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THE COMPLETE GUIDE

Exam Details & Eligibility • Dates • Exam Patterns • Syllabus Comparison
Topic-wise Syllabus Expansion • Official Syllabus of Every Exam

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UPPSC Polytechnic | MPPSC | Rajasthan SET | Punjab Lecturer Cadre | J&K | CSIR-NET | AP SET

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About PhysicsByAaryan

PhysicsByAaryan is an online institute dedicated to physics aspirants preparing for **Assistant Professor (Physics), GATE, CSIR-NET, JEST, TIFR, JAM, UPSC Geophysics/Geoscientist and BARC** examinations. Our courses are built around complete syllabus notes, topic-wise assignments and full-length tests, designed so that no topic of any of these examinations is ever left behind.

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Section 1 | Exam-wise Details, Eligibility and Pattern

Each of the following examinations recruits (or gives eligibility for) Assistant Professor / Lecturer posts in Physics. Read the eligibility carefully - the NET/SET requirement, age limit and additional state-specific conditions differ from state to state.

Exam	Apply By	Exam Date	NET/SET	Age
UPPSC Polytechnic Lecturer (Physics)	Closed	06 Sep 2026	Not needed	40
MPPSC Assistant Professor (Physics)	15 Aug 2026	04 Oct 2026	Net/Set or PhD	40
Rajasthan SET (State Eligibility Test) - Physical Sciences	10 Aug 2026	13 Sep 2026	Not needed	No limit
Punjab Lecturer Cadre (Physics)	17 Aug 2026	Not announced	Not needed	37 (upto 5 year relaxation for SC/ST and widdow women)
J&K Assistant Professor (Physics)	31 Aug 2026	Not announced	Net/Set or PhD	40

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1.1 UPPSC Polytechnic Lecturer (Physics)

Uttar Pradesh Public Service Commission - Lecturer, Government Polytechnic (Physics). A Group-B Gazetted post in Uttar Pradesh.

Eligibility

Educational Qualification	MSc with 60%
NET / SET / PhD	Not needed
Age Limit	40
Additional Eligibility	Nothing

Important Dates

Last date to apply: 02 Jan 2026 (applications now closed) - Last date for correction: 09 Jan 2026 - Date of examination: 06 Sep 2026.

Post, Salary and Vacancies

Group B Gazetted post, Grade 9A (Level-9A, entry pay Rs. 56,100/-). In-hand salary after DA, HRA and deductions as per 8th Pay Commission is expected to be Rs. 1,20,000+ (starting).

Vacancies: 24 posts in Physics - UR 11, SC 06, ST 00, OBC 05, EWS 02, DFF 00, PH 00, ExS 01, Women 04.

Exam Pattern

Stage	Composition	Marks / Duration
Paper I	25 Questions: Basic Hindi + 100 Questions: Physics Paper-1	375 Marks, 2.5 Hours. Each question +3M, wrong answer -1M
Paper II	25 Questions: General Studies + 100 Questions: Physics Paper-II	375 Marks, 2.5 Hours. Each question +3M, wrong answer -1M
Stage 2	Interview	-
Stage 3	Document Verification	-

Exam pattern above is extracted from the official UPPSC notification.

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1.2 MPPSC Assistant Professor (Physics)

Madhya Pradesh Public Service Commission - Assistant Professor in Physics for Government Colleges of Madhya Pradesh.

Eligibility

Educational Qualification	MSC with 55% (MSc must be done)
NET / SET / PhD	Net/Set or PhD
Age Limit	40
Additional Eligibility	Nothing

Important Dates

Last date to apply	15 Aug 2026	Date of examination	04 Oct 2026
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Exam Pattern

Stage	Composition	Marks / Duration
Paper I	General Studies - 50 Questions	200 Marks, 1 Hour
Paper II	Physics - 150 Questions	600 Marks, 3 Hours
Interview	Personality Test	100 Marks

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1.3 Rajasthan SET (State Eligibility Test) - Physical Sciences

Conducted for eligibility for Assistant Professor in the state of Rajasthan. Final year students are also eligible to appear.

Eligibility

Educational Qualification	MSC with 55% (last year student eligible)
NET / SET / PhD	Not needed
Age Limit	No limit
Additional Eligibility	Nothing

Important Dates

Last date to apply	10 Aug 2026	Date of examination	13 Sep 2026
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Exam Pattern

Paper	Composition	Marks / Duration
Paper I	Teaching & Research Aptitude - 50 Questions	100 Marks, 1 Hour
Paper II	Physical Sciences - 100 Questions	200 Marks, 2 Hours

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1.4 Punjab Lecturer Cadre (Physics)

Recruitment of Lecturers in the school/college cadre of Punjab. Punjabi language at matriculation level is compulsory.

Eligibility

Educational Qualification	MSC with 55% and B.ed
NET / SET / PhD	Not needed
Age Limit	37 (upto 5 year relaxation for SC/ST and widdow women)
Additional Eligibility	Must have passed Punjabi as a compulsory or elective subject at the matriculation level

Important Dates

Last date to apply	17 Aug 2026	Date of examination	Not announced
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Exam Pattern

Paper	Composition	Marks / Duration
Paper I	Aptitude Test - English 30, Punjabi 30, Teaching 30, General Knowledge/Current Affairs 30, Mental Aptitude 30 = 150 Questions	150 Marks, 2.5 Hours. No negative marking
Paper II	Physics - 150 Questions	150 Marks, 2.5 Hours

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1.5 J&K Assistant Professor (Physics)

Jammu and Kashmir Public Service Commission - Assistant Professor in the subject of Physics. Only domiciles of J&K may apply.

Eligibility

Educational Qualification	MSC with 55% (MSc must be done)
NET / SET / PhD	Net/Set or PhD
Age Limit	40
Additional Eligibility	Must be domicile of J&K

Important Dates

Last date to apply	31 Aug 2026	Date of examination	Not announced
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Exam Pattern

Paper	Composition	Marks / Duration
Written Examination	120 Questions (Physics)	3 Hours

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Section 2 | Syllabus Comparison of All Exams

A single topic-by-topic map of what is asked in each examination. **Yes** = topic is part of that syllabus, **No** = topic is not required. Use this table to plan one common preparation for all exams.

Topic	UPPSC Poly.	MPPSC Asst.Prof	CSIR NET	Raj. SET	Punjab Lect.	J&K Asst.Prof	AP SET
Mathematical Physics							
Dimension Analysis	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector Calculus	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tensors	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Differential Equations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Special Functions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fourier and Laplace Analysis	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Partial Differential Equations and Greens function	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Probability	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matrices	No	Yes	Yes	Yes	Yes	Yes	Yes
Complex Analysis	No	Yes	Yes	Yes	Yes	Yes	Yes
Group theory	No	Yes	Yes	Yes	Yes	Yes	Yes
Numerical Methods	No	Yes	Yes	Yes	Yes	Yes	Yes
Classical Mechanics							
Basic Mechanics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rotational Motion	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Central Forces	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagrangian and Hamiltonian	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Poisson bracket and laplace transform	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo Forces	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Special theory of Relativity	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bulk Matter and Fluid mechanics	Yes	Yes	No	No	Yes	No	No
Phase Space	No	Yes	Yes	Yes	Yes	Yes	Yes
Small Oscillations	No	Yes	Yes	Yes	Yes	Yes	Yes
Electromagnetism							
Electrostatics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Magnetostatics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Electromagnetic Induction	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EM Waves	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plasma	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Waveguides and Transmission Line	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Potential formulation	No	Yes	Yes	Yes	Yes	Yes	Yes
Radiations	No	Yes	Yes	Yes	Yes	Yes	Yes
Relativistic EMT	No	Yes	Yes	Yes	Yes	Yes	Yes



Topic	UPPSC Poly.	MPPSC Asst.Prof	CSIR NET	Raj. SET	Punjab Lect.	J&K Asst.Prof	AP SET
Multipole expansion	No	No	Yes	Yes	Yes	Yes	Yes
Electric field in matter	No	No	Yes	Yes	Yes	Yes	Yes
Image problem	No	No	Yes	Yes	Yes	Yes	Yes
Quantum Mechanics							
Modern Physics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Basics of Quantum Mechanics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Potential Well	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Harmonic Oscillator and 1D potentials	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hydrogen atom (Radial and orbital angular momentum)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spin and Total Angular momentum	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perturbation Theory	No	Yes	Yes	Yes	Yes	Yes	Yes
Scattering theory	No	Yes	Yes	Yes	Yes	Yes	Yes
WKB approximation	No	Yes	Yes	Yes	Yes	Yes	Yes
Variational Principle	No	Yes	Yes	Yes	Yes	Yes	Yes
Relativistic Quantum	No	Yes	Yes	Yes	Yes	Yes	Yes
Identical Particles	No	Yes	Yes	Yes	Yes	Yes	Yes
Thermodynamics							
Kinetic theory of gases	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Laws and thermodynamic processes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Carnot Cycle	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Maxwell Relation	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thermodynamic Potential	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Phase transition	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Black Body Radiations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Statistical Mechanics							
Microstates and Microcanonical ensemble	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Canonical Ensemble	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Grand Canonical Ensemble	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fermi Stat. Mech.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bose Stat. Mech.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Random Walk and Diffusion	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ising Model	No	No	Yes	Yes	Yes	Yes	Yes
Optics							
Optical Instruments	Yes	No	No	No	Yes	No	No
Interference	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Diffraction	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polarization	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lasers	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Oscillations and Waves	Yes	No	No	No	Yes	No	No
Ray optics	No	No	No	No	Yes	No	No



Topic	UPPSC Poly.	MPPSC Asst.Prof	CSIR NET	Raj. SET	Punjab Lect.	J&K Asst.Prof	AP SET
Electronics							
Semiconductor Physics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PN Junctions	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Transistors	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Amplifiers and OPAMP	Yes	Yes	Yes	Yes	Yes	Yes	Yes
High Frequency devices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Electronic instruments	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Optoelectronic Devices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Logic Gates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Digital Circuits	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FET	No	Yes	Yes	Yes	Yes	Yes	Yes
AC and DC Circuits	No	No	Yes	Yes	Yes	Yes	Yes
Experimental techniques							
Error analysis	No	Yes	Yes	Yes	Yes	Yes	Yes
Curve fitting	No	Yes	Yes	Yes	Yes	Yes	Yes
Transducers	No	Yes	Yes	Yes	Yes	Yes	Yes
Fourier application and filtering	No	Yes	Yes	Yes	Yes	Yes	Yes
Lock In Amplifier	No	Yes	Yes	Yes	Yes	Yes	Yes
Atomic and Molecular Physics							
Structure of atom	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector Model	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Effects and coupling in atom	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Xray Spectra	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ESR, NMR and EPR	No	Yes	Yes	Yes	Yes	Yes	Yes
Molecular Physics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nuclear and Particle Physics							
Nuclear Properties	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nuclear Models	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nuclear Forces	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Radioactivity	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Particle Physics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Condensed Matter Physics							
Crytallography	No	No	Yes	Yes	Yes	Yes	Yes
Xray Diffraction	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bonding in solids	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lattice Vibrations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Free electron theory	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Band theory	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hall effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dielectric Properties	No	No	Yes	Yes	Yes	Yes	Yes
Magnetism in Solids	Yes	Yes	Yes	Yes	Yes	Yes	Yes



Topic	UPPSC Poly.	MPPSC Asst.Prof	CSIR NET	Raj. SET	Punjab Lect.	J&K Asst.Prof	AP SET
Superconductivity	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Defects in solids	No	Yes	Yes	Yes	Yes	Yes	Yes
Contributions in physics							
contributions by indian scientists	No	Yes	No	No	Yes	No	No

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Section 3 | Topic Expansion - What is Asked in Each Topic

Every topic of the comparison table is expanded below into the exact sub-topics that appear in the syllabus. Prepare topic by topic and tick them off as you finish.

Mathematical Physics

Dimension Analysis	Dimensional analysis
Vector Calculus	Vector algebra and vector calculus
Tensors	Concept of Tensor
Differential Equations	Linear ordinary differential equations of first & second order
Special Functions	special functions (Legendre, Hermite, Bessel, Laguerre functions).
Fourier and Laplace Analysis	Fourier series, Fourier and Laplace transforms
Partial Differential Equations and Green Function	Partial differential equations (Laplace, wave and heat equations in two and three dimensions) and Green's function
Probability	Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.
Matrices	Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors.
Complex Analysis	Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals
Group theory	Introductory group theory: SU(2) and O(3)
Numerical Methods	Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Solution of first order differential equation using Runge-Kutta method. Finite difference methods.

Classical Mechanics

Basic Mechanics	Newton's laws of motion
Rotational Motion	Dynamic of System of particle and rigid body, Center of mass and Center of Gravity, moment of inertia tensor, conservation law's of Energy, momentum and angular momentum
Central Forces	central force and its characteristics, Kepler's law's of planetary motion, Reduction of Two body Central Force Problems, Planate and Satellite, Orbital and escape velocity, communication satellite.
Lagrangian and Hamiltonian	Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates.
Poisson bracket and laplace transform	Poisson Brackets and canonical transformations, Hamilton-Jacobi Theory
Pseudo Forces	Non-inertial frames and pseudoforces
Special theory of Relativity	Special theory of relativity-Lorentz transformations, relativistic kinematics and mass-energy equivalence. Doppler effect in light.



Bulk Matter and Fluid mechanics	Elastic behavior of loaded wire, Elastic constants, Torsion of Cylinder, Bending of beam, Cantilever, surface tension, surface energy, angle of contact, capillarity, Excess pressure, Ideal fluid, hydro dynamical equations based on conservation of mass, Momentum and energy, Viscous force (Newton's law, Poiseuille law, Stokes law).
Phase Space	Dynamical systems, Phase space dynamics, stability analysis.
Small Oscillations	Periodic motion: small oscillations, normal modes.

Electromagnetism

Electrostatics	Electric Flux, Gauss law in electrostatics and its applications, Electric Field and Potential, Laplace and Poisson equations, boundary value problems. Conductors, capacitors
Magnetostatics	Ampere's circuital law and its applications, Lorentz force, cyclotron (limit and modification)
Electromagnetic Induction	Magnetic Flux, Laws of electro-magnetic induction, static and dynamic Induced emf, Self and Mutual induction and inductance, equation of continuity and modification of Ampere's circuital law, Conduction and displacement current
EM Waves	Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction
Plasma	Dispersion relations in plasma.
Waveguides and Transmission Line	Transmission lines and wave guides.
Potential formulation	Scalar and vector potentials, gauge invariance.
Radiations	Radiation- from moving charges and dipoles and retarded potentials.
Relativistic EMT	Lorentz invariance of Maxwell's equation
Multipole expansion	multipole expansion
Electric field in matter	Linear dielectrics, dielectric polarization, volume and surface bound charges,
Image problem	method of images

Quantum Mechanics

Modern Physics	Wave particle duality, Matter waves, Uncertainty Principle, Photoelectric and Compton effect, Davisson - Germer experiment
Basics of Quantum Mechanics	Wavepacket, Schrodinger equation (Time dependent and Time independent), Physical Significance of wave function, Normalisation, Orthogonality, Orthonormality, Eigen value equation, Eigen value, Eigen function, Expectation value, Ehrenfest Theorem, Dirac function and Kronecker delta, Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors.
Potential Well	Particle in a box, Potential step, Potential barrier, Tunneling through a barrier
Harmonic Oscillator and 1D potentials	Harmonic oscillator, Dirac Delta potential and other 1D potentials
Hydrogen atom (Radial and orbital angular momentum)	Motion in a central potential: orbital angular momentum, angular momentum algebra
Spin and Total Angular momentum	spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment
Perturbation Theory	Timeindependent perturbation theory and applications. Time dependent perturbation theory and Fermi's golden rule, selection rules.
Scattering theory	Elementary theory of scattering: phase shifts, partial waves, Born approximation.



WKB approximation	WKB approximation.
Variational Principle	Variational method
Relativistic Quantum	Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.
Identical Particles	Identical particles, Pauli exclusion principle, spin-statistics connection.

Thermodynamics

Kinetic theory of gases	Elements of Kinetic theory of gases. Velocity distribution and Equipartition of energy. Specific heat of Mono-, di- and tri-atomic gases. Ideal gas, van-der-Waals gas and equation of state. Mean free path
Laws and thermodynamic processes	Laws of thermodynamics. Zeroth law and concept of thermal equilibrium. First law and its consequences. Isothermal and adiabatic processes. Reversible, irreversible and quasi-static processes. Second law and entropy
Carnot Cycle	Carnot cycle, Heat engine, Refrigerator.
Maxwell Relation and thermodynamic potentials	Maxwell's relations, Joule's effect and Joule's Thomson effect, Transport Phenomenon of gases, thermodynamic potentials
Phase transition	First and second order phase transition.
Black Body Radiations	conduction, convection, Black Body Radiation Kirchhoff's laws, Planck's distribution law and deduction of Stefan's law, Wien's law and Rayleigh-Zeans law,

Statistical Mechanics

Microstates and Microcanonical ensemble	Macrostate and microstate, Micro-canonical, Gibb's- canonical, hermodynamic and statistical Entropy and theorems, Gibb's paradox and its resolution
Canonical Ensemble	connonical ensembles, Partition functions
Grand Canonical Ensemble	Grand-connonical ensembles
Fermi Stat. Mech.	Fermi gases
Bose Stat. Mech.	Ideal Bose gases, Bose Eintein condensation
Random Walk and Diffusion	Random walk and Brownian motion.Diffusion equation. Introduction to nonequilibrium processes.
Ising Model	Ising model.

Optics

Optical Instruments	Cardinal points, Huygens and Ramsden eyepiece Defect of visions, Human eye and camera, Telescope and microscope,
Interference	Young's double slits, Biprism, Colour in thin films, Newton's ring, Michelson interferometer, Fabry-Perot inter-ferometer,
Diffraction	Fresnel and Fraunhofer's Diffraction , Zone Plate, Single slit and multiple slits diffraction, plane Grating, Resolving Power of Grating and optical instruments, Limit and criteria of resolution.
Polarization	Unpolarised and polarised light, Plane of vibration and plane polarization, Polarization by Reflection, Refraction, Double refraction, Dichroism, Law of Malus, Nicol Prism, Retaradation Plates (Half and Quarter), Babinet compensator, Optical rotation, Polarimeters,
Lasers	Coherence (Temporal and Spatial), Induced emission, Spontaneous emission, Induced absorption, Einstein's A & B co-efficients, components of Laser, Types of pumping, Ruby lasers, He-Ne lasers, Semi-conductor lasers, Holography and Photography, Medical application of lasers,



Oscillations and Waves	Undamped, Damped, Forced and Resonance Vibrations, Lissajous figures, Velocity of Sound, Plane progressive and stationary waves, Vibration of Stretched strings and organ Pipes, Reflectivity and Transmittivity at boundary, Phase velocity and Group velocity.
Ray optics	ray-transfer matrix for mirrors and lenses; General theory of image formation

Electronics

Semiconductor Physics	Intrinsic and extrinsic semi conductors,
PN Junctions	PN Junction, Zener Diode and their characteristic, Rectifier and filters,
Transistors	Bipolar and Unipolar transistors, Input and Output characteristics curve, Hybrid Parameters, Gains (Resistances, Current, Voltage, Power),
Amplifiers and OPAMP	Voltage and Power Amplifiers, Feedback Amplifiers, Operational Amplifiers and its application,
High Frequency devices	Oscillators, Modulators, Detectors, Supersonics, Ultrasonic (Production, Detection and Applications),
Electronic instruments	Multimeters, CRO, Voltmeter, Galvanometer, Ammeter
Optoelectronic Devices	Opto electronic devices (LED, Photo detectors, Photo transistors, Solar cells).
Logic Gates	Logic Gates (NOT, AND, OR, NAND, NOR, XOR, XNOR) and their switching circuit, Logic symbols, Truth Tables, Venn diagram, Boolean functions, K-Map, Adder and Subtractor, Boolean Theorems,
Digital Circuits	Counters, Comparators, Flip-flops, Micro processors, microcontroller basics. A/D, D/A conversion
FET	field effect devices, device structure, device characteristics, frequency dependence and applications
AC and DC Circuits	KCL, KVL, Cells and basic electronics, Simple DC and AC circuits with R, L and C components.

Experimental techniques

Error analysis	least count, significant figures; methods of measurement and error analysis for physical quantities associated with various measurements;
Curve fitting	Least square fitting, linear and non-linear curve fitting, Chi-square test.
Transducers	Transducers (Temperature, Pressure/vacuum, magnetic field, Vibrations, Optical and particle detectors) measurement and control, Signal conditioning and recovery, impedance matching.
Fourier application and filtering	Filtering and Noise reduction, shielding and grounding, Fourier transformation.
Lock In Amplifier	Lock-in detector, Box-car integrator, modulation technique.

Atomic and Molecular Physics

Structure of atom	Bohr's and Sommerfeld Atomic Models, Hydrogen like atoms, Quantum states of an electron in an atom. Electron spin.
Vector Model	Vector atom model, Sodium D1 and D2 lines, Bohr magneton, Larmor frequency, Stern-Gerlach experiment, Selection rules, Spectral terms,
Effects and coupling in atom	L-S coupling, J-J coupling, Lande-g factor, Zeeman effect (Normal and anomalous), Paschenback effect, Stark effect,
X-ray Spectra	Optical spectra and X-Ray spectra, Duane-Hunt's law, Moseley law,
ESR, NMR and EPR	ESR, NMR and EPR
Molecular Physics	Electronic, Rotational, Vibrational molecular Spectra, Raman effect,



Nuclear and Particle Physics

Nuclear Properties	Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy,
Nuclear Models	semiempirical mass formula, liquid drop model, Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra.
Nuclear Forces	Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem.
Radioactivity	Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions.
Particle Physics	Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

Condensed Matter Physics

Crytallography	Elements of crystallography
Xray Diffraction	Bravais lattices. Reciprocal lattice. Diffraction and the structure factor
Bonding in solids	Bonding of solids.
Lattice Vibrations	Elastic properties, phonons, lattice specific heat.
Free electron theory	Free electron theory and electronic specific heat.
Band theory	Drude model of electrical and thermal conductivity, Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. nearly free electron model, conductivity, electron and hole statistics in intrinsic and extrinsic semiconductors, mobility and effective mass
Hall effect	Hall effect and thermoelectric power. metal-semiconductor junctions; ohmic and rectifying contacts;
Dielectric properties	dielectric properties of solids; polarizability, ferroelectricity
Magnetism in Solids	magnetic properties of solids; dia, para, ferro, antiferro and ferri magnetism, ferromagnetic domains;
Superconductivity	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.

Contributions in physics

contributions by indian scientists	Contribution of Aryabhata, Varahmihir, Brahmagupta and Bhaskaracharya to Astrophysics in ancient times. Basic information of ancient and modern observatories in India. Contribution of Indian Physicists J C Bose, C.V. Raman, S N Bose, Meghnad Saha, Homi Bhabha, Vikram Sarabhai, Raja Ramanna and J. V. Narlikar.
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Section 4 | Official Syllabus of Each Exam (Exact Text)

The following pages reproduce the syllabus exactly as published in the official notification of each examination, paper by paper. Text of scanned notifications has been extracted and reproduced faithfully.

4.1 UPPSC Polytechnic Lecturer (Physics) - Official Syllabus

General Studies and Physics Paper-1 & Paper-II as per the official UPPSC notification.

GENERAL STUDIES

(for the post of Lecturer/Workshop Superintendent)

1. History of India: Emphasis should be on general understanding of political, economic and social aspects of Indian History.
2. Geography of India: Candidates will be expected to have knowledge of the Physical and Human aspects of the Geography of India in general terms.
3. Indian Polity and Constitution: Candidates are expected to have a basic knowledge and preliminary understanding about Indian Political system as well as Indian Constitution.

4. Current events of National and International significance.

Physics Paper-1 Syllabus

1. Mathematical Physics

Dimensional analysis. Vector algebra and vector calculus, concept of Tensor, Linear ordinary differential equations of first & second order, special functions (Legendre, Hermite, Bessel, Laguerre functions). Fourier series, Fourier and Laplace transforms. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

2. Classical Mechanics and Properties of Matters

Newton's laws of motion, Dynamics of System of particle and rigid body, Center of mass and Center of Gravity, conservation laws of Energy, momentum and angular momentum, central force and its characteristics, Kepler's laws of planetary motion, Reduction of Two body Central Force Problems, Planet and Satellite, Orbital and escape velocity, communication satellite. Virtual and Actual Displacement, D'Alembert's Principle, Generalized co-ordinates, Lagrangian equations, Hamiltonian functions and equations, cyclic co-ordinates, Poisson Brackets and canonical transformations, Hamilton-Jacobi Theory, Inertial and non-inertial frame of references, Events, Galilean transformations, Galilean invariance and variance, special theory of Relativity, Lorentz transformations, Relativity of simultaneity and colocality, Length contraction, Time Dilation, Velocity addition theorem, Non-relativistic and relativistic particles, Relativistic Dynamics, Mass-energy equivalence, Doppler effect in light.

Elastic behavior of loaded wire, Elastic constants, Torsion of Cylinder, Bending of beam, Cantilever, surface tension, surface energy, angle of contact, capillarity, Excess pressure, Ideal fluid, hydro dynamical equations based on conservation of mass, Momentum and energy, Viscous force (Newton's law, Poiseuille law, Stokes law).

3. Thermodynamics and Statistical Physics

Four Laws of thermodynamics and their consequences Carnot cycle, Heat engine, Refrigerator. Thermodynamic potentials, Maxwell's relations, Joule's effect and Joule's Thomson effect, Transport Phenomenon of gases, Kinetic theory of matters, conduction, convection, Black Body Radiation Kirchhoff's laws, Planck's distribution law and deduction of Stefan's law, Wien's law and Rayleigh-Jeans law, Phase space (p and q), Macrostate and microstate, Micro-canonical, Gibb's-canonical, Grand-canonical ensembles and Partition functions, Classical and Quantum statistical mechanics, Maxwell speed distribution Ideal Bose and Fermi gases, Bose Einstein condensation, Thermodynamic and statistical Entropy and theorems, Gibb's paradox and its resolution. First and second order phase transition.



4. Optics and Acoustics

Cardinal points, Huygens and Ramsden eyepiece Defect of visions, Human eye and camera, Telescope and microscope, Theories of light, concept and condition of interference, Young's double slits, Biprism, Colour in thin films, Newton's ring, Michelson interferometer, Fabry-Perot inter-ferometer, Fresnel and Fraunhofer's Diffraction, Zone Plate, Single slit and multiple slits diffraction, plane Grating, Resolving Power of Grating and optical instruments, Limit and criteria of resolution.

Unpolarised and polarised light, Plane of vibration and plane polarization, Polarization by Reflection, Refraction, Double refraction, Dichroism, Law of Malus, Nicol Prism, Retardation Plates (Half and Quarter), Babinet compensator, Optical rotation, Polarimeters, Coherence (Temporal and Spatial), Induced emission, Spontaneous emission, Induced absorption, Einstein's A & B co-efficients, components of Laser, Types of pumping, Ruby lasers, He-Ne lasers, Semi-conductor lasers, Holography and Photography, Medical application of lasers, Undamped, Damped, Forced and Resonance Vibrations, Lissajous figures, Velocity of Sound, Plane progressive and stationary waves, Vibration of Stretched strings and organ Pipes, Reflectivity and Transmittivity at boundary, Phase velocity and Group velocity.

Physics Paper-II Syllabus

5. Electromagnetism

Electric Flux, Gauss law in electrostatics and its applications, Electric Field and Potential Due to Dielectric sphere and Electric Dipole, Laplace and Poisson equations, Gauss law in magnetostatics, Behavior of dipole in uniform and non-uniform fields, (magnetic chemical and Heating), effect of currents, Biot-Savart law and its applications, Ampere's circuital law and its applications, Lorentz force, cyclotron (limit and modification), Galvanometer, Ammeter, Voltmeter, Magnetic Flux, Laws of electro-magnetic induction, static and dynamic Induced emf, Self and Mutual induction and inductance, Laws of Electrostatics, Laws of magnetostatics, laws of electromagnetism, equation of continuity and modification of Ampere's circuital law, Conduction and displacement current, Maxwell's equations in free space and Dielectrics, Electromagnetic waves, Poynting vector, Dispersion relation in Plasma, Transmission line and Waveguide.

6. Quantum Mechanics

Wave particle duality, Matter waves, Uncertainty Principle, Photoelectric and Compton effect, Davisson - Germer experiment Wavepacket, Schrodinger equation (Time dependent and Time independent), Physical Significance of wave function, Normalisation, Orthogonality, Orthonormality, Eigen value equation, Eigen value, Eigen function, Expectation value, Ehrenfest Theorem, Dirac function and Kronecker delta, Particle in a box, Potential step, Potential barrier, Harmonic oscillator, Rigid Rotator, Hydrogen Atom, Spherical harmonics, Commutation and Non commutation Relations, Pauli spin matrices, Operators, Exchange degeneracy.

7. Atomic, Molecular, Nuclear and Particle Physics

Bohr's and Sommerfeld Atomic Models, Hydrogen like atoms, effect of nuclear motion, Optical spectra and X-Ray spectra, Duan-Hunts law, Moseley law, Vector atom model, Sodium D1 and D2 lines, Bohr magneton, Larmor frequency, Stern-Gerlach experiment, Selection rules, Spectral terms, L-S coupling, J-J coupling, Lande-g factor, Zeeman effect (Normal and anomalous), Paschenback effect, Stark effect, Electronic, Rotational, Vibrational molecular Spectra, Raman effect, phosphorescence effect.

Laws of Radio activity, Earth and Carbon dating, Mass defect, Packing fraction, Binding energy, Binding energy curve, Nuclear fission and fusion, Nuclear Reactor, Nuclear reaction, Q- values, Chain reaction (Controlled and un-controlled), Thermo nuclear reactions, Hydrogen bomb, Semi-empirical mass formula, Liquid drop model, Shell model, Collective model, Nuclear forces, Fundamental particles, four fundamental interactions, classification of elementary particles on the basis of Spin, Mass and Interaction, Quantum numbers (Charge, Spin, Parity, Isospin, Strangeness) Of Elementary particles, Quark model, Baryons, Leptons, Mesons, Conservation laws.

8. Electronics and Condensed Matters

Intrinsic and extrinsic semi conductors, P-N Junction & Zener Diode and their characteristic, Rectifier and filters, Bipolar and Unipolar transistors, Input and Output characteristics curve, Hybrid Parameters, Gains (Resistances, Current, Voltage, Power), Voltage and Power Amplifiers, Feedback Amplifiers, Operational Amplifiers and its application, Oscillators, Modulators, Detectors, Supersonics, Ultrasonic (Production, Detection and Applications), Multimeters, CRO, Opto electronic devices (LED, Photo detectors, Photo transistors, Solar cells).

Analog and Digital signals, Logic Gates (NOT, AND, OR, NAND, NOR, XOR, XNOR) and their switching circuit, Logic symbols, Truth Tables, Venn diagram, Boolean functions, K-Map, Adder and Subtractor, Boolean Theorems, A/D, D/A, Resistors, Counters, Comparators, Flip-flops, Micro processors, Bravais Lattices, Reciprocal Lattices, Electron



Diffraction, Bonding of Solids, liquid Crystals, Free Electron and Band theory of Solids, Electron motion in Periodic Potential, Effective mass of free electrons and holes, Specific heat of Solid (Classical and Quantum theories), Hall effect and Thermo electric Power, Super conductivity (Type-I and Type-II), Super conductors, Josephson Junction, BCS theory, Cooper pairs, Super fluidity. Dia, Para, Ferro, Antiferro, Ferri magnetism.

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4.2 MPPSC Assistant Professor - Paper I (General Studies) - Official Syllabus

First Paper - General Studies (Madhya Pradesh).

UNIT:01 - History of Madhya Pradesh

- * Ancient History of Madhya Pradesh - Prehistoric Period, Protohistoric Period and Historic Period.
- * Medieval History of Madhya Pradesh
- * Modern History of Madhya Pradesh
- * Freedom Movement in Madhya Pradesh
- * Tribal History and Tribal Literature of Madhya Pradesh

UNIT-02 - Geography of Madhya Pradesh

- * Geographical location and extent of the state, major Rivers, mountains.
- * Climate: Seasons, Soils, Temperature, Rainfall, Forest types and Forest produce.
- * Agriculture: Major crops, Sources of irrigation, Irrigation projects.
- * Thermal power projects, Non-conventional energy sources, Major Minerals.
- * Population size, Growth and Literacy, Transportation, Food processing industries.

UNIT-03 - Politics and Economy of Madhya Pradesh

Politics of Madhya Pradesh

Governor, Chief Minister, Cabinet, Vidhan Sabha, High Court, Lokayukta, State Secretariat, Chief Secretary, Divisional Commissioner, Police Commissioner.

District Administration, Urban Administration, Local Self Government, Panchayati Raj Institutions.

State Election Commission, State Information Commission, State Scheduled Castes Commission, State Scheduled Tribes Commission, State Backward Classes Commission, State Commission for Women.

Scheduled Caste and Schedule Tribe Prevention of Atrocities Act, 1989; Panchayats Extension to Schedule Areas (PESA) Act, 1996; Environment Protection Act, 1986; Madhya Pradesh Govansh Vadh Pratishedh Adhiniyam, 2004.

Economy of Madhya Pradesh

Overview of the Economy of Madhya Pradesh.

Status of Agriculture and Rural Development in Madhya Pradesh.

Development of Industrial and Infrastructural Framework in Madhya Pradesh.

Status of Education, Health, and Skill Development in Madhya Pradesh.

Status of Madhya Pradesh in Sustainable Development Goals, Ease of Doing Business and Multidimensional Poverty Index.

UNIT-04 - Tribes of Madhya Pradesh: Heritage, Folk Culture and Folk Literature (with special reference to MP)

The geographical spread of tribes in Madhya Pradesh, constitutional provisions related to tribes.

Major tribes of Madhya Pradesh and Particularly Vulnerable Tribal Groups (PVTGS). Tribal welfare programs.

Tribal culture of Madhya Pradesh: Traditions, special arts, festivals, celebrations, language, dialects and literature.

Madhya Pradesh tribal's contribution to the freedom struggle of India and iconic tribal personalities of state. Popular institutes related to tribes of Madhya Pradesh, tribal museums, publications etc.

Folk culture and folk literature of Madhya Pradesh.

UNIT-5: - Important Contemporary Events of International, National and Madhya Pradesh and Information and Communication Technology

- * Important International and National Contemporary events.
- * Important Contemporary events and Major Public Welfare Schemes of Madhya Pradesh.



- * Prominent personalities and Important Places of Madhya Pradesh.
- * Computers, Information & Communication Technology, E-Governance.
- * Basic knowledge of Artificial Intelligence (AI), Machine Learning, Cloud Computing, Data Science and Internet of Things.

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4.3 MPPSC Assistant Professor - Paper II (Physics) - Official Syllabus

Second Paper - Physics.

Unit 1: Mathematical methods of Physics

- * Dimensional analysis, Vector algebra and vector calculus, Linear algebra.
- * Linear differential equations, Special functions (Hermite, Bessel, Laguerre and Legendre).
- * Fourier series, Fourier and Laplace transforms, Elements of complex analysis, Laurent series, poles, residues and evaluation of integrals.
- * Elementary ideas about tensors, Introductory group theory, $SU(2)$, $O(3)$.
- * Elements of computational techniques, roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, solution of first order differential equations using Runge-Kutta method, Finite difference methods.
- * Elementary knowledge of probability theory, random variables, binomial, Poisson and normal distributions.

Unit 2: Classical Mechanics

- * Newton's laws. Phase space dynamics; stability analysis.
- * Central-force motion, Two-body collisions, scattering in laboratory and center-of-mass frames.
- * Rigid body dynamics, moment of inertia tensor; non-inertial frames and pseudo-forces.
- * Variational principle, Lagrangian and Hamiltonian formalisms and equations of motion; Poisson brackets and canonical transformations, Symmetry, invariance and conservation laws, cyclic coordinates; Periodic motion, small oscillations and normal modes.
- * Special theory of relativity, Lorentz transformations, relativistic kinematics and mass-energy equivalence.

Unit 3: Electromagnetic Theory

- * Electrostatics: Gauss' 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 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, Dispersion relations in plasma, Lorentz invariance of Maxwell's equations.
- * Transmission lines and wave-guides, Dynamics of charged particles in static and uniform electromagnetic fields, Radiation from moving charges, dipoles and retarded potentials.

Unit 4: Quantum Mechanics

- * Wave-particle duality, Wave functions in coordinate and momentum representations, Commutators and Heisenberg's uncertainty principle, Matrix representation, Dirac's bra and ket notation.
- * Schrodinger equation (time-dependent and time-independent), Eigenvalue problems such as particle-in-a-box, Harmonic oscillator, Tunneling through a barrier.
- * Motion in a central potential, Orbital angular momentum, Angular momentum algebra, spin, Addition of angular momenta, Hydrogen atom, spin-orbit coupling and fine structure.
- * Time Independent perturbation theory and its applications, Variational method, WKB approximation.
- * Time dependent perturbation theory and Fermi's Golden Rule, Selection rules, Semi-classical theory of radiation, Elementary theory of scattering, phase shifts, partial waves, Born approximation, Identical particles, Pauli's exclusion principle, spin-statistics connection, Relativistic quantum mechanics, Klein Gordon and Dirac equations.

Unit 5: Thermodynamics and Statistical Physics

- * Laws of thermodynamics and their consequences, Thermodynamic potentials, Maxwell relations, Chemical potential, phase equilibria, Phase space, micro and macrostates.
- * Microcanonical, canonical and grand-canonical ensembles and partition functions.



- * Free energy and connection with thermodynamic quantities, First and second order phase transitions.
- * Classical and quantum statistics, ideal Fermi and Bose gases, Blackbody radiation and Planck's distribution law, Bose-Einstein condensation.
- * Random walk and Brownian motion, Introduction to non-equilibrium processes, Diffusion equation.

Unit 6: Electronics

- * Semiconductor devices including diode, Junction transistors, Field-Effect devices, Homo and Hetero junction devices.
- * Device Structure, device characteristics, Frequency dependence and application.
- * Optoelectronic devices including Solar cells, Optical detectors and Light Emitting Diode, High frequency devices including: generators and detectors.
- * Operational amplifier and its application, Digital technique and applications (Registers, Counters, Comparators and equivalent circuits) Analog to Digital and Digital to Analog Converters, Micro-processor and Micro-controller.

Unit 7: Experimental techniques and data analysis

- * Data representation and analysis, Analysis of exact and appropriate errors, Propagation of errors.
- * Least square fitting, linear and non-linear curve fitting, Chi-square test.
- * Transducers (Temperature, Pressure/vacuum, magnetic field, Vibrations, Optical and particle detectors) measurement and control, Signal conditioning and recovery, impedance matching.
- * Amplification (operational amplifier based, instrumentation amplifier, feedback), Filtering and Noise reduction, shielding and grounding, Fourier transformation.
- * Lock-in detector, Box-car integrator, modulation technique.

Unit 8: Atomic & Molecular Physics

- * Quantum states of an electron in an atom, Electron spin, Stern-Gerlach experiment, Spectrum of Hydrogen, Helium and alkali atoms.
- * Relativistic corrections for energy levels of hydrogen, Hyperfine structure and isotopic shift, width of spectral lines, LS & JJ coupling.
- * Zeeman, Paschen Back & Stark effect, X-ray spectroscopy.
- * Electron spin resonance, Nuclear magnetic resonance, chemical shift, Rotational, vibrational, electronic and Raman spectra of diatomic molecules.
- * Frank - Condon principle and selection rules, Spontaneous and stimulated emission, Einstein A & B coefficients, Lasers, optical pumping, population inversion, rate equation, Modes of resonators and coherence length.

Unit 9: 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. Diamagnetism, paramagnetism, and ferromagnetism.
- * Electron motion in periodic potential, band theory of metals, insulators and semiconductors.
- * Superconductivity: Type-I and type II superconductors, Josephson junctions, Defects and dislocations, Ordered phases of matter, translational and orientational order, kinds of liquid crystalline order, Conducting polymers, Quasicrystals.

Unit 10: Nuclear Physics and Contribution of Physicists

- * Basic nuclear properties: size, shape, charge distribution, spin and parity, Binding energy. Semi-empirical mass formula, Liquid drop model, Fission and fusion.
- * Nature of the nuclear force, form of nucleon-nucleon potential, Charge-independence and charge-symmetry of nuclear forces, Isospin; 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, nuclear reactions, reaction mechanisms, compound nuclei and direct reactions.
- * Classification of fundamental forces, Elementary particles (quarks, baryons, mesons, leptons), Spin and parity assignments, isospin, strangeness, Gell-Mann-Nishijima formula; C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction; Relativistic kinematics.
- * Contribution of Aryabhata, Varahmihir, Brahmagupta and Bhaskaracharya to Astrophysics in ancient times. Basic information of ancient and modern observatories in India. Contribution of Indian Physicists J C Bose, C.V. Raman, S N Bose, Meghnad Saha, Homi Bhabha, Vikram Sarabhai, Raja Ramanna and J. V. Narlikar.

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4.4 Rajasthan SET - Paper I (Teaching & Research Aptitude) - Official Syllabus

UGC NET Bureau General Paper on Teaching & Research Aptitude (Code 00).

UNIVERSITY GRANTS COMMISSION

NET BUREAU

SYLLABUS

Subject: GENERAL PAPER ON TEACHING & RESEARCH APTITUDE Code No. : 00

PAPER-I

The main objective is to assess the teaching and research capabilities of the candidates. The test aims at assessing the teaching and research aptitude as well.

Candidates are expected to possess and exhibit cognitive abilities, which include comprehension, analysis, evaluation, understanding the structure of arguments, deductive and inductive reasoning. The candidates are also expected to have a general awareness about teaching and learning processes in higher education system. Further, they should be aware of interaction between people, environment, natural resources and their impact on the quality of life.

The details of syllabi are as follows:

Unit-I Teaching Aptitude

- Teaching: Concept, Objectives, Levels of teaching (Memory, Understanding and Reflective), Characteristics and basic requirements.
- Learner's characteristics: Characteristics of adolescent and adult learners (Academic, Social, Emotional and Cognitive), Individual differences.
- Factors affecting teaching related to: Teacher, Learner, Support material, Instructional facilities, Learning environment and Institution.
- Methods of teaching in Institutions of higher learning: Teacher centred vs. Learner centred methods; Off-line vs. On-line methods (Swayam, Swayamprabha, MOOCs etc.).
- Teaching Support System: Traditional, Modern and ICT based.
- Evaluation Systems: Elements and Types of evaluation, Evaluation in Choice Based Credit System in Higher education, Computer based testing, Innovations in evaluation systems.

Unit-II Research Aptitude

- Research: Meaning, Types, and Characteristics, Positivism and Post-positivistic approach to research.
- Methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods.
- Steps of Research.
- Thesis and Article writing: Format and styles of referencing.
- Application of ICT in research.
- Research ethics.

Unit-III Comprehension

- A passage of text be given. Questions be asked from the passage to be



answered.

Unit-IV Communication

- Communication: Meaning, types and characteristics of communication.
- Effective communication: Verbal and Non-verbal, Inter-Cultural and group communications, Classroom communication.
- Barriers to effective communication.
- Mass-Media and Society.

Unit-V Mathematical Reasoning and Aptitude

- Types of reasoning.
- Number series, Letter series, Codes and Relationships.
- Mathematical Aptitude (Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc.).

Unit-VI Logical Reasoning

- Understanding the structure of arguments: argument forms, structure of categorical propositions, Mood and Figure, Formal and Informal fallacies, Uses of language, Connotations and denotations of terms, Classical square of opposition.
- Evaluating and distinguishing deductive and inductive reasoning.
- Analogies.
- Venn diagram: Simple and multiple use for establishing validity of arguments.
- Indian Logic: Means of knowledge.
- Pramanas: Pratyaksha (Perception), Anumana (Inference), Upamana (Comparison), Shabda (Verbal testimony), Arthapatti (Implication) and Anupalabddhi (Non-apprehension).
- Structure and kinds of Anumana (inference), Vyapti (invariable relation), Hetvabhasas (fallacies of inference).

Unit-VII Data Interpretation

- Sources, acquisition and classification of Data.
- Quantitative and Qualitative Data.
- Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data.
- Data Interpretation.
- Data and Governance.

Unit-VIII Information and Communication Technology (ICT)

- ICT: General abbreviations and terminology.
- Basics of Internet, Intranet, E-mail, Audio and Video-conferencing.
- Digital initiatives in higher education.
- ICT and Governance.

Unit-IX People, Development and Environment

- Development and environment: Millennium development and Sustainable development goals.



□ Human and environment interaction: Anthropogenic activities and their impacts on environment.

□ Environmental issues: Local, Regional and Global; Air pollution, Water pollution, Soil pollution, Noise pollution, Waste (solid, liquid, biomedical, hazardous, electronic), Climate change and its Socio-Economic and Political dimensions.

□ Impacts of pollutants on human health.

□ Natural and energy resources: Solar, Wind, Soil, Hydro, Geothermal, Biomass, Nuclear and Forests.

□ Natural hazards and disasters: Mitigation strategies.

□ Environmental Protection Act (1986), National Action Plan on Climate Change, International agreements/efforts -Montreal Protocol, Rio Summit, Convention on Biodiversity, Kyoto Protocol, Paris Agreement, International Solar Alliance.

Unit-X Higher Education System

□ Institutions of higher learning and education in ancient India.

□ Evolution of higher learning and research in Post Independence India.

□ Oriental, Conventional and Non-conventional learning programmes in India.

□ Professional, Technical and Skill Based education.

□ Value education and environmental education.

□ Policies, Governance, and Administration.

NOTE: (i) Five questions each carrying 2 marks are to be set from each Module.

(ii) Whenever graphical/pictorial question(s) are set for sighted candidates, a passage followed by equal number of questions and weightage be set for visually impaired candidates.

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4.5 Rajasthan SET - Paper II (Physical Sciences) - Official Syllabus

Physical Sciences syllabus (CSIR-UGC NET pattern).

CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship

and Lecturer-ship

PHYSICAL SCIENCES

PART A

CORE

I. 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.

II. 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.

III. 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.

IV. 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.

V. 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.

VI. 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,

PART B

ADVANCED

I. Mathematical Methods of Physics

Green's function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Solution of first order differential equation using Runge-Kutta method. Finite difference methods. Tensors. Introductory group theory: SU(2), O(3).

II. Classical Mechanics

Dynamical systems, Phase space dynamics, stability analysis. Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

III. Electromagnetic Theory

Dispersion relations in plasma. Lorentz invariance of Maxwell's equation. Transmission lines and wave guides. Radiation- from moving charges and dipoles and retarded potentials.

IV. Quantum Mechanics

Spin-orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: phase shifts, partial waves, Born approximation. Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.

V. Thermodynamic and Statistical Physics

First- and second-order phase transitions. Diamagnetism, paramagnetism, and ferromagnetism. Ising model. Bose-Einstein condensation. Diffusion equation. Random walk and Brownian motion. Introduction to nonequilibrium processes.

VI. Electronics and Experimental Methods

Linear and nonlinear curve fitting, chi-square test. Transducers (temperature, pressure/vacuum, magnetic fields, vibration, optical, and particle detectors). Measurement and control. Signal conditioning and recovery. Impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding. Fourier transforms, lock-in detector, box-car integrator, modulation techniques.

High frequency devices (including generators and detectors).

VII. 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.

VIII. 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.

IX. 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.

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4.6 Punjab Lecturer Cadre - Paper I (Aptitude Test) - Official Structure & Syllabus

Scheme, structure and nature of questions for the aptitude paper.

—) —

5 Structure of Question Paper

SCHEME/STRUCTURE AND CONTENT OF TEST:

All questions in the test will be multiple choice questions. Each carrying one mark, with four alternatives out of which one answer will be correct. There shall be no negative marking. Detailed scheme and structure for all three levels is as given here under:

There shall be only one Paper in this category. All questions will be Multiple Choice Questions (MCQs) each carrying one mark with four alternatives out of which one answer will be correct.

No. of marks: 150; Duration: 120 minutes.

Structure and Content:

(i) English 30

(ii) Punjabi 30

(iii) Teaching 30

(iv) General Knowledge/Current affairs 30

(v) Mental Aptitude 30

NATURE AND STANDARD OF QUESTIONS:

* The test items on General Intelligence and Reasoning Ability shall be both verbal and non-verbal types. Test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure besides testing the knowledge of Everyday Science, Scientific Research, Sports, Indian Culture, Indian History, Indian Geography, Economics, Indian Polity, Indian Constitution, etc.

* The test items for language 1] (Punjabi) will be designed to test the candidate's understanding, correct usage and knowledge of Punjabi Language and will be based on error recognition, fill in the blanks (using Verbs, Prepositions, Articles, etc.), vocabulary, spellings, grammar, sentence structure, synonyms, antonyms, sentence completion, phrases and idioms, etc.

† The Language 1] (English) will be designed to test the candidate's understanding, correct usage and knowledge of English Language and will be based on error recognition, fill in the blanks (using Verbs, Prepositions, Articles, etc.), vocabulary, spellings, grammar, sentence structure, synonyms, antonyms, sentence completion, phrases and idioms, etc.

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4.7 Punjab Lecturer Cadre - Paper II (Physics) - Official Syllabus

Subject paper - Physics.

PHYSICS

I. Mathematical Methods of Physics

Dimensional analysis; Vector algebra and vector calculus; Linear algebra, matrices, Cayley Hamilton theorem, eigenvalue problems; Linear differential equations; Special functions (Hermite, Bessel, Laguerre and Legendre); Fourier series, Fourier and Laplace transforms; Elements of complex analysis: Laurent series-poles, residues and evaluation of integrals; Elementary ideas about tensors; Introductory group theory, $SU(2)$, $O(3)$; Elements of computational techniques: roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, solution of first order differential equations using Runge-Kutta method; Finite difference methods; Elementary probability theory, random variables, binomial, Poisson and normal distributions.

II. Classical Mechanics

Newton's laws; Phase space dynamics, stability analysis; Central-force motion; 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, Lagrangian and Hamiltonian formalisms and equations of motion; Poisson brackets and canonical transformations; Symmetry, invariance and conservation laws, cyclic coordinates; Periodic motion, wave motion, small oscillations and normal modes; Special theory of relativity, Lorentz transformations, relativistic kinematics and mass-energy equivalence, work power energy, gravitation, pressure, motion of fluids, viscosity, surface tension.

III. Electromagnetic Theory

Electrostatics: Gauss' 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 fields at interfaces; Scalar and vector potentials; Gauge invariance; Electromagnetic waves in free space, dielectrics, and conductors; Reflection and refraction, polarization, optical instrument, defects of eye. Fresnel's Law, interference, coherence, and diffraction; Dispersion relations in plasma; Lorentz invariance of Maxwell's equations; Transmission lines and wave guides; Dynamics of charged particles in static and uniform electromagnetic fields; Radiation from moving charges, dipoles and retarded potentials, current electricity-Kirchhoff's Law, Wheat Stone Bridge, Potentiometer & Slide Wire Bridge.

IV. Quantum Mechanics

Wave-particle duality; Wave functions in coordinate and momentum representations; Commutators and Heisenberg's uncertainty principle; Matrix representation; Dirac's bra and ket notation; Schroedinger equation (time-dependent and time-independent); Eigenvalue problems such as particle-in-a-box, harmonic oscillator, etc.; Tunneling through a barrier; Motion in a central potential; Orbital angular momentum, Angular momentum algebra, spin; Addition of angular momenta; Hydrogen atom, spin-orbit coupling, fine structure; Time-independent perturbation theory and applications; Variational method; WKB approximation; Time dependent perturbation theory and Fermi's Golden Rule; Selection rules; Semi-classical theory of radiation; Elementary theory of scattering, phase shifts, partial waves, Born approximation; Identical particles, Pauli's exclusion principle, spin-statistics connection; Relativistic quantum mechanics: Klein Gordon and Dirac equations.

V. Thermodynamic and Statistical Physics

Laws of thermodynamics and their consequences; Thermodynamic potentials, Maxwell relations; Chemical potential, phase equilibria; Phase space, micro- and macrostates; Microcanonical, canonical and grand-canonical ensembles and partition functions; Free Energy and connection with thermodynamic quantities; First- and second-order phase transitions; Classical and quantum statistics, ideal Fermi and Bose gases; Principle of detailed balance; Blackbody radiation and Planck's distribution law; Bose-Einstein condensation; Random walk and Brownian motion; introduction to non-equilibrium processes; Diffusion equation.

VI. Electronics and Experimental methods

Semiconductor device physics, including diodes, junctions, transistors, field effect devices, homo and heterojunction devices, device structure, device characteristics, frequency dependence and applications; Optoelectronic devices, including solar cells, photodetectors, and LEDs; High-frequency devices, including generators and detectors; 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, Logic gates, communication system.

Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting.

VII. Experimental Techniques and data analysis

Data interpretation and analysis; Precision and accuracy, error analysis, propagation of errors, least squares fitting, linear and nonlinear curve fitting, chi-square test; Transducers (temperature, pressure/vacuum, magnetic field, vibration, optical, and particle detectors), measurement and control; Signal conditioning and recovery, impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding; Fourier transforms; lock-in detector, box-car integrator, modulation techniques.

Applications of the above experimental and analytical techniques to typical undergraduate and graduate level laboratory experiments.

VIII. Atomic & Molecular Physics

Quantum states of an electron in an atom; Electron spin; Stern-Gerlach experiment; Spectrum of Hydrogen, helium and alkali atoms; Relativistic corrections for energy levels of hydrogen; Hyperfine structure and isotopic shift; width of spectral lines; LS & JJ coupling; Zeeman, Paschen Back & Stark effect, Photoelectric effect, X-ray spectroscopy; Electron spin resonance, Nuclear magnetic resonance, chemical shift; Rotational, vibrational, electronic, and Raman spectra of diatomic molecules; Frank - Condon principle and selection rules; Spontaneous and stimulated emission, Einstein A & B coefficients; Lasers, optical pumping, population inversion, rate equation; Modes of resonators and coherence length.

IX. 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 & relaxation phenomena; Drude model of electrical and thermal conductivity; Hall effect and thermoelectric power; Diamagnetism, paramagnetism, and ferromagnetism; Electron motion in a periodic potential, band theory of metals, insulators and semiconductors; Superconductivity, type - I and type - II superconductors, Josephson junctions; Defects and dislocations; Ordered phases of matter, translational and orientational order, kinds of liquid crystalline order; Conducting polymers; Quasicrystals.

X. Nuclear and Particle Physics

Basic nuclear properties: size, shape, charge distribution, spin and parity; Binding energy, semi-empirical mass formula; Liquid drop model; Fission and fusion; Nature of the nuclear force, form of nucleon-nucleon potential; Charge-independence and charge-symmetry of nuclear forces; Isospin; 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; Nuclear reactions, reaction mechanisms, compound nuclei and direct reactions; Classification of fundamental forces; Elementary particles (quarks, baryons, mesons, leptons); Spin and parity assignments, isospin, strangeness; Gell-Mann-Nishijima formula; C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction; Relativistic kinematics.

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4.8 J&K Assistant Professor (Physics) - Official Syllabus

Jammu and Kashmir Public Service Commission - written examination syllabus for Assistant Professor in Physics.

Syllabus for written examination for the Post of Assistant Professor in the subject of Physics

I. Mathematical Methods of Physics

Dimensional analysis; Vector algebra and vector calculus; Linear algebra, matrices, Cayley Hamilton theorem, eigenvalue problems; Linear differential equations; Special functions (Hermite, Bessel, Laguerre and Legendre); Fourier series, Fourier and Laplace transforms; Elements of complex analysis: Laurent series - poles, residues and evaluation of integrals; Elementary ideas about tensors. Functions of a complex variable, Cauchy Riemann equations, Harmonic functions, complex integration, Cauchy's integral formula.

II. Classical Mechanics

Newton's laws; Phase space dynamics, stability analysis; Central-force motion; 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, Lagrangian and Hamiltonian formalisms and equations of motion; Poisson brackets and canonical transformations; Symmetry, invariance and conservation laws, cyclic coordinates; Periodic motion, small oscillations and normal modes. Hamilton-Jacobi equations for Hamilton's characteristic function.

III. Electromagnetic Theory

Electrostatics: Gauss' Law and its applications; Laplace and Poisson equations, boundary value problems, Maxwell's equations in free space and linear isotropic media; boundary conditions on fields at interfaces; Scalar and vector potentials; Gauge invariance; Electromagnetic waves in free space, dielectrics, and conductors; Dispersion relations in plasma; Lorentz invariance of Maxwell's equations; Transmission lines and wave guides; Dynamics of charged particles in static and uniform electromagnetic fields; Radiation from moving charges, dipoles and retarded potentials, Lienard-Wiechert potentials.

IV. Quantum Mechanics

Wave-particle duality, Wave functions in coordinate and momentum representations; Commutators and Heisenberg's uncertainty principle, Matrix representation; Dirac's bra and ket notation; Schrodinger equation (time-dependent and time-independent); Eigenvalue problems such as particle-in-a-box, harmonic oscillator, etc.; Tunneling through a barrier; Motion in a central potential; Orbital angular momentum, Angular momentum algebra, spin; Addition of angular momenta; Hydrogen atom, spin-orbit coupling, fine structure; Time-independent perturbation theory and applications; Variational method; WKB approximation; Time dependent perturbation theory; Fermi's Golden Rule; Selection rules; Semi-classical theory of radiation; Elementary ideas of relativistic quantum mechanics; Klein Gordon and Dirac equations; Identical particles, Pauli's exclusion principle, spin-statistics connection.

V. Thermodynamic and Statistical Physics

Phase space, micro- and macro-states, ensembles: microcanonical, canonical and grand canonical ensembles and partition functions; Free Energy and connection with thermodynamic quantities; Gibb's paradox. First- and second-order phase transitions, Mean field theory, Landau's theory. Classical and quantum statistics, ideal Fermi and Bose gases; Blackbody radiation and Planck's distribution law; Bose-Einstein condensation; Diffusion equation.

VI. Electronics

Semiconductor device physics, including diodes, junctions, transistors, field effect devices, homo and heterojunction devices, device characteristics, frequency and power dependence. Opto-electronic devices, high-frequency devices, Operational amplifiers and their applications; Digital techniques and applications (registers, counters, and similar circuits); A/D and D/A converters. Logic gates; one bit RS, JK, JK-slave, D and T Flip Flops.

VII. Computational methods in physics

Numerical analysis: Elements of computational techniques; interpolation and extrapolation, curve fitting, solutions of equations; Bisection method, secant method, numerical integration; Trapezoidal, Simpson's methods, Runge-Kutta method. Solutions of algebraic and transcendental equations; Newton-Raphson method, solution of linear system of equations by Gauss Elimination method.

VIII. Atomic & Molecular Physics



Quantum states of an electron in an atom; Electron spin: one electron atoms, Relativistic corrections for energy levels of hydrogen; Hyperfine structure and isotopic shift; width of spectral lines; LS & JJ coupling; Zeeman, Paschen Back & Stark effect; X-ray spectroscopy; Electron spin resonance, Nuclear magnetic resonance, chemical shifts, rotational, vibrational, electronic and Raman spectra of diatomic molecules, selection rules, Frank - Condon principle, spontaneous and stimulated emission, Einstein A & B coefficients.

IX. 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; Drude and Sommerfeld theory, Hall effect and thermoelectric power; Di and paramagnetism, diamagnetism of free electrons and Landau levels; Weiss theory of ferromagnetism and antiferromagnetism; ferroelectricity; Superconductivity, type - I and type - II superconductors, Josephson junctions; Defects and dislocations; Ordered phases of matter, translational and orientational order, kinds of liquid crystalline order; Conducting polymers; Quasicrystals.

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