: 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 pseudo forces. 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.

Quantum Mechanics: Wave-particle duality. Schrödinger equation, Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. 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.

Module 3 - STATISTICAL, THERMAL AND CONDENSED MATTER PHYSICS

Statistical and Thermal Physics: Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro - and macro - states. Micro -canonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law.

Condensed Matter 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: type-I and type -II superconductors. Josephson junctions. Super fluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

Module 4 - APPLIED PHYSICS

Electronics: Semiconductor devices, device structure, device characteristics, frequency dependence and applications. Optoelectronic devices, Operational amplifiers and their applications. Digital techniques and applications. 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.

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. 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.

Module 5 - NUCLEAR AND PARTICLE PHYSICS

Nuclear 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. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions.

Particle Physics: Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann -Nishijima formula. Quark model, baryons and mesons. C, P and T invariance. Application of symmetry arguments to particle reactions. Parity non -conservation in weak interaction. Relativistic kinematics.

Note: Equal distribution of questions and marks in all the modules.

Department of Chemistry

Syllabus for Ph. D Entrance Examinations

Module 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2 - INORGANIC CHEMISTRY

Chemical periodicity- Structure and bonding in homo - and heteronuclear molecules, including shapes of molecules (VSEPR Theory) - Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds - Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms - Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications-Organometallic compounds: synthesis, bonding and structure, and reactivity - Analytical Chemistry- separation, spectroscopic, electro- and thermoanalytical methods - Bioinorganic Chemistry- photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine

Module 3 - PHYSICAL CHEMISTRY

Basic principles of quantum mechanics: Postulates; operator algebra; exactly-solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; tunnelling - Approximate methods of quantum mechanics: Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions - Statistical thermodynamics: Nernst equation, redox systems, electrochemical cells; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions - Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis

Module 4 - ORGANIC CHEMISTRY

IUPAC nomenclature of organic molecules including Regio- and stereoisomers - Principles of stereochemistry: Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species - Determination of reaction pathways - Common named reactions and rearrangements – applications in organic synthesis - Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic) - Concepts in organic synthesis: Retrosynthesis, disconnection, synthons - Asymmetric synthesis: Pericyclic reactions – electrocyclization, cycloaddition, sigmatropic rearrangements and other related concerted reactions - Principles and applications of photochemical reactions in organic chemistry.

Module 5 – SPECTROSCOPY AND GROUP THEORY

(a) Organic Spectroscopy

Structure determination of organic compounds by IR, UV-Vis, 1H & 13C NMR and Mass spectroscopic techniques.

(b) Inorganic Spectroscopy

Characterization of inorganic compounds by IR, Raman, NMR, EPR, Mossbauer, UV-VIS, NQR, MS, electron spectroscopy and microscopic techniques.

(c) Molecular Spectroscopy

Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules

(d) Group Theory

Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.

Note: Equal distribution of questions and marks in all the modules.

Department of Mathematics

Syllabus for Ph.D Entrance Examinations

Module 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

MODULE 2 - LINEAR ALGEBRA

Linear Algebra

Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms.

Algebra

Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle. Fundamental theorem of arithmetic, divisibility in Z, congruence's, Chinese Remainder Theorem, Euler's Ø- function, primitive roots. Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibility criteria. Fields, finite fields, field extensions, Galois Theory.

MODULE 3- ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Ordinary Differential Equations (ODEs)

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs)

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Probability

Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Binomial, Poisson and Normal Distribution.

MODULE 4-COMPLEX ANALYSIS

Analysis

Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral. Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems. Metric space s, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Complex Analysis

Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

MODULE 5-STATISTICS

Statistics

Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests. Simple nonparametric tests for one and two sample problems. Correlation, rank correlation and Regression.

Numerical Analysis

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Graph theory

Graph, properties of graphs, connected graphs, Euler and Hamilton graphs, planar Graphs, Trees, properties of trees, Rank, Nullity and kruskals algorithm.

Note: Equal distribution of questions and marks in all the modules.

Department of English

Syllabus for Ph.D Entrance Examination

MODULE 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis -Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

MODULE 2 - CHAUCER TO SHAKESPEARE

- Geoffrey Chaucer: The Book of the Duchess
- Edmund Spencer: Epithalamion
- Shakespeare: Sonnet(8,15,24,30,37,40,46,76,82,91,112,116,126,140,144,147,154)
- Francis Bacon: Of Oxford, Of Nobility, Of Travel, Of Friendship, Of Love
- Ben Jonson: Volpone or the Fox
- Christopher Marlowe: Dr. Faustus
- Sir Thomas More: Utopia
- John Webster: The White Devil
- William Langland: Piers Plowman
- Shakespeare: The comedy of Errors, A Midsummer Night's Dream, Hamlet, Henry VIII, Love's Labour Lost

MODULE 3 - JACOBEAN TO RESTORATION PERIODS

- John Milton: Paradise Regained
- John Dryden: All for Love
- Alexander Pope: The Rape of the Lock
- Andrew Marwell: Garden
- Thomas Gray: Elegy written in a country churchyard
- Jonathan swift: A Tale of a Tub
- Addison and Steele: The spectators and the coverly papers. (Essays 1-10, Macmillan Edn)
- Oliver Goldsmith: The Deserted Village
- Henry Fielding: Joseph Andrews
- Samuel Daniel: Christ Victoric Triumph
- Sir Thomas Brown: The Garden of Cyrus

- ❖ William Blake: Songs of Experience
- ❖ Daniel Defoe: Robinson Crusoe
- ❖ Jonathan Swift: Gulliver's Travels
- ❖ Henry Vaughan: Regeneration

MODULE 4 - AMERICAN LITERATURE

- ❖ Whitman: When Lilacs Last in the Dooryard Bloom'd
- ❖ H.W. Long Fellow: The May Queen
- ❖ Edgar Allan Poe: The Haunted Palace, To my Mother, The Lake
- ❖ Emily Dickinson: A something in a summer's Day, Bless God, he went as soldiers, How happy is the little Stone, This is my Letter to The World
- ❖ Robert Frost: Blue Berries
- ❖ Wallace Stevens: The Snow Man
- ❖ Emerson: The American Scholar
- ❖ Henry James: The Lesson of the Master
- ❖ O'Neill: The Great God Brown
- ❖ Hawthorne: A House of the Seven Gables
- ❖ Edward Albee: The American Dream
- ❖ Alice Walker: By the Light of My Father's Smile
- ❖ Mark Twain: The Adventures of Tom Sawyer
- ❖ Earnest Hemingway: The Old Man and the Sea

MODULE 5 - INDIAN AND ENGLISH LITERATURE

- ❖ Nissin Ezekiel: Night of the Scorpion
- ❖ A.K. Ramanujam: A River
- ❖ R. Parthasarathy: Lines for a Photograph
- ❖ Toru Dutt: Our Casuarina Tree
- ❖ Sarojini Naidu: The Soul's Prayer
- ❖ Anita Desai: Where shall we go for this summer?
- ❖ Badal Surcar: Evam Indrajit
- ❖ Sri Aurobindo: Rose of God
- ❖ Arundhati Roy: The God of Small Things
- ❖ Mulk Raj Anand: Untouchable
- ❖ Deshpande: The Dark Holds No Terror
- ❖ Kirish Karnad: Tugulaq

Note: Equal distribution of questions and marks in all the modules.

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
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Madagadipet, Puducherry - 605 107

Department of Management

Syllabus for Ph. D Entrance Examinations

Module 1 - RESEARCH METHODOLOGY

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling – Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis - Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

Module 2- GENERAL MANAGEMENT

General Management: Principles and Functions - Planning - MBE - MBO - Decision making - Organizing - Departmentation - Directing - Controlling.
Organizational Behaviour: Personality - Perception - Learning - Attitudes - Values - Motivation - Communication - Emotions - Emotional intelligence - Group behaviour - interpersonal relations - Power - Politics - Teams - Leadership - Organizational Development - Organizational Climate - Organizational Change - Culture - Stress - Organizational Effectiveness

Module 3- BUSINESS ENVIRONMENT

Business Environment: The concept of business environment – Its significance and nature, The process of environmental scanning, Basic philosophies of capitalism and socialism with their variants, The rise of consumerism in India, Economic environment, Socio-cultural environment, Politico-legal environment, Technological environment, Indian financial markets and their regulating body- SEBI, Institutional financing bodies and role of RBI in regulating money and economy, Indian planning and sectoral development, National Income - Concepts & Measurement, Industrial policy, Fiscal & monetary Policy, Economic Reforms since 1991, EXIM Policy-EPZ, export houses and trading houses, etc, Inflationary trends- impacts and analysis, concept of WPI, CPI. Global Economy: Size, Growth, Inflation, Developed, NISs and underdeveloped countries and their growth Prospects, International Trade: World Trade, Pattern, Composition, Significant shifts, Volume, Trade in services. India's Position in world trade.

Module 4 - MARKETING MANAGEMENT

Marketing Management: Marketing Environment - Marketing Planning Process - Marketing Mix Elements - Segmentation, Targeting, Positioning - Strategic Marketing - Customer Relationship Management - Marketing Information System - Marketing Research - Recent Marketing Trends.

Human Resource Management: Recruitment - Induction - HR Planning - Selection - Training and Development - Performance measurement - Career management - Work life balance - Grievance Redressal Mechanism.

Financial Management: Capital Budgeting - Cost of Capital, Capital Structure, Designing capital structure, Financial and operating leverages - Working capital Management, Determinants, working capital finance.

Operations Management: Demand forecasting - Capacity planning - Aggregate Planning - Product Design - Vendor rating and Value analysis.

Module 5- PROJECT AND STRATEGIC MANAGEMENT

Project Management: Scheduling Technique, PERT, CPM - Quality - Customer Focus - Customer Perception of Quality, Dimensions of Product and Service Quality. Concepts of Quality Circle - Six sigma - Quality functions development (QFD) - Failure mode effect analysis (FMEA) - Benchmarking.

Strategic Management: Process - Vision - Mission - Objectives - Goals - Policies - Porter's Five Forces Model - Generic Strategies - SWOT Analysis - Balance Score Card - Value Chain - Corporate Strategy - Corporate Governance and Social responsibility.

Note: Equal distribution of questions and marks in all the modules.