![Chitkara University logo]

[Established under the Sections 2(f) of the UGC Act, 1956]

ADMISSION TO Ph.D. PROGRAMME OF SESSION 2013-14

Chitkara University has been established with a mission to pursue excellence in all fields of education and to adhere to the highest standards of academic rigor in all its work. The University is fast moving towards attaining leadership position in North India, which speaks volumes about its enduring commitment, outstanding faculty and rich learning environment.

The Chitkara University offers Ph.D. Programme which has been designed to impart knowledge through courses, seminars, projects and thesis work. It will help the scholars to consolidate the concepts and intellectual skills as well as to explore the potential in analyzing the knowledge related to their respective areas of research in a free and objective manner in order to meet the needs of the society. Admission to Ph.D. programme will be made purely on the basis of merit following the prescribed criteria of the University.

Eligibility Criteria

(i) Master's degree in the concerned discipline or equivalent in a relevant discipline with 55% marks or CGPA of 5.5 on a 10 point rating scale or equivalent.

(ii) Part-Time Candidates must provide a 'No Objection Certificate' from the employer at the time of admission.

Areas of Research

Chitkara University offers PhD programme in different disciplines of Engineering, Technology, Management and Sciences etc in the following Departments/Schools of the University:

a) Engineering (Computer Science, Electronics & Communication, Mechanical, Information Technology)

b) Applied Sciences (Mathematics, Physics, Chemistry)

c) Management

d) Pharmacy

e)   Mass Communication

f)   Education

g)   Architecture

h)   Health Care Management

Mode of Selection

Admission to the Ph.D. Programme is made on the basis of Entrance Test and Interview. Exemption from the Test will be given to those who have qualified UGC-NET/CSIR-JRF or GATE during the last two years. The written test shall be followed by a mandatory interview in the form of interaction.

Scheme of Test

The medium of test shall be English only. The Paper shall comprise two sections (I & II) of objective/ descriptive type questions.

Section I will consist of 60 objective questions of 1 mark each designed from the components; English & General Studies, Quantitative Reasoning, and Analytical Reasoning & Mental Ability.

Section II will consist of descriptive questions of 5 marks each designed from the area of specialization(based on ME/MTech/MPhil/MCA/MSc/MA/MBA/CA) in which a candidate seeking admission to the degree of Doctor of Philosophy and carrying 20 marks. The candidates will be required to attempt any 4 questions out of 5 questions.

The duration of the test shall be two hours. The qualifying marks for the test will be 50%.

Section III (Personal Interview)

Candidates qualifying the written test will be subjected to personal interview to assess their motivation and potential in the proposed research area. Personal interview will be carrying 20 marks. The merit list will be made having 60% weigtage for section III and 40% weigtage for the section I & II.

Pre-Registration

(i)   Depending upon the availability of the supervisors in the chosen discipline registration process will be initiated and a supervisor will be allotted to the candidates who qualify in the entrance test.

(ii)   The candidate will have to deposit the prescribed fee immediately after   research supervisor is allotted.

(iii)   During the pre-registration process that may last up to one semester the candidates would be required to:

- Attend and pass a course on Research Methodology and seminar. Candidates who have already passed a course on Research Methodology while pursuing studies for PG degree or equivalent are exempted.
- Pass a qualifying examination in the chosen domain.
- Carry out literature survey
- Make a presentation on literature survey to the Doctoral Research Committee (DRC).
- Submit the research proposal to the respective department

Registration

(i)   Candidates who pass the examination for the prescribed courses and whose research proposal is accepted will be allowed to register for the Ph.D. program after due approval from Doctoral Research Committee. The date of registration will be from the date of approval of research proposal by Doctoral Research Committee.

(ii)   Candidates will be permitted to commence research thereafter.

Important Note: Every admitted candidate shall have to do course work for a minimum of one Semester. The course work shall include three courses, namely, a course on research methodology of 4 credits, a domain course of 4 credits (its syllabus to be proposed by the allocated supervisor and approved by In-charge Ph.D. programme) and a seminar of 2 credits. Minimum credits for the course work shall be 10. Only those candidates who successfully complete the course work with minimum grade points of 6.5 (C^+ grade) in each course on 10.00 point scale shall be registered in the PhD programme. A student getting C or lower grade in any course will have to reappear in the end semester examination of that

subject again, whenever its exam is conducted again with the regular examination, after payment of appropriate examination fee.

After successful completion of the course work, every candidate will be required to submit research proposal, duly recommended by the Supervisor(s). **The minimum time period to submit the research proposal shall be one semester from the date of completion of the course work and maximum time allowed to submit the research proposal shall be one year.** In case of non-submission of proposal within one year, on the recommendations of the Supervisor and In-Charge of Ph.D Programme as well as after approval of VC, may grant an extension for a maximum period of six months. If the candidate fails to submit the proposal even during the extended period her/his admission will be cancelled. In case the proposal is rejected by the Doctoral Research Committee (DRC), she/he may resubmit it within next six months starting the date of meeting of DRC failing which her/his admission will be cancelled.

Conditions to be met for Successful Completion of Ph. D Program

(i)   Candidates should have at least two research papers published in refereed SCI journals with impact factor greater than/equal to 0.5.

(ii)   Minimum time required for completion of Ph.D program will be 24 months from the date of registration.

(iii)   Maximum time allowed to complete the Ph.D program will be five years from the date of registration. This time limit may be extended by a maximum of one year by the Vice-Chancellor based on the recommendations of Doctoral Research Committee.

Submission of Application Form for PhD Admission

Application for admission must be submitted on the prescribed form. The application form can be downloaded from the University website www.chitkara.edu.in. Completed application form along with a Demand Draft of Rs 1000/- in favour of Chitkara University payable at Chandigarh should reach in the office the "Registrar, Chitkara University, Punjab Campus (Chandigarh - Patiala National Highway (NH-64), Distt. Patiala – 140401 (Punjab), INDIA), by **December 25, 2013**.

Date of Entrance test to be conducted by Chitkara University will be announced thereafter. Candidates are advised to regularly browse University website www.chitkara.edu.in.for information regarding Ph.D. Entrance test /admission.

Fee Structure:

Academic Fee (per semester)   ----   Rs 30000/-

Caution Money (one time)   ----   Rs 10000/-

Note : All Research Scholars who are on the rolls of the Chitkara University are exempted from paying the tuition fee but will have to sign a bond with the University to continue to serve the University for at least one year after the completion of the Degree.

Dr Pankaj Kumar
In-Charge, PhD Programme
Chitkara University, Punjab

Ph.D PROGRAMME 2013-14

SYLLABUS FOR THE Ph.D ENTRANCE EXAMINATION

*****

SECTION I

1. English & General Studies

Interpersonal skills including communication skills, anonyms/synonyms, sentence completion, active/passive voice, prepositions, direct/indirect speech, idioms & phrases. General issues on environmental ecology, biodiversity and climate change (not requiring subject specialization). Economic and social development – multilateral trade agreement, sustainable development, poverty, inclusion, demographics, social sector initiatives, etc. Indian polity and governance – constitution, political system, public policy, rights issues, etc. Indian and world geography – physical, social, economic geography of India and the world. History of India and Indian national movement. Nobel prize winners, inventions & discoveries, awards & recognitions

2. Quantitative Reasoning

Ratios and proportion, percentages, profit & loss, averages, partnership; time-speed-distance, work and time; number system, factors, multiples; pipes and cisterns, simple interest & compound interest, installment payments; clocks, calendar; in-equations, quadratic and linear equations, functions, logarithm geometry, mensuration and solid geometry, geometry (lines, angles, triangles, spheres, rectangles, cube, cone etc), co-ordinate geometry.

Set theory, measures of central tendency and dispersion, probability and theory random variables (single variable case only), probability distribution (binomial, poisson and normal), correlation & regression; permutation & combinations; maxima & minima progression; complex numbers; data Interpretation based on text, graphs (column graphs, bar graphs, line charts, Pie charts, graphs representing area) and tables.

3. Analytical Reasoning & Mental Ability

Critical reasoning, visual reasoning, assumption-premise-conclusion, assertion and reasons; statements and assumptions, identifying valid inferences, identifying strong arguments and weak arguments, statements and conclusions; cause and effect, identifying probably true, probably false, definitely true, definitely false kind of statement; linear arrangements, matrix arrangements, puzzles, family tree problem, symbol based problems; coding and decoding, sequencing, identifying next number in series, etc; tables. Basic numeracy (numbers and their relations, orders of magnitude, etc.)

SECTION II

COMPUTER SCIENCE & ENGINEERING

Digital Logic:

Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point).

Computer Organization and Architecture:

Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

Programming and Data Structures:

Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

Algorithms:

Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-andconquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes P, NP, NP-hard, NP-complete.

Theory of Computation:

Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability.

Compiler Design:

Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

Operating System:

Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

Databases:

ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Information Systems and Software Engineering:

information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

Computer Networks:

ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security basic concepts of public key and private key cryptography, digital signature, firewalls.

Web Technologies:

HTML, XML, basic concepts of client-server computing

ELECTRONICS AND COMMUNICATION ENGINEERING

Networks :

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.

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.

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, ztransform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, 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.

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.

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.

MECHANICAL ENGINEERING

Engineering Mechanics :

Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials :

Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.

Theory of Machines :

Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

Vibrations :

Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

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, spur gears, rolling and sliding contact bearings, brakes and clutches.

Fluid Mechanics and Thermal Sciences

Fluid Mechanics :

Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

Heat-Transfer :

Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Thermodynamics :

Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

Applications :

Power Engineering **:** Steam Tables, Rankine, Brayton cycles with regeneration and reheat. *I.C. Engines*: air-standard Otto, Diesel cycles. *Refrigeration and air-conditioning*: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. *Turbomachinery:* Peltonwheel, Francis and Kaplan turbines - impulse and reaction principles, velocity diagrams. Manufacturing and Industrial Engineering

Engineering Materials :

Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

Metal Casting :

Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

Forming :

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.

Joining :

Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

Machining and Machine Tool Operations :

Mechanics of machining, 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, principles of design of jigs and fixtures.

Metrology and Inspection : Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing :

Basic concepts of CAD/CAM and their integration tools.

Production Planning and Control :

Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Inventory Control :

Deterministic and probabilistic models; safety stock inventory control systems.

Operations Research :

Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

MATHEMATICS

Linear Algebra :

Finite dimensional vector spaces; Linear transformations and their matrix representations, rank; systems of linear equations, eigen values and eigen vectors, minimal polynomial, Cayley-Hamilton Theroem, diagonalisation, Hermitian, Skew-Hermitian and unitary matrices; Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, self-adjoint operators.

Complex Analysis :

Analytic functions, conformal mappings, bilinear transformations; complex integration: Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle; Taylor and Laurent's series; residue theorem and applications for evaluating real integrals.

Real Analysis :

Sequences and series of functions, uniform convergence, power series, Fourier series, functions of several variables, maxima, minima; Riemann integration, multiple integrals, line, surface and volume integrals, theorems of Green, Stokes and Gauss; metric spaces, completeness, Weierstrass approximation theorem, compactness; Lebesgue measure, measurable functions; Lebesgue integral, Fatou's lemma, dominated convergence theorem.

Ordinary Differential Equations :

First order ordinary differential equations, existence and uniqueness theorems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients; method of Laplace transforms for solving ordinary differential equations, series solutions; Legendre and Bessel functions and their orthogonality.

Algebra :

Normal subgroups and homomorphism theorems, automorphisms; Group actions, Sylow's theorems and their applications; Euclidean domains, Principle ideal domains and unique factorization domains. Prime ideals and maximal ideals in commutative rings; Fields, finite fields.

Functional Analysis :

Banach spaces, Hahn-Banach extension theorem, open mapping and closed graph theorems, principle of uniform boundedness; Hilbert spaces, orthonormal bases, Riesz representation theorem, bounded linear operators.

Numerical Analysis :

Numerical solution of algebraic and transcendental equations: bisection, secant method, Newton-Raphson method, fixed point iteration; interpolation: error of polynomial interpolation, Lagrange, Newton interpolations; numerical differentiation; numerical integration: Trapezoidal and Simpson rules, Gauss Legendre quadrature, method of undetermined parameters; least square polynomial approximation; numerical solution of systems of linear equations: direct methods (Gauss elimination, LU decomposition); iterative methods (Jacobi and Gauss-Seidel); matrix eigenvalue problems: power

method, numerical solution of ordinary differential equations: initial value problems: Taylor series methods, Euler's method, Runge-Kutta methods.

Partial Differential Equations :

Linear and quasilinear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification; Cauchy, Dirichlet and Neumann problems; solutions of Laplace, wave and diffusion equations in two variables; Fourier series and Fourier transform and Laplace transform methods of solutions for the above equations.

Mechanics :

Virtual work, Lagrange's equations for holonomic systems, Hamiltonian equations.

Topology :

Basic concepts of topology, product topology, connectedness, compactness, countability and separation axioms, Urysohn's Lemma.

Probability and Statistics :

Probability space, conditional probability, Bayes theorem, independence, Random variables, joint and conditional distributions, standard probability distributions and their properties, expectation, conditional expectation, moments; Weak and strong law of large numbers, central limit theorem; Sampling distributions, UMVU estimators, maximum likelihood estimators, Testing of hypotheses, standard parametric tests based on normal*, X2 , t, F* - distributions; Linear regression; Interval estimation.

Linear programming :

Linear programming problem and its formulation, convex sets and their properties, graphical method, basic feasible solution, simplex method, big-M and two phase methods; infeasible and unbounded LPP's, alternate optima; Dual problem and duality theorems, dual simplex method and its application in post optimality analysis; Balanced and unbalanced transportation problems, u -u method for solving transportation problems; Hungarian method for solving assignment problems.

Calculus of Variation and Integral Equations :

Variation problems with fixed boundaries; sufficient conditions for extremum, linear integral equations of Fredholm and Volterra type, their iterative solutions.

PHYSICS

Mathematical Physics :

Linear vector space; matrices; vector calculus; linear differential equations; elements of complex analysis; Laplace transforms, Fourier analysis, elementary ideas about tensors.

Classical Mechanics :

Conservation laws; central forces, Kepler problem and planetary motion; collisions and scattering in laboratory and centre of mass frames; mechanics of system of particles; rigid body dynamics; moment of inertia tensor; noninertial frames and pseudo forces; variational principle; Lagrange's and Hamilton's formalisms; equation of motion, cyclic coordinates, Poisson bracket; periodic motion, small oscillations, normal modes; special theory of relativity - Lorentz transformations, relativistic kinematics, mass-energy equivalence.

Electromagnetic Theory :

Solution of electrostatic and magnetostatic problems including boundary value problems; dielectrics and conductors; Biot-Savart's and Ampere's laws; Faraday's law; Maxwell's equations; scalar and vector potentials; Coulomb and Lorentz gauges; Electromagnetic waves and their reflection, refraction, interference, diffraction and polarization. Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves; radiation from a moving charge.

Quantum Mechanics : Physical basis of quantum mechanics; uncertainty principle; Schrodinger equation; one, two and three dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta; time independent perturbation theory; elementary scattering theory.

Thermodynamics and Statistical Physics :

Laws of thermodynamics; macrostates and microstates; phase space; probability ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck's distribution law; Bose-Einstein condensation; first and second order phase transitions, critical point.

Atomic and Molecular Physics :

Spectra of one- and many-electron atoms; LS and jj coupling; hyperfine structure; Zeeman and Stark effects; electric dipole transitions and selection rules; X-ray spectra; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR; lasers.

Solid State Physics :

Elements of crystallography; diffraction methods for structure determination; bonding in solids; elastic properties of solids; defects in crystals; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids; metals, semiconductors and insulators; transport properties; optical, dielectric and magnetic properties of solids; elements of superconductivity.

Nuclear and Particle Physics :

Nuclear radii and charge distributions, nuclear binding energy, Electric and magnetic moments; nuclear models, liquid drop model - semi-empirical mass formula, Fermi gas model of nucleus, nuclear shell model; nuclear force and two nucleon problem; Alpha decay, Beta-decay, electromagnetic transitions in nuclei; Rutherford scattering, nuclear reactions conservation laws; fission and fusion; particle accelerators and detectors; elementary particles, photons, baryons, mesons and leptons; quark model.

Electronics :

Network analysis; semiconductor devices; Bipolar Junction Transistors, Field Effect Transistors, amplifier and oscillator circuits; operational amplifier, negative feedback circuits , active filters and oscillators; rectifier circuits, regulated power supplies; basic digital logic circuits, sequential circuits, flip-flops, counters, registers, A/D and D/A conversion.

CHEMISTRY

Atomic Structure and Periodicity :

Planck's quantum theory, wave particle duality, uncertainty principle, quantum mechanical model of hydrogen atom; electronic configuration of atoms; periodic table and periodic properties; ionization energy, election affinity, electronegativity, atomic size.

Structure and bonding :

Ionic and covalent bonding, M.O. and V.B. approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridisation, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding, van der Waals interactions. Ionic solids, ionic radii, lattice energy (Born-Haber Cycle).

s.p. and d Block Elements :

Oxides, halides and hydrides of alkali and alkaline earth metals, B, Al, Si, N, P, and S, general characteristics of 3d elements, coordination complexes: valence bond and crystal field theory, color, geometry and magnetic properties.

Chemical Equilibria :

Colligative properties of solutions, ionic equilibria in solution, solubility product, common ion effect, hydrolysis of salts, pH, buffer and their applications in chemical analysis, equilibrium constants (K_c, K_p and K_x) for homogeneous reactions.

Electrochemistry :

Conductance, Kohlrausch law, Half Cell potentials, emf, Nernst equation, galvanic cells, thermodynamic aspects and their applications.

Reaction Kinetics :

Rate constant, order of reaction, molecularity, activation energy, zero, first and second order kinetics, catalysis and elementary enzyme reactions.

Thermodynamics :

First law, reversible and irreversible processes, internal energy, enthalpy, Kirchoff's equation, heat of reaction, Hess law, heat of formation, Second law, entropy, free energy, and work function. Gibbs-Helmholtz equation, Clausius-Clapeyron equation, free energy change and equilibrium constant, Troutons rule, Third law of thermodynamics.

Basis of Organic Reactions Mechanism :

Elementary treatment of SN1, SN2, E1 and E2 reactions, Hoffmann and Saytzeff rules, Addition reactions, Markonikoff rule and Kharash effect, Diels-Alder reaction, aromatic electrophilic substitution, orientation effect as exemplified by various functional groups. Identification of functional groups by chemical tests

Structure-Reactivity Correlations :

Acids and bases, electronic and steric effects, optical and geometrical isomerism, tautomerism, conformers, concept of aromaticity

MANAGEMENT

Marketing Management

Definition, Importance and Purpose of Marketing. Core marketing concepts, Marketing Channels, Societal forces. Capturing marketing insights. Developing Marketing Strategies and Plans, Value Chain, Value Delivery process, Strategic Planning, Defining Corporate Mission, Strategic Business Units, SWOT Analysis, Marketing Plan, Gathering information and environment scanning, Data warehousing and mining. Market research and forecasting demand :Market research process, forecasting the demand.

Micro environment. Connecting with customers, Creating Customer Value, Satisfaction and Loyalty, Customer Perceived Value, Customer Satisfaction, Customer Profitability. Customer Lifetime value, building loyalty, attracting and retaining customers, customer relationship management. Product life cycle stages and marketing strategies of companies in each stage of PLC. Identifying Market Segments and Targets, defining segmentation, Levels of Market segmentation, Evaluation and selection of segments, segmentation criterion. Analyzing Consumer Markets, consumer behavior, motivation, learning, buying decision process, decision heuristics. Analyzing Business Markets, organizational buying, participants in business buying process, stages in buying process, institutional and governmental markets.

Branding, Positioning strategy, PLC, Marketing strategies, Product mix, Pricing, Marketing mix, Packaging, labeling, Warranties, Guarantees, Designing and managing Integrated Marketing Channels, E-commerce, M-commerce, Retailing, Communication mix, Advertising, Sales promotions, Events, Experiences, Public relations, Direct and interactive marketing, Word of mouth, Personal selling, Designing sales force, Tapping new markets, Offerings, New product development, Global branding, Strategies to enter in foreign, licensing, joint ventures, direct investment.

Financial Accounting

Background: Need of Book Keeping & Accounting, Legal requirements in India. Book Keeping & Accounting: Basic Accounting Concepts, Accounting procedure and process involved in the preparation of Journal, Ledger, Trial Balance, Profit & Loss Account and Balance Sheet, Introduction to Subsidiary Books, Introduction to Computerized Accounting. Procedure of recording transactions, preparation of profit & loss account. Balance Sheet in computerized environment with Case study. Generally Accepted Accounting Principles: Meaning of Capital vs Revenue, Recognition of Cost of Sales and Inventories. Accounting for Fixed Assets and Depreciation. Concept of Deferred Revenue Expenditure. Introduction to Accounting Standards and International Financial reporting Standards (IFRS). Bank Reconciliation Statement, Reading Financial Statements with the help of Case Study. The annual Report: Introduction, types of report, general meetings, financial summary and other information, interim report.

Organizational Behavior

Introduction to Organization Behavior, managerial roles, management functions. Organization Behavior, contribution disciplines, managing diversity, Individual Behavior in Organizations. Learning and Behavior Management: Theories of learning, Attitudes and job satisfaction. Meaning, Types and measurement of personality, Concept of Perception, Perception and decision making. Motivation: concept and Theories of motivation, Contemporary theories of Motivation and motivation at work place, Emotion and Moods

Leadership concept, Trait and contingency theories, Leadership Contingency theories, Contemporary Issues in Leadership. Foundations of Group Behavior: Model for Group formation, Understanding Work Teams, Team-effectiveness model. Foundations of and New Design option in Organizational Structure.

Statistics for Managers

Role of Mathematics and statistics in Business Decisions, Theory of Sets, Compound interest. Equations: Linear, Quadratic & Simultaneous Equations, Matrix Algebra, Binomial Theorem, Principles of Mathematical Induction, Arithmetic Progression & Geometric Progression, Data Analysis: Measure of Central Tendency Measures of Dispersion: Skewness and Kurtosis, Correlation Analysis, Regression Analysis:, Index Numbers, Theory of Probability, Theoretical Distributions: Binomial, Poisson and Normal Distribution, Sampling Distribution, Standard Error, Theory of Estimation, Testing of Hypothesis: Large Sample Tests, Small Sample test.

Managerial Economics

Theory of Demand and Elasticity of Demand, Utility Analysis, Indifference curve Analysis and Consumer Equilibrium, Price Effect, Income Effect, Substitution Effect, Short run and long run production function and factors of production. Short run law of production: Law of returns to variable input (Law of Diminishing returns), Long run law of production: Law of returns to scale. Isoquant Curves, Law of returns to scale through Production function, Cobb- Douglas Production function, CES Production function. Classification of Costs Short run Cost- Output Relations, Short run Cost functions and cost curves. Long run Cost-Output Relations and Lond run cost curves. Economies and Diseconomies of Scale Break Even Analysis. Markets Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly.

Cost and Management Accounting

Cost accounting, Inventory management, Just-in-time purchasing (JIT), Material Requirement Planning (MRP), Cost-Volume-Profit analysis, The breakeven point, Tools for planning and Control, Budgeted costs, Management Accounting, Fund flow and cash flow analysis, Concept of fund, Shutdown analysis, Ratio analysis, Budgeting, Profit and loss accounts and balance sheet, Variance analysis, Management reporting system.

Principles of Management

Nature, purpose and scope of management, An overview of planning, organizing, decision-making, staffing, controlling and leadership. Ethics in managing and social responsibility of managers, Evolution of management thought.

Strategic Management

Introduction to Management, Strategic decision-making, Mission vs. Vision, Environmental appraisal, Internal appraisal, Corporate level strategies, Business Level Strategies, Industry level analysis, Leadership and corporate culture, Values, Ethics and Social responsibility, Strategic control and operational control, Strategic evaluation.

Marketing Research

Introduction to research, Relevance and significance of research in business, Research process, Research design, Experimental designs :- principles of experimental designs: formal and informal experimental designs completely randomized block designs-randomized block designs - latin square designs. Measurement and scaling theory types of errors, Sources and methods of collection of data. Differentiate between qualitative and quantitative research. Qualitative research - focus groups, in depth interviews, projective techniques. Quantitative research - survey and observation techniques. Sampling and sampling procedures, Sample size determination, Data preparation, tabulation and examination :- frequency distribution, measures of location, measures of variability and measures of shape). Hypothesis testing , parametric tests (t&z tests), chi square. ANOVA, correlation, regression, univariate and multivariate statistics. Interdependence techniques: - factor analysis, cluster analysis. Report writing - steps to prepare the report; Questionnaire design.

Sales and Distribution Management

The art of selling, Understanding the buying motive, The art of persuasion, Prospecting, planning the sales, Sales presentation, Negotiation and sales close. New developments in the selling practices, Telemarketing, Relationship marketing, Retail selling and business to business selling, Electronic media, Emerging trends. The job of sales manager, Sales budgeting, Routing and scheduling sales force. Organizing the sales department, Link with other functional areas of business. Sales force management, Recruiting, Selecting, Training, Compensation plans, Motivation, Evaluation of sales force performance. Channel management, Structure, Designing channel system. Retailing and wholesalin, International channels, Channel performance evaluation. Physical distribution and logistics management, Logistic system analysis, Org. control, Transportation, Routing, Operation plans. Warehouse management, Merchandise handling, Stacking, Protection, Control against theft, Pilferage, Spoilage, Shrinkage, Pests & insects' control, Recv. & issuing inventory, Overhead costs, Control systems.

Financial Management

Evolution of Financial, Budgeting: Capital Budgeting process, Project formulation & Project Selection, Source of Long Term funds, Lease financing, Capital structure, Cost of Capital, Operating and Financial

Leverage, Working capital, Management of Retained Earnings & Dividend policy, Bonus Shares. Corporate Restructuring, Recent Developments—Introduction to concepts of EVA, MVA and CAPM.

Management of Financial Services

Financial Services, Merchant Banking, organizational aspects and importance of merchant bankers, Latest guidelines of SEBI w.r.t Merchant bankers, Mutual funds and AMCs, Leasing, Factoring, Plastic Money, Credit process followed by credit card organizations, Credit rating, Venture capital, Call money market, Treasury bill market, Commercial bill market ,Discount market and market for financial guarantees. Depository,Financial Institutions, Theories of Liquidity Management, Management of Primary & Secondary Reserve, Management of Loans.

Human Resource Management

Introduction to Human Resource Management, HRM & HRD a comparative analysis, Human Resource Management practices in India. Human Resource Planning. Job analysis, description, specification & job evaluation. Recruitment, selection, placement and induction process, Human Resource Development, Career Planning & development, Performance management, performance appraisal, Potential appraisal, Job Compensation, incentive plans & fringe benefits. Promotions, demotions, transfers, separation, absenteeism & turnover, Quality of work life (QWL), Quality circles, Job satisfaction and morale, Health, Safety & Employee welfare, Counseling for effective Human Resource Development, Human Relations, Employee grievances and discipline, participation & empowerment. Introduction to collective bargaining, HR Audit, Introduction to Business Ethics.

Consumer Behaviour

Consumer Behaviour, customer value, satisfaction, retention. marketing strategies, Consumer research, research process, ethics. Market segmentation, Criteria, strategies. Consumer motivation, Measurement , evaluation of motivational research. Personality and consumer behaviour, theories , consumer diversity, brand personality, self and self image. Consumer perception, sensation and perception, Consumer imagery, perceived risk. Consumer Learning, elements, learning theories, cognitive learning theory, measures of consumer learning. Consumer attitude, models of attitude. Communication and consumer behaviour, communication process, persuasive communications, marketing communications. Reference groups and family influences, power of groups, consumer related, celebrity reference groups, family, family life cycle, consumption related roles. Social class and consumer behaviour, status, measurement, lifestyle profiles, affluent customer, applications of social class. Influence of culture on Consumer Behaviour, measurement, core values. Subculture and consumer behaviour, nationality, regional, religious, racial, age and sex. Cross cultural consumer behaviour, consumer analysis,

multinational strategies. Consumer influence and diffusion of innovation, opinion leadership, diffusion of innovation process, adoption process, customer dissonance.Levels of decision making, models of decision making, relationship marketing.

Strategic Human Resource Management

HRM, SHRM, role of HRM, evolution of SHRM, SHRM approaches in India, HR strategies. HRM in knowledge economy. Human Resource Evaluation, HRM and firm performance. Rationale for HR evaluation, measures of performance, approaches to HR evaluation. Human resource planning, business strategy , significance, perspectives, objectives of HRP. Job analysis and HRP, HRP horizons, HRP process. Acquiring Human Resources. Recruitment sources, methods and approaches , Strategic Recruitment and Selection. Methods of employee selection, staffing process, evaluation of staffing process. Hiring for diverse workforce, alternatives to hiring Permanent employees. Induction, Training and Development of Human Resources, need, purpose, significance, approaches, process. Performance management and reward system, developing the system, problems in Performance Management, Role of technology in Performance management, strategic linkage of performance management. Compensation and Rewards Management, determinants, approaches, Equity in Reward decisions. Business strategy and compensation, Managing careers, career planning, development, management, organizational career management. HRD approach to career management, SHRM approach . Managing ageing workforce Quality of work life, Balanced Score Card. Mentor relationships, concept and perspectives, design and implementation of formal mentoring programmes, SHRM approach to Mentoring. Work Life Integration: International Human Resource management, types , external environment and IHRM, IHRM practices and its strategy.

Corporate Tax Planning

Corporate Taxation, Direct Taxes, Basics of Income Tax, Determination of Residential Status. Computation of income under different heads of income, Clubbing of Income, Set off and carry forward of losses, Deductions out of gross total income, Computation of Taxable Income, Rates of tax and Computation of tax liability. TDS and Advance Tax. MAT and CDT. Presumptive income in certain cases. Provisions relating to Audit of Tax records and Due dates of filing Income Tax Returns. Penal Provisions, Introduction to Tax Management, tax planning; Tax avoidance and tax evasion; Tax Planning with reference to Residential Status, Identification of income . Capital expenditure vs Revenue Expenditure, Minimum Alternate Tax, Corporate Dividend Tax, Deductions out of Gross Total Income, Clubbing of Income, Set off & Carry forward. Tax Planning for New Business. Tax Planning and Financial Management Decisions, Tax planning related to Ownership pattern, Location of Business, Nature of

Business, Amalgamation and merger of companies. Special Tax Provisions. Tax related provisions in current year Budget. Double Taxation Avoidance Agreements. Other Corporate Tax Laws: Basics of Wealth Tax, Computation of Net wealth, tax rate and computation of tax. Introduction to Indirect Taxes.

Financial Risk Management & Derivative Analysis

Time value of Money, Financial Ratio Analysis. Objectives of an Investor: Valuation, return and Risk and their calculations. Risk in Fixed Income securities and its management.Risk in an equity share, its management and its classification. Portfolio Management, Portfolio construction (Return and Risk calculations using various Models). Portfolio Evaluation, Portfolio Rebalancing and Revision. Derivatives, Forwards and Futures, Speculation strategy in Futures, Hedging strategy in Futures, Arbitrage strategy in Futures. Options, Speculation strategy in Options, Combination strategy , Hedging, Straddle, Strangle, Strap, Strip, Covered, Put- call Parity Theorem. Spread strategy in Options, Bull spread, Bear Spread, Butterfly Spread. Arbitrage Strategy in Options. Models for Valuation of Options. FOREX (International Finance).

Services Marketing

Growth of service sector economy, Service Characteristics, Service Classification, Service Marketing Triangle, Service Marketing Mix, Quality Gaps Model, Consumer Behavior in Services, Customer Expectation of Service, Customer Perception of Service, Understanding Customer expectation and Perception through Marketing Research, Relationship Marketing - Concept, Benefits and Strategies. Market Segmentation and Targeting. Service recovery, Service Development and Design: New Service Types, Supplementary Services, Developing Positioning Strategy, Positioning Maps, Importance and Strategies for effective delivery through Employees, Intermediaries and customer participation, Managing Demand, Managing Capacity, Waiting Line Strategies, Services Marketing Communication Mix, Communication Strategies, Factors related to Pricing, Pricing approaches, Pricing Strategies, Service Quality and Productivity, Quality Gaps, Prescriptions for closing Quality Gaps, Customer Service Function, Services Management Trinity, Interactional Conflicts, Internal Marketing.

Security Analysis & Portfolio Management

Investment management: Objective, investment opportunities and philosophy of individual & institutional investors, Fundamental analysis: concept & significance of economic analysis, industry analysis: introduction, need for industry analysis, alternative classification of industry, industry life cycle analysis, economic factors & industry analysis, SWOT analysis for industries, Company analysis - nature and style of management, key role of financial analysis, ratio analysis, Technical analysis - different techniques of analysis, DOW theory, volume indicators, market sentiment indicators, confidence

indicators, points & figure charting, bar charting, Efficient market theory random walk: weak form, semi-strong, strong form of market, Empirical tests, Comparison of random walk, technical & fundamental analysis. Portfolio analysis selection: portfolio theory, return portfolio risk, efficient set of portfolios, optimum portfolio, capital asset pricing theory (CAPM), capital market line, security market line, corporate or folio management in India, portfolio revision techniques, constant value & constant ration plan, formula plan, dollar cost averaging. Options & futures: concept of derivatives, option trading, option contracts settlement, pricing of option futures, concept of futures, characteristics of future contract, its types, difference between future, options, forwards & badla contracts.

Retail Marketing

Introduction to Retail as an activity, types of retailers, global retailers, economic significance of retailing. Retail marketing and associated consumer buying behavior in retail, social factors affecting buying and patterns, Product category structure and management, merchandise management and planning, merchandise buying management, Retailing strategies: HR, locational, marketing and financial, Development of Retail marketing plan, Effect of pricing, distribution, multichannel retailing, SCM on retail marketing and costs, Retail communication mix: developing brands and building customer loyalty, CRM and customer service, Promotional strategy and planning, retail advertising, media, message, Store layout and visual merchandising, Design aspects of store layout, Warehousing and backend SCM, CRM-analyzing customer data, CRM processes and developing loyal customer base, Multichannel retailing, IT in retailing, technology, bar coding, electronic point of sales, Economic changes, globalization, International retailing, FDI, Non store retailing.

Direct and Online Marketing Direct Marketing & Interactive Marketing, The key principles of targeting, interaction, control and continuity, Direct marketing in real-time – interactive marketing, Direct marketing vs. marketing through channels, Traditional Methods of Direct Marketing, Technology that enables Direct & Interactive Marketing, Data-driven marketing planning, Integrating Direct Marketing Media, Media channels in a multi media age, Differences between direct marketing media and non-direct media, Technology mediated marketing channels, Direct mailing- Direct response methods, Data Protection and Privacy-self-regulation and codes of practice, e-marketing, Search Engine Marketing, Affilixate marketing, Web Analytics and Conversions Optimizations, Web Development, Search Engine Optimization, Online copywriting, Online Advertising, Web PR, Online Reputation management, Pay per Click Advertising, Viral Marketing, Social Media Marketing, Permission Marketing.

Business Valuation

Concept of value , Meaning and Importance of Valuation, Principles & techniques of valuation, Valuation of Debentures, Bonds, & Preference Shares, Return on Fixed Income Securities, Valuation of Equity Shares, Return on Equity shares, Buy-back, Share split, Reverse Split, Valuation of Right Shares, Valuation of Convertibles, Valuation of a Firm, Valuation of Options, Valuation methods analyses, Discounted Cash Flow Method (DCF), Discounted Residual Income Valuation Method, Discounted cash flow valuation, Relative valuation, Contingent claim valuation, Asset valuation, Valuation of Swaps, Forward rate Agreements, Caps, Floors, Collars- Valuation, The global socio-economic environment, The domestic socio-economic and political environment , Accounting and financial analyses, Factors influencing accounting quality, Inputs to forecasting: Forecasting models and templates, Forecast sales, making forecasts. Dividend Discount Model, Sensitivity analyses, Valuation methods analyses, Asset Backing Method , Multiplier (Earnings Capitalization) Method.

Production and Operations Management

Nature and Scope of Production and Operations Management; Facility Location; Types of Manufacturing Systems and Layouts; Layout Planning and Analysis; Material Handling : Principles & Equipments; Line Balancing; Production Planning and Control in Mass Production, in Batch and Job Order manufacturing; Capacity Planning; Product Planning and Selection, Process Planning, Aggregate Planning and Master Production Scheduling; Maintenance Management, Work Study : Method Study and Work Measurement, Material Management, Material Management; An Overview of Material Management, Material Requirement Planning and Inventory Control; JIT; Purchase Management; Stores Management; Quality Assurance : Acceptance Sampling, Statistical Quality Control, Total Quality Management; ISO-9000.

Entrepreneurship Development

Significance of Entrepreneur in Economic Development; Economic, Social and psychological need for entrepreneurship; Characteristics, qualities and pre – requisites of entrepreneur; The function of the entrepreneur in economic development of a Country; Methods and procedures to start and expand one's own business; Life cycle of new business and relationship with large enterprises; Achievement motivation; Environmental Factors affecting success of a new business; Reasons for the failure and visible problems for business.

Feasibility Study – Preparation of Feasibility Reports : Selection of factory location, Demand Analysis, Market potential measurement, Capital saving and project costing, Working capital requirements, profit and tax planning; Economic, Technical, Financial and Managerial Feasibility of Project.Govt. support to

new enterprise; Incentives; source of Finance; Role of Govt. and Promotional agencies in entrepreneurship development. Entrepreneurship Development Programmes; Role of various institutions in developing entrepreneurship in India (A brief description only).

PHARMACY

A. Pharmaceutical Analysis

Spectroscopic methods: Theory, Instrumentations, chemical applications and structural elucidation by UV, IR, NMR, NMR including DEPT, Mass Spectrometry, ESR and Emission spectroscopy.

B. Pharmaceutics

I.   Preparation, evaluation and packaging of

    A.   Solid dosage form like tablets, capsules,

    B.   Parenteral Products,

    C.   Lliquid orals like solutions, suspensions and emulsions,

    D.   Semisolids : ointments, suppositories,

    E.   Aerosols,

    F.   Others: eye drops, eye ointments etc.

II.   Preformulation studies : Introduction and concept, Need, Advantages, Organization. Techniques: Solubility & pKa, Spectroscopy, Chromatography, Thermal Analysis, X-ray diffraction Techniques to generate & characterize amorphous & crystalline forms. Stability. Physics of tablet compaction and consolidation effect of particle size, moisture content, lubrication, lubricant sensitivity ii) Oral liquids, Suspension, iii) Semisolid, iv) Aerosol products. III. Controlled release (CR) delivery systems: Principle, Advantages and Disadvantages, Classification and types of oral drug delivery system, transdermal and parenteral CR drug delivery agents. Fundamentals of Controlled Release Drug Delivery: Influence of drug properties and routes of drug administration on the design of sustained and controlled release systems, Oral controlled drug delivery systems: Formulation, fabrication and evaluation of various oral controlled drug delivery systems. Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.

C. Pharmacology

    I.   Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying Drug action, tolerance and dependence, Pharmacogenetics. Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, ADME drug interactions, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.

    II.   Pharmacology of drugs acting on Central Nervous System. PNS, Pharmacology of Cardiovascular System, Endocrine, GIT, Urinary, Hoemopoeitic system, Chemotherapy.

    III.   Development and Scope of Experimental Pharmacology: Common laboratory animals in pharmacological research, limitations of animal tests, alternatives to animal use, anesthetics used in laboratory animals. Cell lines and other in-vitro techniques: ELISA, PCR techniques. Genetically Modified Animals as Tools of Experimental Pharmacology: Transgenic animals and their applications in drug discovery, techniques involved in transgenic technology and gene knockout animals. Pharmacological Techniques to Preclinical Evaluation of the following Classes of Drugs: ANS, CNS, CVS, Analgesics, Anti-inflammatory agents, Local anesthetics, Skeletal muscle relaxants, neuromuscular blockers and Antidiabetic agents.

D. Medicinal Chemistry

    I.   Physicochemical and Stereochemical aspects of drugs including bioisosterism in relation to biological activity, Drug-Receptor interaction. Conventional methods of drug design, Lead, Discovery of Lead, lead optimization.

    II.   Introduction, General pathways of drug metabolism: Phase I (Functionalization) and Phase II (Conjugation) Phase I: Oxidative reactions, Reductive reactions and Hydrolytic Reactions Phase II: Glucuronic acid conjugation, Sulphate conjugation, Amino acid conjugation, Glutathione conjugation, Acetyl conjugation and Methyl conjugation.

    III.   Introduction, Structure, Stereochemistry, Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action, Structure Activity Relationships (if any) uses and Physicochemical properties of the following classes of drugs: ANS, PNS, CVS, Penicillins, Cephalosporins, Tetracyclines, Aminoglycosides, Polypeptides antibiotics, Chloramphenicol, Quinolones, Sulphonamides. Antimycobacterials: (p-Aminosalicyclic

acid, Thiacetazone, Isoniazid, Dapsone)**,** Steroids: Opioid Analgesics, Psychopharmacological Agents: Antipsychotic agents:

E. **Pharmacognosy and Phytochemistry of Natural Products**

    I.   Chemical and spectral approaches to simple molecules of natural origin. Concept of stereoisomerism taking examples of natural products. Chemistry, and pharmacological activity of medicinally important Carotenoids, Glycosides, Alkaloids, terpenes, steroids, lignans, flavonoids, coumarins, tannins

    II.   Pharmacognosy of important alkaloid, glycoside and steroid containing crude drugs

MASS COMMUNICATION

Communication and Journalism—Basic terms, Concepts and definition, Nature and process.

Types of Communication. Mass communication—Nature of media and content.

Mass communication in India—Reach, access and nature of audience .

Role of media in society . Impact of media on specific audiences—Women, children, etc.

Mass media effects studies and their limitations .Mass campaigns for specific issues—Social concerns, environment, human rights, gender equality.

The press, radio, television, cinema and traditional form of communication.

Journalism as a profession. Journalists- role and responsibilities.

Freedom of Press. Ethics and journalism .

Media management—Principles and practices Professional organizations in Media . Media—Ownership and management perspectives

Media Laws in India.

History of Print and Broadcast media in general with particular reference to Post-independent development. Press Commission, Press Councils. Development of Radio after independence. Development of television Cinema—Historical overview and contemporary analysis. Problems and prospects for the film industry .

Communication and theories of social change. Role of media in social change.

Introduction of research methods and process .Mass communication research. Strength and limitations Communication research in India.-Landmark studies Quantitative and qualitative approaches Sampling techniques—Strengths and limitations. Statistical methods of analysis basics.

Convergence of media—Problems and options. Media Policies in an International Context .

Radio & TV and Video as Media of Communication. Grammar of TV & Radio and Video The production team .Role of Producer. Different types of programmes, Writing for Radio . Writing for 'TV—Researching for Scripts. The Visual Language. Camera Movements. Basic Theories of Composition. Cues and Commands. Formats for Radio-Television—News, Sitcoms, Features, Documentaries etc. Editing-Theory and Practice. Microphones, Sets and Lighting.

Advertising basics . Copy and Layout. Public Relations basics.

Different forms of writing. Printing Technology and Production methods. News 'agencies . Syndicates and Freelancing. Specialized areas of Journalism

EDUCATION

1.   **Philosophical Foundation of Education**

Relationship of Education and Philosophy

Western Schools of Philosophy:

Idealism, Realism, Naturalism, Pragmatism, Existentialism with special reference to the concepts of knowledge, reality and values and their educational implications for aims, contents and methods of education.

Indian Schools of Philosophy (Sankhya, Vedanta, Buddhism, Jainism) with special reference to the concept of knowledge, reality and values and their educational implications.

Contributions of Vivekanand, Tagore, Gandhi and Aurobindo to educational thinking.

National values as enshrined in the Indian Constitution, and their educational implications

2.   **Sociological Foundations of Education**

Relationship of Sociology and Education

Meaning and nature of Education Sociology and Sociology of education

Education – as a social sub-system - specific characteristics.

Education and the home

Education and the community with special reference to Indian society

Education and modernization

Education and politics

Education and religion

Education and culture

Education and democracy

Socialization of the child

Meaning and nature of social change

Education as related to social stratification and social mobility

Education as related to social equity and equality of educational opportunities

Constraints on social change in India (caste, ethnicity, class, language, religion, regionalism)

Education of the socially and economically disadvantaged sections of the society with special reference to schedule castes and schedule tribes, women and rural population

3. **Psychological Foundations of Education**

Relationship of Education and Psychology

Process of Growth and Development

- physical, social, emotional and intellectual

- development of concept formation, logical reasoning, problem solving anti creative thinking; language development

- individual differences – determinations; role of heredity and environment; implications of individual difference for organizing educational programmes

Intelligence – it theories and measurement

Learning and Motivation

Theories of learning- Thorndike is connectionism; Pavlov's classical and Skinner's operant conditioning; Learning by insight; Hull's reinforcement theory and Tolman's theory of learning; Lewin's Filed theory

- Gagne's hierarchy of learning

- Factors influencing learning

- Learning and motivation

- Transfer of learning and its theories

Psychology and education of exceptional children- creative, gifted, backward, learning disables and mentally retarded

Personality – type and trait theories- measurement of personality

Mental health and hygiene- process of adjustment, conflicts and defence mechanism, mental hygiene and mental health. Sex Education Guidance

4. **Methodology of Educational Research**

Nature and Scope of Educational Research.

Meaning and Nature

Need and Purpose

Scientific Inquiry and Theory Development- some emerging trends in research foundation – Applied and Action Research

Formulation of Research Problem

Criteria and sources of identifying the problem

Delineating and Operationalzing variables

Developing assumptions and hypothesis in various types of research

Collection of Data

Concept of population and sample

Various methods of sampling

Characteristics of a good sample

Tools and Techniques

Characteristics of a good research tool

Types of research tools and techniques and their uses

Questionnaire – Interviews – Observations

Tests and scales, projective sociometric techniques

Major Approaches to Research

Descriptive Research

Ex-post facto Research

Laboratory Experiment

Field Experiment, Field Studies

Historical Research

Analysis of Data

Descriptive and inferential Statistics. The null hypothesis, test of significance, types of error, one-tailed and two-tailed tests

The t-test

The F-test (one-way and ANOVA)

Non-parametric test (Chi-square test)

Biserial, point-biserial, tetrachoric and phi-coefficient of correlation

Partial and multiple correlations

ARCHITECTURE AND PLANNING

City Planning :

Evolution of cities; principles of city planning; types of cities & new towns; planning regulations and building byelaws; eco-city concept; sustainable development.

Housing :

Concept of housing; neighbourhood concept; site planning principles; housing typology; housing standards; housing infrastructure; housing policies, finance and management; housing programs in India; self help housing.

Landscape Design :

Principles of landscape design and site planning; history of landscape styles; landscape elements and materials; plant characteristics & planting design; environmental considerations in landscape planning.

Computer Aided Design :

Application of computers in architecture and planning; understanding elements of hardware and software; computer graphics; programming languages C and Visual Basic and usage of packages such as AutoCAD, 3D-Studio, 3D Max.

Environmental Studies in Building Science :

Components of Ecosystem; ecological principles concerning environment; climate responsive design; energy efficient building design; thermal comfort; solar architecture; principles of lighting and styles for illumination; basic principles of architectural acoustics; environment pollution, their control & abatement.

Visual and Urban Design : Principles of visual composition; proportion, scale, rhythm, symmetry, harmony, datum, balance, form, colour, texture; sense of place and space, division of space; barrier free design; focal point, vista, image ability, visual survey, figure-background relationship.

History of Architecture :

Indian Indus valley, Vedic, Buddhist, Indo-Aryan, Dravidian and Mughal periods; *European* Egyptian, Greek, Roman, medieval and renaissance periods- construction and architectural styles; vernacular and traditional architecture.

Development of Contemporary Architecture :

Architectural developments and impacts on society since industrial revolution; influence of modern art on architecture; works of national and international architects; art novuea, eclecticism, international styles, post modernism, deconstruction in architecture.

Building Services :

Water supply, sewerage and drainage systems; sanitary fittings and fixtures; plumbing systems, principles of internal & external drainage systems, principles of electrification of buildings, intelligent buildings; elevators & escalators, their standards and uses; airconditioning systems; fire fighting systems, building safety and security systems.

Building Construction and Management :

Building construction techniques, methods and details; building systems and prefabrication of building elements; principles of modular coordination; estimation, specification, valuation, professional practice; project management techniques e.g., PERT, CPM etc;

Materials and Structural Systems :

Behavioural characteristics of all types of building materials e.g. mud, timber, bamboo, brick, concrete, steel, glass, FRP, different polymers, composites; principles of strength of materials; design of structural elements in wood, steel and RCC; elastic and limit state design; complex structural systems; principles of pre-stressing; tall buildings; principles of disaster resistant structures.

Planning Theory :

Regional planning; settlement system planning; history of human settlements; growth of cities & metropolises; principles of Ekistics; rural-urban migration; urban conservation; urban renewal; Five-year plan; structural and sectoral plan.

Techniques of Planning : Planning survey techniques; preparation of urban and regional structure plans, development plans, action plans; site planning principles and design; statistical methods of data analysis; application of G.I.S and remote sensing techniques in urban and regional planning; decision making models.

Traffic and Transportation Planning :

Principles of traffic engineering and transportation planning; traffic survey methods; design of roads, intersections, grade separators and parking areas; hierarchy of roads and levels of services; traffic and transport management in urban areas, intelligent transportation system; mass transportation planning; para-transits and other modes of transportation, pedestrian & slow moving traffic planning.

Infrastructure, Services and Amenities :

Principles of water supply and sanitation systems; water treatment; solid waste disposal systems; waste treatment, recycle & reuse; urban rainwater harvesting; power supply and communication systems --- network, design & guidelines; demography related standards at various levels of the settlements for health, education, recreation, religious & public-semi public facilities.

Development Administration and Management :

Planning laws; development control and zoning regulations; laws relating to land acquisition; development enforcements, urban land ceiling; land management techniques; planning and municipal administration; disaster mitigation management; 73rd & 74th Constitutional amendments; valuation & taxation; revenue resources and fiscal management; public participation and role of NGO & CBO; Institutional networking & capacity building.

HEALTH CARE MANAGEMENT

Concept of Health and Disease : Health – definition, dimensions, Health definition concept, standard of living, quality of life, hygiene, dimensions of   health, determinants of health, indicators of health, levels of healthcare, health service philosophies, concept and modes of intervention,

Indian Health System – Central, State, District, Panchayati Raj, Rural development, health care of the community-levels of health care, principles of healthcare, health for   all, health problems of India, Indian Health care resources- HR, Money and material, time; Health care services, Health care systems, Public health; sector; private health sector,

Health Planning, Management and Administration - National Health policy, health planning in India, health sector planning, evaluation of health services, millennium development goals, key areas of healthcare management – quality - accreditations, benchmarking, service marketing, operations management, hospital waste management, hospital information system

National health programmes- National Anti malaria programme, National leprosy eradication programme, National AIDS control programme, National Programme for Control of Blindness, Universal immunisation programme, reproductive health programme.