

MVN UNIVERSITY, PALWAL
DEPARTMENT OF CSE/CIS

Syllabus for MVN Ph. D. Entrance Test (MPET 2017-18)

SECTION A

Data mining : Association, clustering, classification

SECTION B

Soft computing : ANN, Fuzzy, GA learning, training ,

Artificial intelligence : searching, reasoning, planning, machine learning,

SECTION C

Computer networks: Introduction, Protocols and Layering, Physical and Link layers, Retransmissions, Multiple access, Switching, Network layer, Inter networking, Intra- and Inter-domain Routing, Network Security

SECTION D

OOPS, Data structures, Software Engg

MVN UNIVERSITY, PALWAL
SCHOOL OF PHARMACEUTICAL SCIENCES
Syllabus for MVN Ph. D. Entrance Test (MPET 2017-18)

SECTION A

Pharmacognosy & Phytochemistry: Chemistry, tests, isolation, characterization and estimation of phytopharmaceuticals belonging to the group of Alkaloids, Glycosides, Terpenoids, Steroids, Bioflavanoids, Purines, Guggul lipids. Pharmacognosy of crude drugs that contain the above constituents. Standardization of raw materials and herbal products. WHO guidelines. Quantitative microscopy including modern techniques used for evaluation. Biotechnological principles and techniques for plant development, Tissue culture.

SECTION B

Pharmacology: General pharmacological principles including Toxicology. Drug interaction. Pharmacology of drugs acting on Central nervous system, Cardiovascular system, Autonomic nervous system, Gastro intestinal system and Respiratory system. Pharmacology of Autocoids, Hormones, Hormone antagonists, chemotherapeutic agents including anticancer drugs. Bioassays, Immuno Pharmacology. Drugs acting on the blood & blood forming organs. Drugs acting on the renal system.

Clinical Pharmacy: Therapeutic Drug Monitoring Dosage regimen in Pregnancy and Lactation, Pediatrics and Geriatrics. Renal and hepatic impairment. Drug-Drug interactions and Drug-food interactions, Adverse Drug reactions. Medication History, interview and Patient counseling.

SECTION C

Pharmaceutical Chemistry: Structure, nomenclature, classification, synthesis, SAR and metabolism of the following category of drugs, which are official in Indian Pharmacopoeia and British Pharmacopoeia. Introduction to drug design. Stereochemistry of drug molecules. Hypnotics and Sedatives, Analgesics, NSAIDS, Neuroleptics, Antidepressants, Anxiolytics, Anticonvulsants, Antihistaminics, Local Anaesthetics, Cardio Vascular drugs ? Antianginal agents Vasodilators, Adrenergic & Cholinergic drugs, Cardiotonic agents, Diuretics, Antihypertensive drugs, Hypoglycemic agents, Antilipidemic agents, Coagulants, Anticoagulants,

Antiplatelet agents. Chemotherapeutic agents ? Antibiotics, Antibacterials, Sulphadruugs. Antiprotozoal drugs, Antiviral, Antitubercular, Antimalarial, Anticancer, Antiamoebic drugs. Diagnostic agents. Preparation and storage and uses of official Radiopharmaceuticals, Vitamins and Hormones. Eicosonoids and their application.

Pharmaceutical Analysis: Principles, instrumentation and applications of the following: Absorption spectroscopy (UV, visible & IR). Fluorimetry, Flame photometry, Potentiometry. Conductometry and Polarography. Pharmacopoeial assays. Principles of NMR, ESR, Mass spectroscopy. X-ray diffraction analysis and different chromatographic methods. Biochemistry. Biochemical role of hormones, Vitamins, Enzymes, Nucleic acids, Bioenergetics. General principles of immunology. Immunological. Metabolism of carbohydrate, lipids, proteins. Methods to determine, kidney & liver function. Lipid profiles.

SECTION D

Pharmaceutics: Development, manufacturing standards Q.C. limits, labeling, as per the pharmacopoeal requirements. Storage of different dosage forms and new drug delivery systems. Biopharmaceutics and Pharmacokinetics and their importance in formulation. Formulation and preparation of cosmetics ? lipstick, shampoo, creams, nail preparations and dentifrices. Pharmaceutical calculations.

Microbiology: Principles and methods of microbiological assays of the Pharmacopoeia. Methods of preparation of official sera and vaccines. Serological and diagnostics tests. Applications of microorganisms in Bio Conversions and in Pharmaceutical industry.

MVN UNIVERSITY, PALWAL
Electronics and Communication Engineering
Syllabus for MVN Ph. D. Entrance Test (MPET 2017-18)

Section A

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 Integrated Circuits:** Single stage amplifiers, Current mirrors, Differential amplifiers, frequency response of common source amplifier. Feedback and stability (analog circuits section), oscillators, multivibrators.

Section B

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, group delay, phase delay. Signal transmission through LTI systems.

DIGITAL SIGNAL PROCESSING: Review of discrete time signals and systems, system properties, discrete LTI system, impulse response, convolution, system representation by difference equation, natural and forced responses, Review of Fourier transform, DTFT, DTFS and Z-transform, DFT and circular convolution, Basic concepts of IIR and FIR filters.

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; root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control.

Section C

ELECTROMAGNETICS: Elements of vector calculus: divergence and curl; Gauss's and Stoke's 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. **Fundamental Concept of Antenna:** Physical concept of radiation, Antenna parameters, Friis transmission equation, Radiation integrals and auxiliary potential functions. **Radar Basics:** Radar equation, receiver noise, probability of detection and signal-to-noise ratio, receiver bandwidth, target cross-section and cross-section fluctuations, statistical description of RCS, antenna coverage and gain, system coverage and gain, system losses.

Electronic Instrumentation: Units and dimensions, characteristics of Instruments. Analog concepts of measurement, Digital instruments. Intelligent Instruments, Biomedical Instruments, Sensors & Transducers.

Section D

DIGITAL ELECTRONICS, MICROPROCESSORS & MICROCONTROLLERS

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). **Combinational Circuit Design:** Combinational design Methodology, Circuit Timings, Combinational PLDs, Decoders, Encoders, Tristate Devices, Adders, Subtractors, ALUs, Comparators, Multiplexers. **Sequential Circuit Design:** Synchronous Design Methodology, Circuit Timings, Latches and Flip-Flops, Sequential PLDs, Counters, Shift Registers, Synchronizer Failure and Metastability. **Memory, CPLDs and FPGAs:** Read-only Memory, R/W Memory, Static RAM, Dynamic RAM, Complex Programmable Logic Devices, Field Programmable Logic Arrays.

8085 Microprocessor, 8086 Microprocessor, 8051 Microcontroller:

Architecture, Pin Description, Addressing Modes, Instruction Set

ANALOG & DIGITAL COMMUNICATION: Amplitude Modulation, Frequency Modulation, Sampling theorem, quantization, quantization noise and signal to noise ratio analysis in PCM, DPCM and DM, Baseband transmission, intersymbol interference, Digital modulation techniques-BPSK, FSK, QPSK, MSK,

Wireless Transmission: Frequencies for radio transmission, Overview of antennas & wave propagation, Multiplexing techniques: TDM, FDM, CDM & SDM, Spread spectrum: Direct sequence, Frequency Hopping. **Mobile & Cellular Communication:** Co-channel and adjacent channel interference, Cell splitting, Handover, Call processing, GSM & IS-95 CDMA digital cellular standard and their Security aspects. **Data Communication Networks & Techniques:** Synchronous & Asynchronous Transmission, Transmission Media & Impairments, Data encoding Techniques, Circuit switching, Message switching, Packet Switching, LAN Technologies, Virtual Circuits, OSI and TCP/IP layered architecture.

**MVN UNIVERSITY, PALWAL MECHANICAL
ENGINEERING DEPARTMENT**

**Syllabus for MVN Ph. D. Entrance Test (MPET 2017-18)
SECTION A**

ENGINEERING MATERIALS

Structure and properties of engineering materials, Concept of unit cell space lattice, Bravais lattices, and common crystal structures. Crystal Directions and planes. Miller indices X-ray crystallography techniques, Imperfections, Defects & Dislocations in solids.

Mechanical Properties: Stress strain diagram, Ductile & brittle material, Toughness, Impact Strength, Hardness, Fracture, Fatigue, Creep, Non-destructive testing (NDT)

Heat treatment,

Physical Metallurgy:

Solid Solution: solubility, Solid solution type, Condition for solubility. Solid solution strengthening. Phase Diagram: Phase, Importance of Phase diagram, Unary and Binary diagrams, cooling curve, construction of phase diagram. Non equilibrium Solidification and Segregation. Phase rules. Iron-carbon equilibrium diagram. Time Temperature Transformation (TTT) diagrams. Various types of heat treatment such as Annealing, Normalizing, hardening. Surface hardening Diffusion in Solid

SECTION B

PRODUCTION ENGINEERING

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. **Lean Management: General concepts**

SECTION C

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 **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.

SECTION D

FLUID MECHANICS & THERMODYNAMICS Fluid Mechanics

Fluid properties; fluid statics, 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; **Thermodynamics:** Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. irreversibility and availability; behavior 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.

SYLLABUS For Ph.D. Entrance (MPET 2017-18)

(CHEMICAL SCIENCES)

Section A Inorganic Chemistry

Chemical periodicity, Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory), Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.

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. Organometallics in homogeneous catalysis.

Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.

Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine.

Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques.

Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Section B 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; orbital and spin angular momenta; tunneling.

Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

Thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titration

Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation;

Polymer chemistry: Molar masses; kinetics of polymerization.

Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

Section C Organic Chemistry

IUPAC nomenclature of organic molecules. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes.

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. Pericyclic reactions – electrocycloisatation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S). Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.

Structure determination of organic compounds by IR, UV-Vis, ^1H & Mass spectroscopic techniques.

Section D Interdisciplinary topics

Carbon nanotubes and Fullerenes, Application of Nano materials, Bio-inorganic nanomaterials, nanocrystals Materials, Bio-nano composites. Introduction Green Chemistry, Need and Principles of Green Chemistry, Goals of Green Chemistry, Green Catalyst, Green Reagents, Green Solvents, Limitation /Obstacles in the pursuit of Green Chemistry, Green Chemistry in India.

Nature and sources of drugs, classification of drugs, basics of antibacterial drugs, antiseptics and disinfectants, analgesics, antipyretics and anti-inflammatory agents. Digestion of carbohydrates, proteins, fats. Chemical nature of enzymes, mechanism of enzyme action.

Properties and function of hormones, structure and physiological functions of hormones-adrenaline, thyroxine, oxytocin, insulin.

MVN UNIVERSITY, PALWAL
DEPARTMENT OF HUMANITIES - ENGLISH

Syllabus for MVNU Ph.D. Entrance Test (MPET 2017-18)

SECTION A

STUDY OF LANGUAGE

Speech Mechanism, Vowels, Consonants, Varieties of language, Dialects, Registers, Idiolects, etc., Morphology, Syntax, Semantics

SECTION B

LITERARY CRITICAL THEORIES

New Criticism, Stylistics, Structuralism, Deconstruction, Discourse Analysis, Feminism, Post Colonialism, Protest Literature

SECTION C

ENGLISH LITERATURE (1400 TO PRESENT ERA)

British Poetry, British Prose, Fiction and Drama

SECTION D

INDIAN ENGLISH LITERATURE AND DIASPORIC LITERATURE

Prose, Poetry, Drama, Fiction (V.S. Naipaul, Salman Rushdie, Bharti Mukharjee, Vikram Seth, Himani Banerjee, Rohinton Mishtri, Uma Parmeshwaran)

MVN UNIVERSITY, PALWAL
Syllabus for MVNU Ph.D. Entrance Test (MPE 2017-18)
MATHEMATICAL SCIENCES

SECTION A

Real 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.

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.

SECTION-B

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: Groups, subgroups, normal subgroups, quotient groups, homomorphism's, cyclic groups, permutation groups, Cayley's theorem, Lagrange's theorem, class equations, Sylow & Cauchy's theorem for abelian and Non-abelian group.

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.

SECTION-C

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.

SECTION-D

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.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigen functions, resolvent kernel.

MVN UNIVERSITY, PALWAL
School of Business Management & Commerce
Syllabus for MVN Ph. D. Entrance Test (MPET 2017-18)

SECTION A

Management Concepts I – HRM, SHRM, IHRM OB, General Management, and International Business.

SECTION B

Finance , Insurance and Banking

SECTION C

Marketing, Retail, Consumer Behaviour, Sales & Distribution, Advertising & sales Promotion, SCM ,CRM, OSCM

SECTION D

General Awareness, Reasoning and Quantitative Aptitude.

MVN UNIVERSITY, PALWAL
SCHOOL OF LAW

Syllabus for MVN Ph. D. Entrance Test (MPET 2017-18)

SECTION A

Constitutional Law:- Preamble, Fundamental Rights and Duties, Directive Principles of Policy, President and his powers, The Union and the state Judiciary, Parliamentary Privileges, Legislative relations between the Union and the State, Emergency provisions and amendment of the constitution.

Jurisprudence:- Meaning, Nature, Scope of Jurisprudence, Sources of Law, Schools of Jurisprudence and their concepts.

SECTION B

Public International Law and Human Rights:- Nature and sources of International Law, Relation between International Law and Municipal Law, Subjects of International Law, Acquisition and loss of State Territory, Recognition, Extradition, Asylum, Intervention, Diplomatic Agents, Treaties, United Nations organization and its organs, Human Rights: Nature, Concept, origin and development. The protection of Human Rights Act, 1993.

SECTION C

Law of Crimes:- Crimes, Mens Rea, Actus Reus, Preparation and attempts, Abetment, General Explanations, General Exceptions, Joint and constructive liability, Offences against public Tranquility, Offence against Human Body, Offences against Women, Offences against Property.

Law of Contract and Transfer of Property:- Contract: General Principles of Law of Contract (Section 1 to 75 of Indian Contract Act, 1872). Transfer of Property: General Principles of Transfer of Property (Sections 1 to 53A of the Transfer of Property Act, 1882).

SECTION D

Family Law:- Hindu Law: Relating to marriage, Divorce, Adoption, Maintenance, Guardianship, Hindu Joint Family, Coparcenary and Succession. Muslim Law: Relating to marriage, Dower, Divorce, Hiba, Pre-emption, Will and Wakf.

Research Methodology: Research Methods, Formulation of Research Problem, Hypothesis, Data collection and report writing.

MVN UNIVERSITY, PALWAL
Syllabus for MVNU Ph.D. Entrance Test (MPET 2017-18)
PHYSICS

SECTION-A

Mathematical Methods of Physics:

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

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 pseudoforces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity- Lorentz transformations, relativistic kinematics and mass-energy equivalence

SECTION-B

Electromagnetic Theory:

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Magnetostatics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction. Dynamics of charged particles in static and uniform electromagnetic fields.

MVN UNIVERSITY, PALWAL

Quantum Mechanics:

Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). 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.

SECTION-C

Thermodynamic and Statistical 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.

Electronics and Experimental Methods:

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

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Atomic & Molecular Physics:

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

SECTION-D

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. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

Nuclear and Particle Physics:

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi-empirical 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. 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.