

NEHRU GRAM BHARATI VISHWAVIDYALAYA

KOTWA-JAMUNIPUR, DUBAWAL, ALLAHABAD (U.P.)



Revised New Syllabus

(w.e.f. Session-2016-17)

B.Sc. Part - I, II, III

(Three years Degree Course)

DEPARTMENT OF PHYSICS

B.Sc. I - Physics (Total 180 Hrs)

Total marks 150

Paper -	I	Each 5 Units	34 Marks	60 Lecturers	2 Periods per week
Paper -	II	Each 5 Units	33 Marks	60 Lecturers	2 Periods per week
Paper -	III	Each 5 Units	33 Marks	60 Lecturers	2 Periods per week
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Practical	50 Marks				
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B.Sc. II - Physics (Total 180 Hrs)

Total marks 150

Paper -	I	Each 5 Units	34 Marks	60 Lecturers	2 Periods per week
Paper -	II	Each 5 Units	33 Marks	60 Lecturers	2 Periods per week
Paper -	III	Each 5 Units	33 Marks	60 Lecturers	2 Periods per week
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Practical	50 Marks				
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B.Sc. III - Physics (Total 270 Hrs)

Total marks 225

Paper -	I	Each 5 Units	50 Marks	90 Lecturers	3 Periods per week
Paper -	II	Each 5 Units	50 Marks	90 Lecturers	3 Periods per week
Paper -	III	Each 5 Units	50 Marks	90 Lecturers	3 Periods per week
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Practical	75 Marks				
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B.Sc. First Year (Paper-I) - Mechanics

Unit 1 . Vector and Dynamics of Rigid Body

Curl, Gradient , Divergence and their applications.

Gauss divergence theorem, Stoke's Theorem and Green's theorem and applications.

Moment of Inertia, Physical significance, Radius of gyration, Theorem of parallel and perpendicular axes and their applications, Moment of Inertia of rod, Lamina, Sphere, Hollow sphere , Cylinder and Fly wheel. Compound Pendulum.

Unit 2 . Motion under a central force and non-rigid bodies.

Two particle central force problem, Reduced mass, Lab and centre of mass co-ordinate systems. Collision in One and two dimensions, Collision cross section with examples. Motion of Satellite, Geostationary Satellite.

Unit 3 . Elasticity and Surface Tension

Stress and strain in an isotropic homogeneous medium, Elastic moduli and relations between them. Torsion of cylinders, Cantilever, Bending of beam, Internal energy of a strained body.

Surface Tension and surface energy, Molecular interpretation of surface tension, Pressure on a curved liquid surface, Theory of Surface tension by Jeager's method.

Unit 4 . Fluid Mechanics

Ideal fluids, Equation of continuity, Streamline flow, Rotational and irrotational flows, Euler's equation of Motion, Bernoulli's Theorem, Viscous fluids, Poiseuille's equation, , Stoke's Law, variation of viscosity with temperature.

Unit 5 . Special Theory of Relativity

Inertial and Non Inertial Frames, Michelson Morley experiment, Postulates of special theory of relativity, Lorentz-transformations, Length-contraction, Time-dilation, Simultaneity in relativity theory, Addition of velocities, Variation of mass with velocity, mass energy relation.

Reference Books :

1. Fundamental of Physics, VIth Edition - Halliday and Resnik, Wiley 2001.
2. Physics (Classical and Modern) - F.J. Keller, E. Gerys and J.J. Skove, Mc Graw-Hill, 2nd Edition.
3. Concept of Physics - H.C. Verma, Vol.I.
4. Berkely Physics Course, Vol I : Mechanics , Mc. Graw Hill.
5. Mechanics, J.C. Upadhyay - Ramprasad and Co. Agra.
6. Mechanics - D.S. Mathur, S.Chand & Company.
7. Properties of Matter - J.C. Upadhyay
8. Mechanics - B.S. Agrawal

B.Sc. First Year (Paper-II) - Waves and Oscillations

Unit 1. Simple Harmonic Motion :

Simple harmonic motion and harmonic oscillator, Equation of motion and solution for harmonic oscillator, Example of harmonic oscillator – Simple pendulum. Extended spring. U-tube, Torsion pendulum, Helmholtz resonator and LC circuit, Lissajou's figures with periods in ratio 1:1 and 1:2.

Unit 2. Fourier Analysis and normal modes of vibrations :

Fourier theorem, analysis of square wave, saw-tooth wave and rectified sinusoidal wave. Coupled Oscillator, Normal modes of vibrations of string and rectangular membrane.

Unit 3. Damped oscillations, forced oscillations and Resonance in Mechanical and Electrical Systems:

Damping force, damped oscillator, Equation of motion and its solution, Power dissipation, Sharpness of resonance, Q-factor, ballistic Galvanometer, Forced Oscillations, Equation of Motion and its solution , Resonance , LCR Circuit, Power in AC circuit and rms value.

Unit 4. Wave motion and E.M. Waves:

Progressive plane wave solution, Phase and group Velocity, waves in absorptive and dispersive medium, Maxwell's equation in integral and differential forms , Plane Electromagnetic Field Equations in free space, Poynting Vector, Poynting theorem.

Unit 5. Acoustics and Ultrasonics :

Acoustics of a building, Conditions for a good hall, Reverberation time and Sabine's formula.

Production of ultrasonic waves and its applications.

Reference Books :

1. The Physics of Waves and Oscillations, Bajaj, Tata McGraw Hills.
2. Waves and Oscillations, Brij Lal and Subrahmanyam.
3. Electromagnetic Fields and waves , Lorrain and Corson.
4. Physics of Vibration & Waves, H.J. Pain.
5. Oscillation & Waves, Satya Prakash.
6. Waves & Oscillations - Dongre & Bhattacharya
7. Physics of Oscillation and waves-R. B. Singh, united Book Depot

**B.Sc. First Year (Paper-III) - Electric and Magnetic Properties of
Materials and Solid State Electronics**

Unit1. Electric Polarization in Di-electrics :

Guass Law and applications, di-electric constant and atomic view of dielectrics, Guass law in Dielectrics, three electric vectors, dielectric susceptibility, permittivity, Ferro and Para electrics, Molecular Polarizability, Lorentz local field, Claussius - Mossoti relation.

Unit 2 . Magnetostatics :

Definition for magnetic field by Biot-Savart's Law, Field due to circular coil, application to Helmholtz galvanometer and solenoid. Energy stored in magnetic field, time integral of magnetic field , curl and divergence of magnetic field, Ampere's theorem.

Unit 3 . Magnetic Properties:

Magnetic Materials and their classification (diamagnetism, paramagnetism and ferromagnetic , Langevin's theory of para and diamagnetic materials, field due to magnetized matter , Elementary idea of domain theory of ferromagnetism, Hysteresis loss and cycle.

Unit 4 . Physics of semi conductors:

Origin of energy bands in solids (with example of carbon and silicon), distinction between metals, semiconductors and insulators, concept of electrons and holes, conductivity due to drift and diffusion of carriers, mobility, elementary idea of Fermi-level, intrinsic and extrinsic semi-conductors.

Unit 5 . Semiconductor Devices :

Physics of p-n junction, idea of depletion layer, potential barrier and electron and hole recombination, characteristics of p-n diode, majority and minority carriers, avelanche and Zener break-down, Zener and tunnel diodes, LED, Principle of transistor action and characteristics in CB, CE and CC configuration.

Reference Books :

1. Electricity principles and Application Fowler : TMH.
2. Electricity and Magnetism, Mahajan: TMH
3. Electricity and Magnetism with Electronics, K.K. Tiwari
4. Electricity and Magnetism, Vinod Prakash
5. Electricity and Magnetism, H.B. Lal.
6. Electricity and Electronics, D.C. Tayal
7. Electronic Fundamentals and Applications - John D. Ryder
8. Solid State Electronics Devices. Stretman, B,O.
9. Introduction to Solid State Physics - A.J. Dekker

List of Experiments :

1. M.I. of a fly wheel.
2. Bar pendulum (g) by graphical method.

3. Surface tension by Jeager's method.
4. Viscosity by Poiseuille's method.
5. Elastic constants by Searle's method (
6. by Maxwell's Needle.
7. by Torsion table.
8. by Statical Method.
9. by bending of beam.
10. Spiral spring (Statical & Dynamical method)
11. Melde's Experiment.
12. Frequency with the help of sonometer.
13. Maxwell's bridge
14. Determination of Self- Inductance
15. Determination of Mutual Inductance
16. Comparison of Capacitance of condenser by de-Sauty's Bridge.
17. Characteristics of p-n diode.
18. Characteristics of Zener Diode.
19. Characteristics of transistors (CE & CB)

Reference Books :

1. Practical Physics Vol.I - Gupta and Kumar
2. Practical Physics - Kor, Khare and Jain.
3. Practical Physics - Srivastava & Srivastava.
4. Practical Physics - C.L. Arora.
5. Practical Physics - Dey and Dutta

B.Sc. Second Year (Paper-I)

Thermal Physics and Statistical Mechanics

Unit 1 .First and Second law of Thermodynamics

Zeroth Law, First Law of thermodynamics and internal energy, reversible and irreversible process, Carnot's engine, Carnot cycle, Refrigerator, Second law of thermodynamics, Carnot's theorem, Thermo-dynamical scale of temperature, Entropy, change of entropy in reversible and irreversible processes, Physical significance of entropy, T-S diagram.

Unit 2 . Thermodynamic Equations :

Classius - Clayperon equation, Thermodynamic potentials and Maxwell's thermodynamic equations and their applications(T-dS equations, energy and heat capacity), Joule- Thomson effect, Inversion temperature, Adiabatic de-magnetization, 3rd law of thermodynamics, Nerst heat theorem.

Unit 3 . Radiation :

Black body spectrum, Stefan-Boltzman law, Solar constant and temperature of Sun, Temperature of non-black bodies, Distribution of energy in the spectrum of black body radiation, Adiabatic expansion of black body radiation, Wein's displacement law, Rayleigh-Jeans law, Plank's quantum hypothesis, Plank's radiation formula.

Unit 4 . Ensemble I : Probability and distribution functions :

Macroscopic and microscopic states, Phase space, connection between statistics and thermodynamics, Liouville's theorem, Micro-canonical ensemble, Classical ideal gas, Gibb's Paradox, Partition function and physical significance.

Unit 5 . Ensemble II : Canonical ensembles :

Description of classical ideal gas and harmonic oscillator, Grand canonical ensemble, Calculation of statistical quantities and their physical significance.

Maxwell-Boltzman, Bose-Einstein and Fermi-Dirac statistics, Bose-Einstein condensation, Photon statistics.

Reference Books :

1. Heat and Thermodynamics, Mark W. Zemansky : TMH.
2. Heat, Thermodynamics and Statistical Physics, Satya Prakash.
3. Heat and Thermodynamics, Brij Lal & Subrahmanyam
4. Heat, Thermodynamics and Statistical physics, Singhal, Agarwal
5. Fundamentals of Statistical and Thermal physics, Reif.
6. Statistical Mechanics, Patharia.
7. A treatise on Heat - Saha and Srivastava
8. Statistical Mechanics - B.K. Agrawal
9. Thermal Physics - B.K. Agrwal.

B.Sc. Second Year (Paper-II)

Optics and E.M. Waves.

Unit 1 . Geometrical Optics :

Focal length of a system of two lenses separated by a small distance. Cardinal points of coaxial system of lenses. Eye piece (Ramsden's and Huygen's), Aberration in lenses and their removal. Resolving power, Rayleigh criterions, Resolving power of prism, grating and telescope.

Unit 2 . Interference :

Interference due to division of wave-front, Bi-prism, Thickness of transparent thin sheet, Interference due to division of amplitude, Interference due to thin films and wedge shaped films, Newton's ring, Interferometers (Michelson's and Multiple beam) Fabry Perot etalon and L. G. Plate, Visibility of fringes.

Unit 3 . Diffraction

Fresnel's half period zone, plane wave-front, half period strips for cylindrical wave front, Rectilinear propagation of light, Zone plate, Diffraction at a single edge, Fresnel's integrals and Cornu's spiral. Diffraction (Frounhofer) at a single and double slit, plane diffraction grating (Multiple), Overlap and absent spectra, Dispersive Power.

Unit 4 . Polarization - I :

Polarization of light, Brewster's law, Malus Law, Double refraction, Geometry of Calcite crystal, Optical axis, Principal section, Ordinary and extraordinary rays; Construction and working of Nicol prism, Circularly and elliptically polarized light, Dichroism, Polaroid, Production and analysis of plane, Circularly and elliptically polarized light.

Unit 5 . Polarization - II :

Retardation plate, Optical activity, Rotatory dispersion, Fresnel's explanation of plane of polarization, Half shade and Bi-quartz polarimeter, Polarization by reflection and total internal reflection, Faraday effect, Waves in a conducting medium, Reflection and refraction by the ionosphere, Polarization of electromagnetic waves, Elementary theory of dispersion.

Reference Books :

1. Optics, A.K. Ghatak
2. Principle of Optics, B.K. Mathur
3. Geometrical and physical optics, Langhurst
4. A Text book of Optics, Brij Lal & Subramanayam.
5. Elements of Electromagnetics, M.N.O. Sadiku.
6. Foundation of E.M. Theory, Reitz, Millford & Christy.
7. Electromagnetic waves and fields, Satya Prakash.
8. Contemporary Optics, A.K. Ghatak, Thyagrajangan
9. Optics - Satya Prakash

B.Sc. Second Year (Paper-III)

Atomic , Molecular and Nuclear Physics

Unit 1 . Atomic Physics :

Origin of atomic spectra (historical back ground) Bohr's theory and explanation of different series in hydrogen spectra. Experimental verification of discrete energy levels, correspondence principle, Bohr & Sommerfield model, Shortcomings of old quantum theory.

Qualitative treatment of hydrogen atom, quantum numbers, Spin quantum number, Pauli's exclusion principle, Stern - Gerlach experiment, Elementary idea of X-rays.

Unit 2 . Molecular Physics :

Pure rotational motion (Spectrum and selection rules) Vibrational motion (Spectrum and selection rules) Rot - Vib Spectrum. Scattering of Light-Tyndall effect, Rayleigh and Raman's Scattering. Experimental study of Raman effect, Quantum theory of Raman Effect.

Unit 3 . Basic Nuclear Physics:

Basic constituents of nuclei, Nuclear radii, Magnetic moment and quadrupole moments, Nuclear binding energy curve, Stability of nuclei, Mass-defect and packing fraction, Semi-empirical mass formula, Nuclear forces.

Unit 4 . Nuclear Models and Radioactive decay :

Feature of Shell model, magic number and liquid drop model, Fusion and fission, Nuclear Reaction, Idea of α -decay, Geiger-Nuttall rule, β -decay, β -spectrum and neutrino, γ -decay.

Unit 5 . Elementary Particles :

Classification : Bosons and Fermions, Photons, Leptons, Mesons, Baryons and Hyperons, life times and time decay modes, Ideas of symmetries and conservation laws for various interactions. Quantum numbers, Iso-spin, Lepton number; Baryon number, Strangeness, Hypercharge, Quarks.

Reference Books :

1. Introduction to Atomic Spectra, White, T.M.H.
2. Nuclear Physics, Kaplan, Narosa Pub.
3. Concept of Nuclear Physics, Cohen, T.M.H.
4. Nuclear Physics, D.C. Tayal
5. Atomic and Molecular Physics, Raj Kumar
6. Nuclear Physics, S.N. Ghoshal.
7. Spectroscopy - Gupta & Kumar
8. Atomic Physics - J.B. Rajam.
9. Modern Physics - A. Beiser.
10. Nuclear Physics - Roy and Nigam
11. Modern Physics - Murugesan
12. Molecular Spectroscopy - Banwell
13. Atomic & Molecular Spectra, Walker & Stra.

List of Experiments :

1. Thermal conductivity of rubber by Lee's Disc Method.
2. Thermal conductivity of copper (Searle's Method)
3. Verification of Stefan's Law
4. Thermo e.m.f. of thermo-couple
5. Height of a distant object by sextant.
6. Dispersive power of prism.
7. Resolving power of a telescope.
8. Specific rotation of cane sugar solution by polarimeter.
9. Resolving power of grating.
10. Nodal Slide (focal length of combination of two lenses)
11. Fresnel's biprism (verification of Fresnel's formula)
12. Wavelength of sodium light by Newton's ring.
13. Verification of Newton's formula $x_1 x_2 = f^2$
14. Diffraction at a single slit
15. Wavelength of Light (Mercury) by plane diffraction grating.
16. Verification of Brewster's Law

Books :

1. Practical Physics Vol-II Gupta & Kumar
2. Practical Physics - Kor, Khare and Jain.
3. Practical Physics - Srivastava & Srivastava.
4. Practical Physics - C.L. Arora.
5. Practical Physics - Dey and Dutta

B.Sc. Third Year (Paper-I)

Solid State Physics and Quantum Mechanics

Unit 1 . Crystal Structure:

Crystalline, Amorphous and Glassy state of solids. Structure - Crystal structure, periodicity, lattices and bases, translation vectors, Primitive lattice cell, Miller Indices, interplaner spacing, Bravis lattice, Crystal structures of s.c., b.c.c., f.c.c., diamond and h.c. Reciprocal lattices, s.c., b.c.c., f.c.c. lattices, Brillouin Diffraction conditions in reciprocal lattice, Bragg's law.

Unit 2 . Free Electron Theory and Band Theory of Solids

Free electron gas in one dimension, Energy levels and density of states, Fermi Energy, Electrical conductivity, Hall Effect.

Energy bands, Kronig-Panny Model in one dimensions, Energy gap, Distribution between metal, Semi conductor and insulator, intrinsic semi conductors, Variation of Fermi level with temperature, Effective mass.

Unit 3 . Quantum Mechanics : I

Origin of the Quantum theory: Inadequacies of the Classical theory, Einstein's explanation of photo-electric effect, Bohr's quantization of angular momentum and it's application to the Hydrogen atom, limitation of the Bohr theory.

Unit 4 . Quantum Mechanics - II

De-Broglie's hypothesis for matter waves, concept of wave and group velocities, evidence for diffraction of particles. wave packets, Heisenberg's uncertainty Principle relation for p and x, extension to energy and time.

Unit 5 . Quantum Mechanics - III

Schrodinger's wave equation, Postulates of quantum mechanics, Operators, expectation values, Applications to one and three dimensional boxes, Harmonic Oscillator particle in reflection at a potential step, Hydrogen atom, Potential barrier, Particle in a box.

Reference Books :

1. Introduction to Solid state physics, C. Kittel , VII Edition.
2. Solid State Physics, A.J. Dekker.
3. Introduction to Solids, L. Azaroff.
4. Solid State Physics, R.L. Singhal.
5. Solid State Physics, Gupta and Kumar
6. Quantum Physics of Atoms, Molecules, Solids, Nuclei and particles, Eisenberg and Resnik, John Wiley & Sons.
7. Introduction to Q.M., H.C. Verma, Surya Publication.
8. Advanced Quantum Mechanics, Satya Prakash
9. Quantum Mechanics, A.K. Ghatak.
10. Mathematical Physics, B.S. Rajput.
11. Mathematical Physics, Satya Prakash
12. Mathematical Physics, Kakani
13. Solid State Physics , Saxena, Gupta- Saxena
14. Solid State Physics , Puri & Babbar.

B.Sc. Third Year (Paper-II)

Electromagnetic theory, Fiber Optics, Laser, Holography and Liquid Crystals

Unit 1 . E.M. Theory:

Electrostatic potential due to a charge distribution, Multipoles and their interaction with electrostatic field. Conservation of energy and momentum for a system of charged particles and electromagnetic fields, Gauge transformations.

Unit 2 . Fiber Optics :

Total internal reflection, Optical fiber, Acceptance angle, Modes of propagation, Types of optical fibers. Merits of optical communication.

Unit 3 . Laser :

Stimulated absorption, Spontaneous and stimulated emission, Relation between Einstein's A and B co-efficients, Metastable state, Population inversion, Inversion, Pumping, Principle of Laser action, Types of Lasers. (Ruby He-Ne, Diode Laser). Application of laser (Remote sensing and communications)

Unit 4 . Holography :

Principle of holography, Construction and reconstruction of hologram. Hologram of a point source, Volume hologram Applications.

Unit 5 . Liquid Crystals :

States of matter; Nematic, Smectic and cholesteric liquid crystals; Thermotropic, Lyotropic and polymeric liquid crystals, Ferro- electric Liquid Crystals, Type of conformations, structural and Dynamical properties of liquid crystals, Application of Liquid Crystals.

Reference Books :

1. Electromagnetic Theory, Satya Prakash
2. Laser optics. A.K. Ghatak, TMH
3. Lasers, B.B. Laud
4. Optics, Jankins & White, T.M.H.
5. Electrodynamics, David, J. Griffith.
6. Contemporary Optics, A.K. Ghatak
7. Principle of Optics - Born & Wolf.
8. The Physics of Liquid crystals - D.G. de. Gennes.

B.Sc. Third Year (Paper-III)

Solid State Devices and Electronics

Unit 1 . Power Supply :

Diode as a circuit element, load line concept, rectification, ripple factor, Zener diode as voltage regulator, IC voltage regulation, Low frequency equivalent circuits, Transistor parameters, Transistor as a switch, bias stability, thermal runaway.

Unit 2 . Field Effect Transistors :

JFET volt-ampere curves, biasing JFET, a.c. operation of JFET, source follower, Depletion and enhancement mode, MOSFET, biasing MOSFET, FET as variable resistor, digital MOSFET circuits.

Unit 3 . Small Signal Amplifiers :

General principle of operation, Classification, distortion, RC coupled amplifier, Gain frequency response, Input and output impedance, Multistage amplifier, Transformer coupled amplifiers, Equivalent circuits at low, medium and high frequencies, Emitter follower, Low frequency common-source and common-drain amplifier, Noise in electronic circuits.

Unit 4 . Basic Logic Concepts :

Digital and Analog methods, Number Systems, Decimal, Binary, Hexadecimal and Octal, Two's complement and Nine's complement in binary Arithmetic, Binary codes, BCD, Gray, Excess - 3.

Unit 5 . Digital Electronics :

Logic Gates : AND, OR, NAND, NOT and NOR gates. Mapping their electrical and electronics circuits, Truth tables, EXOR gate, RTL gate fan out, Boolean Algebra, Karnaugh mapping , DTL and TTL gates fan out, Half adder, Full adder and subtractor, Series and Parallel adders. BCD adder, LSI and MSI, photoresistor and photoconductor, photodiode, photo transistor.

Reference Books :

1. Principle of Electronics, V.K. Mehta
2. Electronic devices and circuit theory, Bolysted/Nashelsky.
3. Electronic Fundamental and Applications, John K. Ryder.
4. Introduction to Solid State physics, Kittel
5. Solid State physics, Dekker
6. Introduction to Solids, Azaroff
7. Solid State physics, Puri & Babbar
8. Hand Book of Electronic - Gupta and Kumar

List of Experiments :

1. FET Characteristics
2. R.C. coupled Amplifier.
3. Voltage regulation by Zener diode.
4. Characteristics of a triode valve.
5. Logic Gates , (i) RTL (ii) DTL (iii) TTL
6. Determination of Di-electric constant.
7. Determination of Plank's constant.
8. Study of Lissajous figures using a CRO.
9. EX-OR Gates
10. Half adder
11. Full adder
12. Subtractor
13. Photodiode, photo transistor
14. Spectrometer(of water)
15. Plane reflection grating (Laser)
16. Verification of Einstein Photoelectric equation.

Books :

1. Practical Physics Vol. – III Gupta and Kumar
2. Practical Physics - Kor, Khare and Jain.
3. Practical Physics - Srivastava & Srivastava.
4. Practical Physics - C.L. Arora.
5. Practical Physics - Dey and Dutta