TEACHING & EXAMINATION SCHEME
For the Examination – 2020
PHYSICS

B.Sc. Part – I

THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks 150
Phy.101	Paper I	Mechanics	2	3	50
Phy.102	Paper II	Optics	2	3	50
Phy.103	Paper III	Electromagnetics	2	3	50
PRACTICAL			6	5	75
				Total :	**225**

B. Sc. Part I

Paper I: Mechanics

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.
Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.
Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Frames of Reference: Inertial frames, Galilean transformations, Non-inertial frames, fictitious forces, Displacement, Velocity and acceleration in rotating coordinate systems and their transformations, Coriolis force, Focault's pendulum, Motion relative to earth. Centre of Mass, collision of particles in laboratory and C.M. frame.

UNIT-2

Special Theory of Relativity: Invariance of c, Michelson-Morley Experiment, Lorentz transformations, addition of velocities, time dilation and length contraction, conservation of momentum in collision at relativistic speeds and variation of mass with velocity, relativistic energy, mass-energy equivalence, work and energy, transformation equations for momentum, energy and rate of change of momentum.

UNIT-3

Oscillations: Qualitative idea of oscillations in an arbitrary potential well, General differential equation for the harmonic motion, mass on a spring, oscillation of two masses connected by a spring, reduced mass, coupled oscillations, normal modes, normal coordinates of two linear coupled oscillators, damped harmonic motion, Forced oscillations and resonances, Resonance width and quality factor.

UNIT-4

Waves: General differential equation of one dimensional wave motion and its solution, plane progressive harmonic wave, differential calculus methods for speed of transverse waves on a uniform string and for that of longitudinal waves in a fluid, energy density and energy transmission in waves, superposition of waves, group and phase velocity.
Fourier series, Fourier analysis of square and saw-tooth waves.
Acoustics: Acoustic impedance of a medium, principle of a Sonar system

UNIT-5

Rigid Body Dynamics: Equation of motion of a rotating body, angular momentum of a rigid body, inertial coefficient and idea of principal axes, case of j not parallel to ω, kinetic energy of rotation.

Elasticity : Young modulus, Bulk modulus and modulus of rigidity, Poisson ratio, relation between elastic constants, Theory of bending of a beam and torsion of a cylinder, experimental determination of Y by loading a beam in the middle and of η by static and dynamic methods, Searle's two bar experiment.

Books suggested:

Berkeley: Physics Course, Vol. I, Mechanics, Tata McGraw Hill, New Delhi.

Berkeley: Physics Course, Vol. III, Waves and Oscillations, McGraw Hill, New Delhi.

A. P. French: Physics of Vibration and Waves.

Alonso and Finn: Fundamental University Physics, Vol. I, Mechanics.

R. S. Gambhir: Mechanics, CBS Publishers.

J.C. Upadhyaya: Mechanics, Ram Prasad & Sons, Agra.

PAPER II: OPTICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.
Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.
Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Geometrical Optics: Axial, Lateral and angular magnifications and their inter-relationship, Abbe's Sine condition for spherical surfaces, Aplanatic points for a spherical refracting surface.
Focal length of two thin lenses separated by a distance, Cardinal points of a co-axial lens system, properties of cardinal points, construction of image using cardinal points, Newton's formula and other relations for a lens system using cardinal points, Ramsden's and Huygen's eye pieces, their cardinal points, and relative merits.
Spherical Aberration in lenses and methods to minimize it.
Chromatic Aberration in lenses, Achromatism for two thin lenses in contact and separated by a distance.

UNIT-2

Interference: Division of Amplitude-Interference exhibited by thin film, Production of colours in thin films, Wedge-shaped film, Newton's rings and determination of wavelength and refractive index of a liquid by Newton's rings.
Michelson Interferometer: Measurement of wavelength and difference between two close wavelengths.

Fabry-Perot interferometer: Intensity Distribution, Co-efficient of sharpness and half width, measurement of wavelength.

UNIT-3

Lasers: Population inversion, laser as source of coherent radiation, Basic principles of He-Ne Laser and Ruby Laser.
Diffraction: Fresnel's class of diffractions, Zone Plate, Phase reversal Plate, Cylindrical wave front and its effect at an external point and geometrical construction, diffraction at a straight edge; thin wire, rectangular slit and circular aperture.

UNIT-4

Fraunhofer class of diffraction: Amplitude and phase due to a number of SH Motions acting on a particle simultaneously, Diffraction at two slits and intensity distribution, Diffraction at N slits.
Plane Transmission Grating: Theory and formation of spectra, width of principal maxima, absent spectra, overlapping of spectral lines, number of spectra, measurement of wave-length of light, Rayleigh's criterion, Resolving Power of a Prism, Telescope, Microscope and plane transmission grating.

UNIT-5

Polarization: Double refraction, production of plane polarized light by double refraction, Nicol Prism, Double refraction in uniaxial crystals, Huygen's explanation of Double Refraction, Plane, circular and elliptically polarized light, Half-wave and quarter-wave plates, production and detection of plane, circularly and elliptically polarized light by Nicol Prism and Quarter-wave plate.
Rotatory Polarization, Fresnel's explanation, specific rotation, half shade and Biquartz Polarimeter, determination of specific rotation and strength of sugar solution.

Books suggested:

Jenkins and White: Optics, McGraw Hill.

Ghatak A.K.: Optics, Tata McGraw Hill.

Khandelwal D.P.: Optics and Atomic Physics, Shivlal Agarwal & Co.

Subramanayam and Brijlal: A text book of Optics, S. Chand, New Delhi.

PAPER III: ELECTROMAGNETICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.
Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.
Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Vector Analysis: Scalar and Vector fields, partial differentiation of vector, gradient of a scalar field, line and surface integral of vector field, flux of a vector field, divergence of vector field and its physical significance, curl of vector field and its physical significance. Gauss law in integral and differential form, Gauss divergence theorem, Stokes theorem and Green's theorem, Laplace equation in Cartesian, cylindrical and spherical polar coordinates (without derivation).

Unit II:

Electrostatics: Potential and field due to a quadrupole and an arbitrary charge distribution, concept of multipoles, Electrostatic energy of a uniformly charged sphere. Classical radius of an electron.
Conductors in an electric field, uniqueness theorem, method of electric images and its application for system of point charge near a grounded conducting plane, Poisson's and Laplace equation in Cartesian coordinate Solution of Laplace equation in Cartesian coordinates, potential at a point inside a rectangular box.

Unit III:

Electric field in matter : Atomic and molecular dipoles, polarizability, permanent dipole moment, Dielectrics, boundary condition for electrostatic field at dielectric surface, polarization Vector, electric displacement vector, electrostatic energy of a charge distribution in dielectrics. Lorentz local field and Clausius-Mossotti equation.
Magnetic field in matter : Magnetization Vector, uniform magnetization and surface current, non-uniform magnetization, B,M,H Vectors and their inter-relations, Bohr magneton, orbital magnetic moment and angular momentum, Gyromagnetic ratio, Magnetic Susceptibility.

Unit IV:

Electromagnetic Induction, Faraday's laws of Electromagnetic induction, integral and differential form, Relation between self and mutual inductance, measurement of self-inductance by (a) Rayleigh method (b) Anderson Bridg, Energy stored in magnetic field.

Transient response: Charge and discharge of condenser through resistance, determination of high resistance by method of leakage, growth and decay of current in LR circuit; significance of operator j and its uses in A.C. circuits. series and parallel LCR circuit, phasor diagram, Resonance and Quality factor, Sharpness of resonance.

Unit V:

Charge particle in electromagnetic field: equation of motion for charged particle, moving charge in electric field, in uniform magnetic field, charged particles in parallel electric and magnetic field, charged particles in cross electric and magnetic field.

Principle construction and working of ballistic galvanometer, determination of constant of ballistic galvanometer using steady deflection method, determination of mutual inductance using B.G., determination of magnetic field using search coil and B.G.

Books suggested:

Berkeley: Physics Course, Vol. II: Electricity and Magnetism, Tata McGraw Hill.

Laud, B.B.: Electro-magnetics, Wiley Eastern.

Ahmed and Lal: Electricity, Magnetism and Electronics.

D.C. Tayal: Electricity and Magnetism, Himalaya Publishing House

A.S. Mahajan A.A. Rangwala: Electricity and Magnetism, Tata McGraw Hill.

Griffiths: Introduction to Electrodynamics, PHI.

Experiments for Practical Work

1. Study of bending of a beam and determination of Young's modulus.
2. Modulus of rigidity by statical method using horizontal apparatus.
3. Modulus of rigidity by statical method using vertical apparatus.
4. Modulus of rigidity by dynamical method using Hollow Maxwell needle.
5. Modulus of rigidity by dynamical method using Solid Maxwell needle.
6. Elastic constants by Searle's method.
7. Determination of focal length of combination of two lenses separated by finite distance using Nodal slide assembly and also locate the cardinal points.
8. Formation of spectrum, prism spectrometer and determination of dispersive power of the material of a prism.
9. Determination of wavelength of monochromatic light (Sodium/ Laser) by Newton's rings.
10. Determination of wavelength of light by plane transmission grating.
11. Specific rotation by polarimeter.
12. Low resistance by Carey Foster Bridge.
13. Variation of magnetic field along the axis of circular Coil.
14. Study of rise and decay in CR Circuit.
15. Study of electro-magnetic induction and verification of Faraday's Laws.
16. Determine the thermodynamic constant $\gamma = C_p / C_v$ using Clement and Desormes method.
17. Verification of Rutherford and Soddy's law of radioactive disintegration using dices and statistical Board.
18. Determination of surface tension of water by Jagger's method.
19. To determine the polarizing angle for the glass prism surface and to determine the refractive index of material of prism using Brewster's law.
20. Wavelength of light by biprism.
21. Resolving power of telescope.
22. Resolving power of a plane transmission grating.
23. To determine the Poisson's ratio of a rubber tube.

Note: - New experiments may be added on availability of equipments.

TEACHING & EXAMINATION SCHEME
For the Examination – 2020
PHYSICS

B.Sc. Part II

			Pd/W (45mts.)	Exam. Hours	Max. Marks 150
THEORY					
Phy.201	Paper I	Statistical and Thermal Physics	2	3	50
Phy.202	Paper II	Quantum Mechanics and Spectroscopy	2	3	50
Phy.203	Paper III	(A) Electronics (Except for those who opt Electronics as a subject)			
		Or			
	Paper III	(B) Computer Systems and Networking (For the students who have offered Electronics as an Optional subject)	2	3	50
PRACTICAL			6	5	75
		Total			**225**

B. SC. PART-II

PAPER I: STATISTICAL AND THERMAL PHYSICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1:

Statistical Method: Particle States, distribution of particles in two particle states, Probability of a given distribution, distribution

corresponding to maximum probability, relative probability curve with increasing number of particles, binomial distribution, Standard deviation, micro-states and macro-states of a system, principle of equal 'a priori' probabilities, equilibrium state, fluctuations, reversibility and irreversibility, States of a particle inside a box, number of accessible states between an infinitesimally small energy interval, momentum interval, phase space, statistical weight of a configuration of a macro-state, indistinguishable and distinguishable particles, entropy and principle of increase of entropy, statistical ensemble, time and ensemble averages; Thermal interaction between two systems, zeroth law of thermodynamics, concept of temperature.

UNIT-2:

Canonical ensemble, Boltzmann canonical distribution, partition function, a two state system, paramagnetic susceptibility, heat capacity, Boltzmann formula for entropy, average energy and fluctuations, free energy, adiabatic interaction, enthalpy, general interaction, Gibbs free energy, first law of thermodynamics, phase transitions, Clausius-Clapeyron equation.

Ideal Classical Gas, Maxwell velocity and speed distributions, partition function, entropy (Sackur-Tetrode relation), Gibbs paradox; equation of state, ideal gas temperature scale, Vander-Waal's equation of state; heat capacities of monatomic and diatomic gases, ortho and para hydrogen.

UNIT-3:

Systems with variable Energy and Particle Number: Chemical potentials, grand canonical distribution, Partition function, number fluctuations, grand potential, equation of state of an ideal classical gas, Saha's ionization formula, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics, Fermi gas at 0K temperature; thermionic emission, strongly degenerate boson gas; Bose-Einstein Condensation, liquid helium.

UNIT-4:

Macroscopic Thermodynamics: Second law of thermodynamics; Carnot cycle, Carnot theorem, thermodynamic temperature scale and its identity with perfect gas temperature scale, entropy change in isothermal, and adiabatic expansions of an ideal gas; Thermodynamic potentials, Maxwell's equations C_p-C_v, C_p/C_v, Black body radiation, energy density and pressure, Stefan-Boltzmann law, Wien's displacement law, Planck's law.

UNIT-5:

Temperature changes in Joule and Joule-Thomson expansions, Regenerative cooling, adiabatic demagnetization and production of low temperatures, third law of thermodynamics, negative temperatures.

Transport Phenomena: Mean free path, collision cross-sections, mean free time, viscosity, thermal conductivity and self-diffusion.

Books suggested:

1. Reif : Statistical Physics, Berkeley, Vol. 5, McGraw Hill.
2. Mandl : Statistical Physics, ELBS and Wiley.
3. Reif : Fundamentals of Statistical and Thermal Physics, McGraw Hill.
4. C. Kittel and H. Kroemer : Thermal Physics, CSS.
5. W.G.V. Rosser: An Introduction to Statistical Physics, Elis Horwood.
6. Lokanathan and Gambhir: Statistical and Thermal Physics, Prentice Hall.

PAPER II: QUANTUM MECHANICS AND SPECTROSCOPY

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1:

Development of quantum theory: Blackbody radiation and their characteristics, failure of classical physics to explain spectral distribution of blackbody radiation, Planck's quantum Hypothesis, Average energy of Planck oscillator, Planck's radiation formula, Wien's law, Rayleigh-Jean's Law, Stefan-Boltzmann's Law; Failure of classical physics to explain photo-electric effect and Compton effect, photons as carrier of energy and momentum of electro-magnetic waves.

UNIT-2:

Wave Mechanics and Schrödinger equation: Phase velocity and group velocity of waves, wave particle duality; De Broglie Hypothesis; De Broglie group and phase velocity, wave packet, Heisenberg uncertainty principle, Statement and its equation from wave-packet in space and time; Application of uncertainty principle such as (i) Non-existence of electron in nucleus, (ii) Ground state of H-atom, (iii) Natural line width of spectral lines, X-ray microscope, Particles passing through (a) single slit and (b) double slit and observed on screen behind, explanation of distribution in terms of probability amplitude and interference of probability amplitude.

Postulates of Quantum Mechanics: Wave functions, Schrödinger superposition principle, operators in Quantum mechanics, Hermitian operators, expectation values, Interpretation of wave-function, symmetric and anti-symmetric wave functions, concept of parity; Probability density, Schrödinger equation, Schrödinger equation for free particle; Arguments in favour of this equation.

UNIT-3:

Application of Schrödinger equation: Schrödinger equation for particle moving in potential field, Time dependent and time independent Schrödinger equation, Stationary states, Orthogonality of wave functions, Probability current density, Ehrenfest Theorem, Simple solution of Schrodinger equation (Restricted to one dimensional case), Particle in one dimensional infinite well, Particle in one dimensional finite well (one or both sides of well may be non-rigid), Calculation of reflection and transmission coefficient for potential step and potential barrier.

UNIT-4:

Atomic Spectroscopy: Orbital angular momentum, electron spin and Stern Gerlac experiment, Total angular momentum, Spin-orbit interaction, Vector model of atom and quantum numbers associated with atom, L-S coupling and j-j coupling, Statement of Hund's Rule and Lande Interval Rule (without derivation), Fine structure of spectral lines, spectral terms up to two valence electron system, Pauli's exclusion principle.

UNIT-5:

Atom in magnetic field: Magnetic moment of atom, contribution from orbital and spin angular momentum, gyro-magnetic ratio; Interaction energy of atom in magnetic field, splitting of energy levels, using good quantum numbers in Normal Zeeman effect, Anomalous Zeeman effect and Paschen-Back effect, Selection rules for dipole transitions.

Molecular spectroscopy: qualitative features of molecular spectra, rigid rotator, rotational and vibrational energy levels of diatomic molecules, rotational-vibrational spectra.

Books suggested:

1. Semat: Atomic Physics
2. Alonso and Finn: Fundamental University Physics, Vol. – III.
3. Beiser: Concepts in Modern Physcis
4. Waghmare: Quantum Mechanics
5. Wehr, Richards, Adair: Physics of the Atom, Narosa.

PAPER III (A): ELECTRONICS

(Except for those students who opt Electronics as a subject)

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.
Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.
Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1:

Intrinsic and extrinsic semi-conductors, Fermi levels, mass-action law; carrier injection, recombination, diffusion and diffusion length, drift and diffusion currents, continuity equation; p-n junction, potential barrier, biasing, current-voltage relation, space charge and diffusion capacitances; varactor diode; Zener diode; tunnel diode; photovoltaic effect, solar cell.
Power supplies: Full wave and half wave rectifiers; ripple factor, voltage regulation; filters; Zener regulation.

UNIT-2:

Network theorems – Thevenin, Norton, Maximum power transfer and Miller theorems.
Dipolar junction transistors, Ebers-Moll equations; CB, CE and CC configurations, BJT characteristics; biasing and thermal stabilization, self bias; hybrid parameters of a two port network; small signal hybrid equivalent model of a BJT at low frequencies, current, voltage and power gains; input and output impedances; high frequency hybrid pi model, short circuit current gain, f_β and f_α; current gain with resistive load.

UNIT-3:

Field effect transistors, JFET, MOSEET, construction and characteristics; FETs as voltage Controlled Devices, small signal model.
Large signal amplifiers, class A, B and C operations and efficiencies; distortions; determination of second harmonic distortion; push-pull amplifiers; impedance matching.

UNIT-4:

Negative Feedback: Current and voltage negative feedbacks; effect on stability, input and output impedances, distortion, frequency response; emitter follower.
Oscillators: Positive feedback, Barkhausen criterion; RC phase-shift oscillator; Hartley and Colpitts oscillators, UJT and sweep generators using UJT; Transistor as a switch and Astable multi-vibrator.

UNIT-5:

Operational amplifiers, inverting and non-inverting; differential amplifiers, CMRR; measurement of OP AMP parameters; use of OP AMPs as adder, in analog integration and differentiation.
Digital circuits: Laws of Boolean algebra and De-Morgan's theorem, realization of Boolean Expression using logic gates

Books suggested:

1. J. Millman and CC Halkias: Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw Hill.
2. Mottertshead: Electronic Devices and Circuits – An Introduction, Prentice Hall India.
3. Bhargava, Kurukshetra & Gupta , "Basic Electronics and Linear Circuits", Tata McGraw-Hill Publishing LTD.
4. V.K. Mehta, "Principles of Electronics", S. Chand and Company LTD.

PAPER III (B): COMPUTER SYSTEMS AND NETWORKING

(For the students who have offered Electronics as an Optional subject)

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

Unit-1

Introduction to computers: Development of computers with electronic devices, brief history of computers, computer generations, IC technology, LSI and VLSI, classification of computers, applications of computers, basic computer organization, basic processor architecture, types of processors, memory, primary memory, cache, RAM and ROM, secondary memory, HDD, CD drive, Pen drive, Power supply, input and output devices, keyboard, pointing device, optical devices, monitor, projector, printers, plotter (only definitions and functions of the devices).

UNIT-2

System software: Operating system, need of OS, functions of OS, different types of OS, batch processing OS, multi programming OS, single user OS and multi user OS, time sharing OS, OS for Personal Computer, DOS, Windows OS, features of Windows OS, Unix OS, Open source OS Linux. Low level languages: machine language, Assembly language, assembler, high level languages, features of high level languages, interpreters and compilers .

UNIT-3

Application software: Program development in high level languages, algorithm and flow chart, execution of user application programs. Software packages: MS Office package, word processing, MS Word, preparing and printing documents in MS Word, MS Excel; using formulas and functions, plotting graphs, Power point presentation. Computer graphics, graphic software packages, Origin software package, plotting graphs in Origin.

UNIT-4

Basic Network Functions: Overview, evolution of computer networks, elements of LAN and WAN, Network architecture, ISO-OSI architecture, hardware elements: modems, multiplexers, concentrators, transmission media, twisted pair, coaxial cable, optical fibre, LAN topologies: bus, ring and star.

UNIT-5

Network interconnection issues: Internetworking bridges, routers, communication methods, store and forward techniques, circuit switching, packet switching, introduction to TCP/IP protocol family, issues related to network reliability and security.

Books suggested:

A. Mottershed: Electronic Devices and Circuits, PHI.
V. Rajaraman: Fundamentals of Computers, PHI.
Martin, J.: Networks and Distributed Processing, PHI.
R. Thareja: Fundamentals of Computers, Oxford Press.

PRACTICALS

1. Determination of temperature coefficient of platinum resistance thermometer using Carey Foster Bridge.
2. Determine thermal conductivity of a bad conductor by Lee's method.
3. Determination of Ballistic Constant of a Ballistic galvanometer using condenser.
4. Determination of Ballistic Constant of a Ballistic galvanometer by steady deflection method.
5. Determination of high resistance by method of leakage.
6. e/m by Thomson's method.
7. Measurement of inductance of coil by Anderson's bridge.
8. Measurement of capacitance and dielectric constant of a liquid and gas by De-Sauty Bridge.
9. Study of Gaussian distribution using statistical board.
10. Determination of mutual inductance of a coil.
11. Experimental verification of the first law of thermodynamics by discharging the condenser.
12. To determine the energy Band gap in a semiconductor using junction diode.
13. Study of the characteristics of a given transistor (PNP/NPN) in common emitter configuration and find the value of parameter of given transistor.
14. Study of the characteristics of a given transistor (PNP/NPN) in common base configuration and find the value of parameter of given transistor.
15. Study the characteristics of rectifier junction diode and Zener diode.
16. Study of dependence of velocity of wave propagation on line parameters using torsional wave apparatus.
17. Study of variation of reflection coefficient on nature of termination using torsional wave apparatus.
18. Study of variation of total thermal radiation with temperature.
19. Plot thermo emf versus temperature and find the neutral temperature and temperature of inversion.
20. Determination of Self Inductance of a Coil using Ballistic galvanometer.
21. To study the electromagnetic damping of a compound pendulum.
22. Study of phase relationship of RL Circuit.

Note: - New experiments may be added on availability of equipments.

TEACHING & EXAMINATION SCHEME
For the Examination – 2020
PHYSICS

B.Sc. PART-III

THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks 150
Phy.301	Paper I	Solid State Physics	2	3	50
Phy.302	Paper II	Nuclear Physics	2	3	50
Phy.303	Paper III	Relativity and Electrodynamics	2	3	50
PRACTICAL			6	5	75
			TOTAL:		**225**

B. SC. PART-III

PAPER I : SOLID STATE PHYSICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1 :

Crystal structure : Different terms of crystal structure, Fundamental types of lattices, Two and three dimensional lattice types; Seven system of crystals, Characteristics of sc, bcc, fcc, hcp; Miller indices, orientation of planes in cubic lattices; Distribution of Atoms in atomic planes of cubic lattices. Distance between successive planes; Von-Laue's equations of diffraction of X-rays, Bragg's Law, scattering from

lattice of point-atoms. Scattering factor. Geometrical Scattering factor for sc, bcc, fcc. Reciprocal lattice and its properties.

UNIT-2 :

Crystal binding and lattice vibrations : Inter-atomic forces of solids. Crystal of inert gases, cohesive energy and bulk modulus. Ionic crystals, Madelung energy and bulk modulus. Covalent crystals. Hydrogen bonded crystals, Atomic radii. Concept of phonons Vibration of monatomic lattices, lattice with two atoms per primitive cell. Local phonon modes. Density of states in one dimension, three dimensions, lattice heat capacity for Einstein model, Debye model.

UNIT-3 :

Free Electron theory of metals : Free electron model, Density of states of electron gas, Fermi-Dirac distribution function, effect of temperature on Fermi-Dirac distribution function, Fermi energy at absolute zero temperature and low temperature. Electron heat capacity. Thermionic emission. Boltzmann transport equation, Sommerfeld theory of electrical conductivity, Thermal conductivity, Wiedmann-Franz Law. Hall effect.

UNIT-4 :

Band theory : Formation of bands and origin of energy gap, Bloch theorem, Kronig Penney model, crystal momentum and velocity of an electron. Effective mass of electrons. Electrons and holes. Number of states in a band, insulator, semi-conductor and metal. Construction of Brillouin Zones and Fermi-surfaces. Fermi levels in intrinsic, n-type and p- type semi-conductors, Mass action Law. The static dielectric constants of solids. Local electric field at an atom.

UNIT-5 :

Magnetism : Diamagnetism and Larmor precession, classical theory of diamagnetism, Para-magnetism and its classical theory, free electron theory. Molecular theory of ferromagnetism.
Experimental Survey of Superconductivity : Zero resistance, persistent currents, effect of magnetic fields, flux exclusion, Intermediate state, Entropy effect, frequency effects, Gyromagnetic ratio, Isotope effect. Occurrence of superconductivity. Thermoelectric effects, thermal conductivity. High temperature oxide, superconductors and their properties. BCS theory (elementary idea without mathematical derivation), Magnetic levitation.

Books suggested :

Kittel : Introduction to Solid State Physics, Wiley Eastern.

A.J. Dekker : Solid State Physics, McMillian India.

L. Azaroff : Theory of Solids.

Paper II: NUCLEAR PHYSICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

Unit I:

Rutherford alpha scattering experiment, scattering formula and experimental verification of scattering formula. nuclear charge, Chadwick's determination of nuclear charge, theories of nuclear composition, nuclear mass, Determination of size of nucleus using Mesonic X ray method, Measurement of potential radius from life time of alpha emitters and scattering of fast neutron. nuclear spin, Determination of nuclear spin from hyperfine splitting of the atomic energy, parity, method of parity investigation, nuclear magnetic moment and electrical moment, relation between quadrupole moment and nuclear spin.

Unit II:

Mass defect, binding energy and packing fraction of nucleus. Liquid drop model of Nucleus, magic number and evidence of it, WEIZSACHER's Semi Empirical Mass formula, Predication of stability against beta-decay for members of an isobaric family.

Types of nuclear reactions, The balance of Mass and energy in nuclear reactions, conservation law in nuclear reactions, Q equation. Solution of the Q equations, concept of centre of mass in nuclear reaction, proton-proton collision and neutron-nucleus collision in CM frame.

Unit III:

The law of radioactive decay, statistical nature of radioactivity. Radioactive growth and decay. Ideal equilibrium, transient equilibrium and secular equilibrium, Radioactive series, Fundamental law of radioactivity, induced radioactivity, radioactivity dating.

Alpha decay: Disintegration Energy, Range of alpha particles, Geiger Nuttal's Law, spectrum and fine structure. alpha particles paradox, Barrier penetration, Beta Decay, disintegration energy of Beta Decay, principle, working and uses of beta ray spectrometer.

Unit IV:

Nuclear Energy: Nuclear induced fission, energy released in fission of U^{235}, Fission chain reaction, stability limits against spontaneous fission, Energetic of Symmetric fission, Neutron cycle in a thermal reactor. Four factor formula. Elementary idea of nuclear reactors, types of nuclear reactor, nuclear reactor in India. Nuclear fusion, fusion in stars, carbon and pp cycle, problems of controlled fusion, fissile and fertile materials and their characteristics.

Unit V:

Gas filled ionisation detectors, Detailed description, principle working and uses of (i) proportional counter (ii) Geiger-Muller Counter, dead time, recovery time and paralysis time, principle of acceleration, classification of accelerators, electrostatic accelerators, linear accelerators, cyclotron, synchrocyclotron, betatron.

Properties of elementary particles, Classification of elementary particles, quantum number of elementary particles, conservation laws, experimental evidence of violation of parity conservation in Beta Decay, C.P.T. theorem, types of cosmic rays and properties of primary cosmic rays.

Books suggested:

Alonso & Finn: Fundamental University Physics – Vol. III, Addision Wesley.

S.N. Ghoshal: Atomic & Nuclear Physics – Vol. II, S. Chand, New Delhi.

Satyapraksh: Nuclear Physics, Pragati Prkashan Meerut

R. R. Roy and B. P. Nigam, Nuclear Physics, New Age Int.(P) Ltd

D.C. Tayal: Nuclear Physics, Himalaya Publishing House

PAPER III: RELATIVITY AND ELECTRODYNAMICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Electromagnetic Waves: Displacement current, Maxwell's equations, Electromagnetic wave equation, Poynting theorem, Plane

Electromagnetic waves in free space, wave impedance of free space, Propagation of plane Electromagnetic waves in non-conducting and conducting media, Skin depth, propagation of Electromagnetic waves in ionized gases, Polarization of Electromagnetic waves.

UNIT-2

Reflection and Refraction of Electromagnetic waves: Boundary conditions at the surface of discontinuity, reflection and refraction of Electromagnetic waves at the interface of non-conducting media, Fresnel's equations and their experimental verification, reflection and transmission coefficients, Brewster's Law and degree of polarization, total internal reflection, phase difference between parallel and perpendicular components and polarization of the reflected wave, reflection from a conducting plane.

UNIT-3

Interaction of Electromagnetic waves with matter: Normal and anomalous dispersion of light, empirical relations, Lorentz theory of dispersion of gases, experimental demonstration of anomalous dispersion in gases, scattering of electromagnetic waves and scattering parameters, Thomson, resonant and Rayleigh's scattering cross-section, polarization of scattered light, coherent and incoherent scattered light, dispersion in liquids and solids, Claussius Mossotti equation and Lorentz-Lorentz formula.

UNIT-4

Relativistic Mechanics: Coordinate transformation, contravariant and covariant vectors, tensors of second and higher rank, addition, subtraction, contraction, outer and inner product of tensors, covariance of tensor equations, Minkowski space, geometrical interpretation of Lorentz transformation, space like and time like intervals, four vectors, four dimensional gradient, divergence and curl operators, four-velocity, four-acceleration, four-momentum, four-force, relativistic classification of particles.

UNIT-5

Relativistic Electrodynamics : Invariance of charge, transformation of surface charge density, transformation of volume-charge density and current density, Equation of continuity in the covariant form, Scalar and vector potentials, Transformation of Electromagnetic potentials, Lorentz condition and its covariant form, Electromagnetic field tensor, Covariance of Maxwell's equations, Transformation of Electro-Magnetic fields, Lorentz-force in a covariant form, Electromagnetic field due to a moving charge.

Books suggested:

S.P. Puri: Electrodynamics, Tata McGraw Hill

J.D. Jackson: Classical Electro-dynamics, John Wisely, New York

B.B. Laud: Electromagnetic, John Wisely, New York

E.C. Jordan: Electromagnetic waves, PHI, New Delhi

D. J. Griffiths: Introduction to Electrodynamics, PHI

Practicals of B.Sc. III Year Physics

Note: These Practicals are divided into two sections, Lab. A & Lab. B.

1. Lab. A is for all students.
2. Lab. B is for all the students except those who offer Electronics as an optional subject.

Examination Scheme for Laboratory Work:

1. Students with Electronics shall be examined in any two experiments from Lab. A.
2. Students with Combinations not involving Electronics shall be examined in one experiment of Lab. A and one experiment from Lab. B

LAB. A: PHYSICS PRACTICALS

1. Determination of Planck's constant using solar cell/ LED.
2. Verification of Stefan's Law (Black Body method).
3. Study of characteristics of a GM counter and verification of inverse square law for the same strength of a radioactive source.
4. e/m measurement by Helical Method.
5. Measurement of magnetic field using Ballistic galvanometer and search coil.
6. Measurement of electric charge by Millikan's oil drop method.
7. To study hysteresis loss of transformer by B-H curve using CRO.
8. Verification of Cauchy's formula.
9. Study of Lissajous patterns.
10. Determination of separation of plates of Etalon using spectrometer.
11. Determination of Dead Time of GM counter.
12. Determination of difference in wavelength of the two line of Sodium light.
13. Determination of refractive index of ordinary and extra ordinary light using Babinet compensator.
14. Determination of Band Gap of a semi conductor using four probe method.
15. To verify Fresnel's formula for the reflection of light.
16. Determination of coefficient of rigidity as a function of temperature using torsional oscillator (resonance method).
17. Determination of dielectric constant of solids and liquids.
18. Determination of velocity of sound in air.
19. Verification of Malus law

LAB. B: ELECTRONICS

1. Study of ripple factor for shunt capacitor, series inductor, L-section and π section filters using full wave rectifier circuit.
2. Study of frequency response of single stage transistor amplifier (variation of gain with frequency).
3. Study the characteristics of field effect transistor (FET).
4. Study the negative feedback effect on voltage gain, and input and output impedances of the amplifier.
5. Study of operational amplifier (OP-AMP).
6. Study of RC circuits as integrating and differentiating systems with Square input.
7. Study of series and parallel LCR resonance circuit.
8. Design and Voltage study of AND, OR, NOT, NAND and NOR gates circuits using diodes and transistors.
9. Design and study of RC phase shift oscillator.
10. Study of Nano TiO_2 Solar Cell.
11. Study of Hybrid Solar and wind energy.
12. Transient Analysis of C-R and L-R circuit.
13. Determination of parameter of transformer.

Note: - New experiments may be added on availability of equipments.