DEPARTMENT OF PHYSICS

Sridev Suman Uttarakhand University, Badshaithaul, Tehri Garhwal

Syllabus

For

Undergraduate Courses

2020-2021

(Annual System)

This syllabus will be prospective and will be enforced at the entry level from the academic year

B. Sc. Part I

PHYSICS

PAPER-I: MECHANICS

UNIT I: Laws of Motion and Conservation Laws

Laws of Motion: Frames of reference, Inertial and Non-inertial frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass, Motion of centre of mass.

Momentum and Energy: Conservation of momentum, Work and energy, Work energy principle, Conservative forces, Conservative force as the negative gradient of potential energy, Conservation of energy, System of variable mass-Motion of rockets.

UNIT II: Rotational Motion

Angular velocity and angular momentum, Torque, Conservation of angular momentum, Equation of motion, Moment of inertia, Theorem of parallel and perpendicular axis, Moment of inertia of rod, rectangular lamina, ring, disc, solid sphere, spherical shell, Kinetic energy of rotation, Rolling along a slope.

UNIT III: Gravitation

Newton's Law of Gravitation, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Gravitational field, potential and potential energy, Gravitational potential and field intensity for spherical shell, Kepler's Laws of planetary motion, Satellite in circular orbit and applications, Geosynchronous orbits, Basic idea of global positioning system (GPS).

UNIT IV: Elasticity:

Hooke's law- Stress-strain diagram, Elastic moduli-Relation between elastic constants, Poisson's Ratio, Expression for Poisson's ratio in terms of elastic constants, Work done in stretching a wire and work done in twisting a wire, Twisting couple on a cylinder, Determination of Rigidity modulus by static torsion, Torsional pendulum, Determination of Rigidity modulus and moment of inertia (Y, η and σ) by Searle's method.

UNIT V: Fluids:

Surface Tension: Synclastic and anticlastic surface, Excess of pressure: Application to spherical and cylindrical drops and bubbles, Variation of surface tension with temperature - Jaegar's method.

Viscosity: Viscosity - Rate flow of liquid in a capillary tube, Bernoulli's theorem, Poiseuille's formula, Determination of coefficient of viscosity of a liquid, Variations of viscosity of a liquid with temperature.

Reference Books:

- University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics course, vol1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Mechanics: D. S. Mathur and P. S. Hemne, S Chand Publications, 2014, New Delhi.
- Mechanics: J. C. Upadhyaya, Ram Prasad and Sons, Agra.
- Mechanics and General Properties of Matter: P. K. Chakrabarti, Books and Allied Pvt. Ltd.

B. Sc. Part I

PHYSICS

PAPER-II: ELECTRICITY AND MAGNETISM

UNIT I: Vector Field:

Scalar and Vector field, Gradient, Divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors.

UNIT II: Electrostatics:

Electrostatic Field, electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, Electric field and potential as line integral of electric field, electric potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere, Calculation of electric field from potential, Capacitance of an isolated spherical conductor, Parallel plate, spherical and cylindrical condenser, Energy per unit volume in electrostatic field, Dielectric medium, Polarization, Displacement vector, Parallel plate capacitor completely filled with dielectric.

UNIT III: Magnetostatics:

Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current, Lorentz force, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law, Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, Brief introduction of dia-, para- and ferro-magnetic materials.

UNIT IV: Electromagnetic Induction and Alternating current:

Field due to Helmholtz coil, solenoid and current loop, Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, Self-inductance (L) of single coil, mutual inductance (M) of two coils, Energy stored in magnetic field, Alternating current, Alternating voltage across R-C, L-C, R-L and LCR circuits, condition of resonance.

UNIT V: Maxwell`s equations and Electromagnetic wave propagation:

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

Reference Books:

• Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
• Electricity and Magnetism, J. H. Fewkes and J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
• Electricity and Magnetism, D. C. Tayal, 1988, Himalaya Publishing House.
• University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
• Introduction to Electrodynamics, D. J. Griffiths, 3rd Edn, 1998, Benjamin Cummings.
• Electricity and Magnetism, K. K. Tiwari, 3rd ed., 2007, S. Chand Publications.
•Electricity and Magnetism, Brijlal and Subrahmanyam.
•Electricity and Magnetism, C. J. Smith.
•Principles of Electromagnetics, Matthew N. O. Sadiku, 2015, Oxford Univ. Press.
• Fundamentals of Electricity and Magnetism, D. N. Vasudeva.

B. Sc. Part I

PHYSICS

PAPER-III: WAVES, OSCILLATIONS AND ACOUSTICS

UNIT I: Wave Motion

Characteristics, Differential equation of wave motion, Transverse waves on a string. Travelling and standing waves on a string. Normal modes of a string, Group velocity and phase velocity. Plane waves, spherical waves. Wave intensity.
Fourier's theorem and its applications to square wave, saw tooth wave and triangular wave.

UNIT II: Simple Harmonic Motion:

Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Simple harmonic oscillations in mechanical and electrical systems.
Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle, (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).
Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures (1:1 and 1:2) and their uses.

UNIT III: Damped Harmonic Oscillations

Damped harmonic oscillations, Differential equation of damped harmonic oscillations and its solutions, power dissipation in damped harmonic oscillator, relaxation time and quality factor, Electrically damped harmonic oscillator (LCR circuit).

UNIT IV: Forced Harmonic Oscillations

Differential equation of Forced harmonic oscillations and its solutions, Forced harmonic oscillations in mechanical and electrical system, Transient and steady state behaviour, Resonance, Sharpness of resonance, Bandwidth, Energy dissipation, Quality factor of forced oscillator, Mechanical and electrical impedances.

UNIT V: Ultrasonics and Acoustics

Sound: Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale.
Ultrasonics: Generation of ultrasonic waves, their detection and applications, Piezo electric effect, quartz crystal.
Acoustics of buildings: Reverberation and time of reverberation, Absorption coefficient, Sabine's formula- measurement of reverberation time, Acoustic aspects of halls and auditoria.

Reference Books:

• Waves and Oscillations, Brijlal and Subrahmanyam, 2nd ed, 2018, Vikas Publishing House.
• The Physics of waves and oscillations, N. K. Bajaj, 2017, McGraw Hill Education.
• Acoustics Waves and Oscillations, S. K. Sen, 2nd ed. 1990, New Age Int. Pvt. Ltd.
• Waves and Oscillations, R. N. Chaudhuri, 2010, New Age Publishers.
• A Textbook of Oscillations, Waves and Oscillations, M. Ghosh, D. Bhattacharya, 2007, S. Chand Publications.

B. Sc. Part I
PHYSICS
PRACTICAL LIST

(Any Sixteen Experiments as per facilities in the Institution)

1. Measurements of length (or diameter) using vernier calipers, screw gauge, spherometer and travelling microscope.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Moment of Inertia of an irregular body by Inertia Table Flywheel.
4. To determine the Young's Modulus of a Wire by Bending of Beam Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Modulus of Rigidity of a Wire by Barton's Apparatus (Vertical Pattern).
7. To determine the Modulus of Rigidity of a Wire by Barton's Apparatus (Horizontal Pattern).
8. To determine g by Bar Pendulum.
9. To determine g by Kater's Pendulum
10. To determine the Elastic Constants of a Wire by Searle's method.
11. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g
12. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
13. To determine surface tension of liquid by Jaeger's method.
14. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
15. To compare capacitances using De' Sauty bridge.
16. To study the Characteristics of a Series RC Circuit.
17. To determine a Low Resistance by Carey Foster's Bridge.
18. Conversion of galvanometer into voltmeter.
19. Conversion of galvanometer into ammeter.
20. Comparison of two resistances by potentiometer.
21. Internal resistance by potentiometer.
22. Variation of magnetic field of coil and to find out radius of coil.
23. To verify Kirchoff's law.
24. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
25. To study the series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
26. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
27. To study damping effect of simple harmonic motion using simple pendulum.
28. To determine the frequency of AC main by sonometer.
29. To determine the frequency of AC main by Melde's method.
30. To study Lissajous Figures.

Reference Books:

• Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.

• Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

• A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

• Physics Practical: Gupta & Kumar, Pragati Prakashan

• Physics Practical: Goyal, Kedar Nath & Sons

B. Sc. Part II

PHYSICS

PAPER-I: THERMAL PHYSICS AND STATISTICAL MECHANICS

UNIT I: Thermodynamical concept and First Law of Thermodynamics:
Thermodynamic Description of system, Equilibrium and thermodynamic variables of a system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP& CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient,

UNIT II: Second and Third Law of Thermodynamics:
Inadequacy of first law of thermodynamics, Reversible & irreversible processes, Principle of heat engine and refrigerator, Second law of thermodynamics & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

UNIT III: Thermodynamic Potentials:
Enthalpy, Gibbs free energy, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for (C_P – C_V), C_P/C_V, TdS equations.

UNIT IV: Kinetic Theory of Gases:
Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

UNIT V: Theory of Radiation:
Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Reference Books:

• Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
• A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, 1969, Indian Press.
• Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
• Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears & G.L.Salinger. 1988, Narosa
• University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
• Statistical Mechanics, Gupta Kumar, Pragati Prakashan.
• Statistical Mechanics, Satyaprakash, Kedar Nath Ram Nath and Sons.
• Statistical Mechanics, E. S. Rajgopal
• Statistical Physics, F. Rief, Mcgraw Hill.

B. Sc. Part II

PHYSICS

PAPER-II: OPTICS

UNIT I: Geometrical Optics:

Fermat's Principle: Principle of extremum path and its application to deduce laws of reflection and refraction, Aplantic points of a sphere, Gauss's general theory of image formation: Coaxial symmetrical system, Cardinal points of an optical system, general relationship, thick lens and lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lens.

UNIT II: Optical Instruments:

Entrance and exit pupils, need for a multiple lens eyepiece, Ramsden's, Hygen's and Gaussiaqn eyepieces, Astronomical refracting telescope, Spectrometer, Aberrations in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses, Monochromatic aberrations and their reduction: aspherical mirrors and Schmidt corrector plates, aplantic points, oil immersion objectives meniscus lens.

UNIT III: Interference of Light:

The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations.

Division of amplitude and division of wavefront, Fresnel's Biprism, Phase change on reflection: Stokes' treatment,

Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes), Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer: Idea of formation of fringes and its application for determination of wavelength, Wavelength difference, Refractive index, Visibility of fringes.

Fabry Perot interferometer.

UNIT IV: Diffraction of Light:

Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

Fraunhofer diffraction: Diffraction of a Single slit; Double Slit, Multiple slits and Diffraction grating.

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UNIT V: Polarization of Light

Transverse nature of light waves, Concept of Plane polarized light – production and analysis, Malus law, Brewster's law, Nicol prism, Circular and elliptical polarization, Double refraction. Optical rotation: Rotation of plane of polarization, origin of optical rotation in liquids and in crystals, polarimeter, half shade and biquartz.

Reference Books:

• Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
• Principles of Optics, B. K. Mathur, 1995, Gopal Printing
• Fundamentals of Optics, H. R. Gulati and D.R. Khanna, 1991, R. Chand Publication
• A Textbook of Optics, N. Subramanyam and Brijlal.
• Optics and Atomic Physics, D. P. Khandelwal.
• Physical Optics, A. K. Ghatak.
• Optics, Eugene Hecht, Pearson Publishers.
• Optics, Satya Prakash.

B. Sc. Part II

PHYSICS

PAPER-III: SOLID STATE PHYSICS

UNIT I: Crystal Structure

Solids: Amorphous and Crystalline Materials, Lattice with a Basis – Central and Non-Central Elements, Bravais lattice and primitive vectors, Lattice Translation Vectors, Unit Cell (primitive, Wigner-Seitz cell and non-primitive), Seven crystal systems and Fourteen Bravais lattices, sc, bcc and closed packed structures (fcc, hcp and diamond structures), Sodium chloride, Cesium chloride and Zinc blende structures.

Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

UNIT II: Reciprocal Lattice

Reciprocal lattice: Definitions, examples and properties, Reciprocal lattice as Bravais lattice, Brillouin Zones, Reciprocal lattice of sc, bcc and fcc lattices, Lattice planes and Miller indices, X-Ray Diffraction, Bragg's law, Laue, powder and rotating crystal methods of X-ray diffraction, Introductory electron and neutron diffraction.

UNIT III: Elementary Lattice Dynamics

Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains, Acoustical and Optical Phonons, Qualitative Description of the Phonon Spectrum in Solids, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law

UNIT IV: Free Electron Theory of Metals

The outstanding properties of metals, Outline and limitation of Lorentz- Drude Theory, Thermal conductivity, Electrical conductivity, Widemann- Franz relation, Sommerfeld theory of free electrons, Electrical conductivity and Ohms law, Electronic specific heat, Thermoionic emission, escape of electrons from metal, Failures of the free electron Model.

UNIT V Elementary band theory

Kronig Penny model, Band Gaps, Distinction between Conductors, Semiconductors and insulators, intrinsic and extensive semiconductors, P and N type Semiconductors, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

Reference Books:

• Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
• Elements of Solid-State Physics, J. P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
• Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
• Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
• Solid-state Physics, H. Ibach and H Luth, 2009, Springer
• Elementary Solid-State Physics, 1/e M. Ali Omar, 1999, Pearson India
• Solid State Physics, M.A. Wahab, 2011, Narosa Publications

B. Sc. Part II

PHYSICS PRACTICAL LIST

(Any Sixteen Experiments as per facilities in the Institution)

1. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
2. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
3. To determine Stefan's Constant.
4. To verify Newton's Law of Cooling.
5. To determine J by Joule's calorimeter.
6. To verify the laws of probability distribution throwing one coin, two coin and ten coin.
7. To show that deviation of probability from theoretical value decreases with increase in number of events.
8. Study of statistical distribution from the given data and to find most probable, average and rms value.
9. Study of random decay of nuclear disintegration and determination of decay constant using dices.
10. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
11. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
12. To determine the Coefficient of Thermal Conductivity of rubber tube.
13. To determine the Coefficient of Thermal Conductivity of glass.
14. Measurement of Planck's constant using black body radiation.
15. Familiarization with Schuster`s focussing; determination of angle of prism by Mercury Lamp.
16. To determine the Refractive Index of the Material of a given Prism using Mercury Light.
17. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
18. To determine wavelength of sodium light using Newton's Rings.
19. To determine the cardinal points of a combination of lenses using nodal slide arrangement.
20. To determine the resolving power of a telescope.
21. To determine specific rotation of cane sugar by polarimeter.
22. To determine refractive index of calcite prism.
23. To determine wavelength of Mercury light using plane diffraction Grating.
24. To investigate the motion of coupled oscillators.
25. To determine the value of Cauchy Constants of a material of a prism.
26. To determine the Resolving Power of a Prism.
27. To determine wavelength of sodium light using Fresnel Biprism.
28. To determine the wavelength of Laser light using Diffraction of Single Slit.
29. To determine wavelength of Sodium light using plane diffraction Grating.
30. To determine the Resolving Power of a Plane Diffraction Grating.

Reference Books:

- Advanced Practical Physics for students, B. L. Flint & H. T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D. P. Khandelwal, 1985, Vani Publication

B. Sc. Part III

PHYSICS

PAPER-I: QUANTUM MECHANICS

UNIT I:
Origin of Quantum theory, Failure of Classical Physics to explain the phenomena such as Black body spectrum, Photoelectric effect, Characteristics and Einstein's explanation, Planck's quantum hypothesis, Planck's constant and light as a collection of photons; Compton scattering.

UNIT II:
De Broglie hypothesis of matter waves and De Broglie wavelength; Davisson-Germer experiment, Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. Two slit interference experiment with photons, atoms and particles;

UNIT III:
Schrodinger's equation (Time independent and Time dependent), Postulates of Quantum Mechanics, Properties of Wave Function, Physical interpretation of Wave Function, Probability and probability current densities in three dimensions; Conditions for Physical acceptability of Wave Functions, Normalization, Eigenvalues and Eigenfunctions, Operator, position, momentum and Energy operators; Expectation values, Wave Function of a Free Particle.

UNIT IV:
General discussion of bound states in an arbitrary potential- continuity of wave function, boundary condition and emergence of discrete energy levels; Applications of Schrodinger's equation to particle in one dimensional box, Transmission across a potential barrier, Potential well of finite and infinite depths, Potential step, Quantum Mechanics of one dimensional simple harmonic oscillator-energy levels and energy eigenfunctions.

UNIT V:
Application of Schrodinger's equation to particle in three dimensional box, Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers; Radial wavefunctions from Frobenius method; Orbital angular momentum quantum numbers l and m; s, p, d,.. shells (idea only)

Reference Books:

• A Text book of Quantum Mechanics, P. M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill
• Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley.
• Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
• Quantum Mechanics, G. Aruldhas, 2ndEdn. 2002, PHI Learning of India.
• Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
• Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press

B. Sc. Part III

PHYSICS

PAPER-II: MODERN PHYSICS

UNIT I:
Thomson model, Rutherford model, Bohr model and spectra of hydrogen atoms, Shortcomings of these models, Bohr-Sommerfeld's model, Stern-Gerlach Experiment, Bohr magneton, Larmor's precession, Vector atom model, Spatial quantization and electron spin.

UNIT II:
Optical spectra and spectral notations, L-S and J-J coupling, selection rules and intensity rules, Explanation of fine structure of sodium D line, Normal Zeeman effect, X-ray spectra (Characteristic and continuous), Moseley's law.

UNIT III:
Absorption, spontaneous and stimulated emission processes, Metastable states, population inversion and pumping process, Einstein's A and B coefficients, Conditions of lasing action, Idea of Laser and Maser, Examples of Laser (Ruby Laser, He-Ne Laser, Semiconductor laser) and some applications of Lasers.

UNIT IV:
Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle, Nature of nuclear force, Packing fraction and binding energy, NZ graph and semi-empirical mass formula, Liquid drop model and Shell Model.

UNIT V:
Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; α decay; β decay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission.
Fission and Fusion: mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions.
Particle Detectors (Ionization Chamber, proportional and G. M. Counter)

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
- Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009, PHI Learning.
- Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill.
- Modern Physics, R. A. Serway, C. J. Moses, and C. A. Moyer, 2005, Cengage Learning.
- Modern Physics, Agrawal and Agrawal, Pragati Prakashan.
- Basic Nuclear Physics, B. N. Srivastava, Pragati Prakashan.
- Nuclear Physics, D. C. Tayal, Himalaya Publishing.
- Lasers and Non Linear Optics, B. B. Laud.

B. Sc. Part III

PHYSICS

PAPER-III: BASIC ELECTRONICS

UNIT I: Semiconductor Diodes

Intrinsic and extrinsic semiconductors, p and n type semiconductors, Semiconductor Diodes, Barrier Formation in PN Junction Diode, Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode, PN junction and its characteristics, Static and Dynamic Resistance, Zener diode, Principle and structure of Opto-electronic devices (1) LEDs (2) Photodiode (3) Solar Cell.

UNIT II: Power Supply

Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor, inductor filters, Clippers and clamping circuits, Voltage multiplier (Doubler and Tripler), Regulated Power supply, Zener Diode as a Voltage Regulator.

UNIT III: Transistor Amplifiers

Bipolar Junction transistors: n-p-n and p-n-p Transistors, Characteristics of CB, CE and CC Configurations, Current gains α and β, Relations between α and β, Load Line analysis of Transistors, DC Load line and Q-point, Active, Cutoff, and Saturation Regions, Transistor biasing circuits for CE Amplifier, Current, Voltage and Power Gains, Class A, B, and C Amplifiers, Field effect Transistor, UJT.

UNIT IV: Oscillators

Negative and positive feedback, Barkhausen's Criterion for Self-sustained Oscillations, Determination of Frequency (no mathematical derivation) of RC Oscillator (Wein bridge and phase-shift oscillator) and LC oscillator (Collector tuned and Colpit oscillator), Crystal Oscillator, Multivibrator (Mono, astable and bistable)

UNIT V: Digital Circuits

Difference between Analog and Digital Circuits. Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gates.

De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Fundamental Products, Minterms and Maxterms, Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

Binary Addition. Binary Subtraction using 2's Complement Method), Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor.

Reference Books:

• Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
• Electronic devices and circuits, S. Salivahanan and N.Suresh Kumar, 2012, Tata Mc-Graw Hill.
• Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
• Digital Principles & Applications, A. P. Malvino, D. P. Leach & Saha, 7th Ed.,2011, Tata McGraw Hill
• Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
• Principle of Electronics, V. K. Mehta.
• Hand Book of Electronics, Gupta and Kumar
• Basic electronics and linear circuits, N. N. Bhargava, D. C. Kulshrestha and S. C. Gupt

B. Sc. Part III

PHYSICS

PRACTICAL LIST

(Any Sixteen Experiments as per facilities in the Institution)

1. Frank-Hertz Experiment.
2. Determination of 'h' Planck's constant by Photoelectric effect.
3. Spectrum of Hydrogen and Rydberg constant.
4. Speed of light by Lecher's wires.
5. 'e/m' by Thomson method.
6. 'e/m' by Magnetron method.
7. 'e/m' by Helical method.
8. Measurement of Magnetic field strength.
9. Child Langmuir Law.
10. Identification and checking of electronic components; resistors, diodes, capacitor, transistors.
11. To verify truth table of AND, OR, NOT, NAND and XOR gates.
12. To verify De Morgan's Theorem.
13. To construct half adder and full adder.
14. To construct half subtractor and full subtractor.
15. To study I-V characteristics of p-n junction diode in forward and reverse bias.
16. To study I-V characteristics of Zener diode.
17. To study I-V characteristics of light emitting diode (LED).
18. To study half-wave rectifier with and without filter.
19. To study full-wave rectifier with and without filter.
20. To study p-n-p transistor in CE configuration.
21. To study n-p-n transistor in CE configuration.
22. To study JFET characteristics.
23. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
24. To design a Wien Bridge Oscillator.
25. Study of regulated power supply.
26. To study characteristics of photo cell.
27. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO to minimize a given logic circuit.
28. To determine energy band gap of a semiconductor.
29. To study MOSFET characteristics.
30. To study UJT characteristics.

Reference Books:

• Basic Electronics: A text lab manual, P. B. Zbar, A. P. Malvino, M. A. Miller, 1994, Mc-Graw Hill.

• Electronics: Fundamentals and Applications, J. D. Ryder, 2004, Prentice Hall.

• Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.