UNIVERSITY OF NORTH BENGAL

Syllabus for B. Sc. General
under revised new course structure
for Part - I, Part - II and Part - III

in

PHYSICS

University of North Bengal
Raja Rammohunpur, Darjeeling - 734430
West Bengal, India.

B. Sc. Physics (General)

Course Structure.

Part – I	:	Theory (90 marks)	:	Paper – I	45 marks
				Paper – II	45 marks
		Practical	:	Paper – III	60 marks
Part – II	:	Theory (90 marks)	:	Paper – IV	45 marks
				Paper – V	45 marks
		Practical	:	Paper – VI	60 marks
Part – III	:	Theory	:	Paper – VII	60 marks
		Practical	:	Paper – VIII	40 marks

Outline of the contents of individual theoretical papers with approximate number of lectures.

Part – I	:	Paper – I	:	A.	Mechanics and Oscillations (30)
				B.	General Properties of Matter (20)
				C.	Waves and Acoustics (15)
		Paper – II	:	A.	Heat and Thermodynamics (25)
				B.	Optics (Geometrical and Physical) (25)
				C.	Magnetism (Magnetostatics) (15)
		Paper – III	:	Practical (Experiments on General Physics, Sound, Heat and Geometrical Optics).	
Part – II	:	Paper – IV	:	A.	Electrostatics (Including quadrant electrometer) (15)
				B.	Current electricity (DC & AC) (30)
				C.	Electronics – I (15)
		Paper – V	:	A.	Special Theory of Relativity (15)
				B.	Atomic & Nuclear Physics (20)
				C.	Quantum Mechanics & Solid state Physics (25)
		Paper – VI	:	Practical (Expts. on Electricity, Magnetism & Electronics)	
Part – III	:	Paper – VII	:	A.	Electronics - II (30)
				B.	Machine & Energy Sources (30)
				C.	Communications and Computers (35 = 20 + 25)
		Paper – VIII	:	Practical (Expts. on Optics, Electronics and Computer).	

* *Students are to answer four questions in each theoretical paper taking not more than one question from any group.*

(Each paper : C. Q – 9, Gr. A – 12, Gr. B – 12, Gr. C – 12 Total = 45)

Detailed Syllabus. B. Sc. (General)

Part – I

Paper – I **Full Marks - 45**

Group-A. Mechanics and Oscillations (30)

1. Mechanics: Vectors- elementary vector algebra- scalar and vector products, scalar triple product and vector triple product, application in mechanics. Line, surface and volume integrals. Scalar and vector fields, gradient, divergence and curl; statements of Stoke's theorem and Divergence theorem.

   Laws of motion, motion in a uniform field, components of velocity and acceleration different coordinate systems. Uniformly rotating frame, centripetal acceleration, Coriolis force and its application. System of particles, centre of mass, equation of motion, conservation of linear and angular momenta, conservation of energy, single stage and multi-stage rockets, elastic and inelastic collisions.

   Dynamics of Rigid Bodies: Translation and rotation of a rigid body, moment of inertia and radius of gyration, theorems of parallel and perpendicular axes, rotational kinetic energy; calculation of moment of inertia for simple symmetric systems including thin disc, solid/ hollow cylinders, solid sphere and their application in problems.

   Gravitation: Motion under central force; Kepler's laws; Gravitational law and field, potential and field due to thin spherical shell, thick spherical shell and solid sphere; Potential energy of a system of masses, gravitational self energy.

2. Oscillations: Periodic motion, simple harmonic motion- differential equation and its solution, superposition of SHMs- analytical, Lissajous figures, elementary ideas about damped vibration, forced vibration and resonance.

Group-B. General Properties of Matter: (20)

1. Elasticity: Hooke's law, elastic moduli and their inter relations; torsion of a cylinder; internal bending moment, cantilever, supported light beam with concentrated load at the centre; strain energy.

2. Surface Tension: surface tension and surface energy, molecular theory, angle of contact, capillary ascent/descent, pressure on a curved surface and applications.

3. Viscosity: streamline and turbulent motion, Poiseuille's formula, critical velocity, Reynold's number, Stoke's law (statement only), terminal velocity; Bernoulle's theorem, pitot tube, venturimeter, Torricelle's theorem.

4. Units and dimensions: dimensions of physical quantities, principle of dimensional homogeneity, dimensional analysis.

Group-C. Waves and Acoustics: (15)

1. Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in solid and fluid media. Waves over liquid surface – gravity waves and ripples. Group velocity and phase velocity. Superposition of Waves-Stationary waves, beats. Doppler effect. Production and detection of ultrasonic waves and applications.

2. Acoustics: Intensity and loudness, bel and decibel, limits of human audibility. Transducers and their characteristics. Recording and reproduction of sound- various systems. The acoustics of halls, reverberation period, Sabine's formula (deduction not required).

PAPER – II **Full Marks- 45**

Group-A. Heat and Thermodynamics: (35)

1. Kinetic Theory of Gases: perfect gas, pressure exerted by an ideal gas, deduction of ideal gas laws; mean free path; Maxwell's law of distribution of velocities (deduction not required), rms, mean and most probable velocities, degrees of freedom, principle of equi-partition of energy, specific heats of monatomic and polyatomic gases; transport phenomena- thermal conductivity and viscosity (elementary treatment); qualitative study of Brownian motion; discussion on specific heats of liquids and solids.

2. Continuity of State: defects of ideal gas equation, equation of state for real gases, critical constants, law of corresponding states.

3. Thermal Conductivity: steady state and variable state, thermal and thermometric conductivity, Fourier equation for one dimensional heat flow – its solution Ingen- Hausz experiment,

measurement of conductivity of good conductors by Searle's method and bad conductors by Lee's method.

4. Thermodynamics: basic concepts- equilibrium state, state function, exact and inexact differentials; internal energy as state function, first law of thermodynamics and its application, isothermal, isobaric, isochoric and adiabatic process; isothermal and adiabatic relations; indicator diagram, reversible and irreversible processes, cyclic processes, Carnot engine and Carnot cycle- efficiency, second law of thermodynamics, entropy- physical interpretation, properties of entropy for reversible and irreversible processes; reversed Carnot engine, Carnot theorem, thermodynamic scale of temperature, impossibility of attaining the absolute zero, third law of thermodynamics; deduction of Maxwell's thermodynamic relations. Enthalpy, Joule-Thomson effect, regenerative cooling, liquefaction of gases.

5. Radiation of Heat: nature of radiant heat, emissive and absorptive powers, Kirchhoff's law, radiation pressure (deduction not required), ideal radiator (balck body), Stefan's law, Newton's law of cooling, solar radiation measurement- pyrometers, black body radiation, Wien's displacement law, Rayleigh-Jeans law (statement only), Planck's distribution law (statement only).

Group-B. OPTICS: (35)

Geometrical Optics:

1. Fermat's Principle: laws of reflection and refraction at plane surface. Refraction at spherical surface, Lens formula, combination of thin lenses-equivalent focal length.

2. Aberration in lenses: Dispersion and dispersive power, chromatic aberration and its remedy; monochromatic aberrations and their reductions.

3. Optical Instruments: Ramsden and Huygen eyepieces; Astronomical telescope and compound microscope.

Physical Optics:

1. Wave Theory of Light: Huygen's principle, explanation of reflection and refraction. Electromagnetic theory of light, propagation of electromagnetic waves, Maxwell's theory of wave propagation (Physical interpretation).

2. Interference of light: Young's experiment, intensity distribution, conditions of interference; Fresnel"s biprism; interference in thin films – Newton's ring.

3. Diffraction of light: classes of diffraction, Fresnel's half period zones, zone plate. Fraunhofer diffraction due to single slit, double slit and a plane diffraction grating (elementary theory). Resolving power of optical instruments.

4. Polarisation of Light: Different states of polarization, plane-polarized light by reflection, refraction and double refraction in crystals, Nicol prism, retardation plates, elliptically and circularly polarized light – production and analysis. Optical activity, elementary discussion of Faraday effect.

Group-C. Magnetism (Magnetostatics)

1. Action of Magnetic Field on a Magnet : Couple on magnet in a uniform magnetic field, magnetic moment of a magnet, work in defecting a magnet, equilibrium of a short magnet in two crossed fields.

2. Magnetic Potential and Field : Magnetic potential due to a magnetic dipole and magnetic shell. Magnetic field due to short magnet (magnetic dipole) general case with A & B position of gauss. Line integral of magnetic field.

3. Magnetometer : Intensity of magnetization, magnetic induction permeability, susceptibility. Ferro, para and dia-magnetic substances. Cycle of magnetization – Hysteresis, calculation of hysteresis loss and its importance.

Practical Papers

PAPER – III **Marks- 60** **Time : 4 Hours**

One experiment to be performed during the B.Sc. Part-I (General) Practical Examination. (Distribution of Marks: LNB-5; Viva-10; Experiment- 45).

1. Determination Young's Modulus of the material of a wire by Searle's method.
2. Determination of Young's Modulus of the material of a beam by the method of flexure.
3. Determination of modulus of rigidity of the material of a wire by dynamical method.
4. Determination of modulus of rigidity of the material of a wire by statical method.
5. Determination of moment of inertia of a metallic cylinder/rectangular bar about an axis passing through its centre of gravity.
6. Determination of the acceleration due to gravity by Kater's pendulum.
7. Determination of surface tension of water by capillary rise method. (Capillary tubes to be supplied).
8. Determination of the co-efficient of viscosity of water by Poiseuille's method.
9. Determination of the density of the material of the sonometer wire by using a tuning fork of known frequency.
10. Determination of the co-efficient of linear expansion of a metal by optical lever.
11. Determination of the thermal conductivity of a metal by Searle's method.
12. Determination of the refractive index of the material of a lens and that of a liquid using a convex lens and a plane mirror.
13. Determination of the refractive index of water by traveling microscope.
14. Determination of the power of a convex lens by displacement method.
15. Determination of the focal length of a concave lens by auxiliary lens method.

Part – II

Paper – IV **Full Marks - 45**

Group-A : Electrostatics

1. Electrostatic field: quantisation of charge, conservation of electric charge, Coulomb's law, intensity and potential, potential of a charge distribution, derivation of field from potential, energy of charge distribution. Gauss' theorem and its application in the determination of electric field due to line distribution of charge, surface distribution of charge and spherical distribution of charge; electric dipole- field and potential due to an electric dipole.
2. Dielectric: polar and non-polar dielectrics, electric polarization, electric displacement, Gauss' law in the presence of dielectric.
3. Conductors, Capacity & Capacitors: field near the surface of a charged conductor, mechanical force on the surface of a charged conductor. Capacity of parallel plate, spherical and cylindrical capacitors, energy stored in a capacitor. Force between two plates of a parallel plate capacitor- absolute electrometer and its use.

Group-B : Current Electricity

1. Steady Current: Network analysis – Kirchhoff's laws, Thevenin and Norton's theorem, Wheatstone bridge, Carey-Foster bridge, Potentiometer.
2. Magnetic effect of current: Force on a moving charge; Lorentz force equation and definition of $\vec{B}$, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment. Biot and Savart's law, Ampere's circuital law (statement only), magnetic field due to straight conductor, circular coil, solenoid, endless solenoid; Galvanometers- moving coil galvanometer, ballistic galvanometer (moving coil type).
3. Electromagnetic Induction & Varying Currents: Faraday's laws of electromagnetic Induction, Self and Mutual inductances, energy stored in inductance, growth and decay of currents in L – R circuit, charging and discharging of capacitor in C – R circuit, displacement current, Maxwell's electromagnetic field equations (only mention of the equations with qualitative discussion).

4. Alternating Current: mean and rms values of current and emf with sinusoidal wave form, LR, CR and LCR circuits, reactance, impedance, phase angle, power dissipation in AC circuits, power factor; vector diagram, resonance in series LCR circuit, Q-factor; principle of ideal transformer.

5. Thermoelectricity: Seebeck, Peltier and Thomson effects, laws of thermoelectricity, thermoelectric curve, neutral and inversion temperatures, thermoelectric power.

Group-C. Electronics – I: (15)

1. Semiconductor Devices and Application: p-n junction diode, half-wave, full-wave and bridge rectifiers, L-type and π-type filters, Zener diode – voltage regulator. Transistor- $(p-n-p, n-p-n)$, α and β parameters and their inter relation, input and output characteristics in CB, CE and CC modes, single stage CE amplifier – approximate expressions of current and voltage gain with the help of load line.

2. Digital Electronics: binary systems, binary numbers, decimal to binary and binary to decimal conversions, binary addition and subtraction. Logic Gates – OR, AND, NOT gates- truth tables; statement of De Morgan's theorem, NOR and NAND gates as universal gates.

PAPER – V **Marks - 45**

Group-A. Special Theory of Relativity (15)

1. Reference systems, inertial frames, Galilean invariance and conservation laws, Michelson-Morley experiment, postulates for the special theory of relativity, Lorentz transformation (deduction not required), length contraction, retardation of moving clocks, relativistic velocity addition, variation of mass with velocity, mass-energy equivalence.

Group-B. Atomic and Nuclear Physics: (8+12)

1. Atomic Physics - e/m for electrons – Thomson's method, determinations of electronic charge- Millikan's oil drop method, Positive rays, determination of e/m – Thomson's parabola method, Isotopes. Structure of the atom – Bohr's hypothesis and description of the atom, Bohr's theory of hydrogen spectra, concept of quantum numbers, Pauli exclusion principle.

2. Nuclear Physics – constitution of atomic nuclei, general properties of nuclei, nuclear spin and magnetic moment, nuclear radius, nuclear mass, stability conditions of atomic nuclei, spontaneous nuclear disintegration, successive disintegration- radioactive equilibrium, radioactive dating, radio-isotopes and their uses, standard devices for the measurement of nuclear radiation- cloud chamber, G. M. counter, Cyclotron, nuclear reaction, Q-value of nuclear reaction, chain reaction, nuclear fission, nuclear fusion, nuclear reactor.

Group-C. Solid State Physics and Elementary Quantum Mechanics. (25)

Solid State Physics: (10)

1. Crystals: crystal lattice, X-ray diffraction, Laue spots, Bragg's law; Miller indices and interplanar spacing.
2. Magnetic Properties of Matter: Intensity of magnetization, magnetic induction, permeability, susceptibility, relation between $\vec{B}, \vec{H}$ & $\vec{M}$, dia-, para- and ferro-magnetic materials, statement of Curie's law, Hysteresis in ferromagnetic materials, hysteresis loss.
3. Semiconductors: intrinsic semiconductors, electrons and holes, Fermi level, temperature dependence of electron and hole concentration. Doping- impurity states, n and p type semiconductors.
4. Semiconductor Devices: p-n junction, majority and minority carriers, diode, zener and tunnel diodes, light emitting diode, transistor, solar cell.

Elementary Quantum Mechanics: (15)

1. Quantum Theory of Radiation: Failure of classical physics to explain the phenomena such as black body spectrum, photoelectric effect. Planck's radiation law (statement only), and Einstein's explanation of Photoelectric effect. Compton effect and Raman effect.
2. Wave nature of material particles: de Broglie hypothesis of matter waves, wave-particle duality; Heisenberg's uncertainty principle, gamma ray microscope. Schordinger equation, wave function and its interpretation, particle in a one-dimensional infinite well, energy eigen value.

Practical Papers

PAPER -VI **Marks- 60** **Time: 4 Hours**

One experiment to be performed during the B.Sc. Part-I (General) Practical Examination. (Distribution of Marks: LNB-5; Viva-10; Experiment- 45).

1. Determination of end corrections of a metre bridge and to measure the specific resistance of a material in the form of a wire.
2. Determination of the resistance per unit length of a Carey Foster's bridge and to measure an unknown resistance.
3. Determination of the value of a low resistance by fall of potential method using a metre bridge.
4. Determination of the temperature coefficient of the material of a coil using a metre bridge.
5. Determination of the reduction factor of a tangent galvanometer using copper voltameter.
6. Determination of the resistance of a suspended coil galvanometer by the method of half deflection and to calculate the figure of merit of the galvanometer.
7. Measurement of current by potentiometer using a low resistance.
8. Determination of the Electro Chemical Equivalent of copper using a potentiometer.
9. Construction and calibration of ammeters and voltmeters of desired ranges using a milli-ammeter and suitable resistances.
10. To draw the resonance curve of a series LCR circuit and hence to determine the Q-factor of the circuit.
11. Determination of the horizontal component of earth's magnetic field and magnetic moment of a magnet using a deflection and an oscillation magnetometer.
12. To study the voltage – current characteristic of a P-N junction diode and to determine the dynamic resistance of the diode at different currents.
13. To draw the reverse characteristics of a zener diode and to study its voltage regulation characteristics using a variable load. (Breakdown region should be identified in the graph. Percentage voltage regulation has to be calculated for given load currents).

14. To study the P-N junction diode as rectifier using half wave/full wave rectifier with and without filter.

15. To verify the truth tables of OR, AND, NOT, NAND, NOR gates and their simple combination using IC.

Part – III

Paper – VII **Full Marks - 45**

Group-A : Electronics – II (30)

1. Semiconductor Devices and Application: Feedback – positive and negative feedback, Barkhausen criterion, oscillator; OPAMP – characteristics, uses of OPAMP as amplifier, oscillator and filter; light emitting diodes, 7-segment display SCR, diac and triac.
2. Digital Electronics: combinational circuits- adder and subtractor, multiplexer, demultiplexer, encoder, decoder, sequential circuits- flip-flop – D and JK, registers and counters.
3. Instruments: Cathode Ray Oscilloscope, digital multimeter, L and C measurements.

Group-B. Machine and Energy Sources: (30)

1. Production of high vacuum and measurement of low pressure – Rotary and diffusion pumps, McLeod, Pirani and Penning gauges.
2. Heat Engines – thermal efficiency, indicated Horse Power and brake Horse Power auto cycle and diesel cycle, four-stroke petrol and diesel engines- calculation of efficiency and comparison.
3. Conventional Energy Sources- thermal power plant, relevance of Rankine cycle (qualitative discussion); steam turbine, hydroelectric power plant- basic principle.
4. Non-conventional Energy Sources- solar, wind, tidal, geothermal and biogas sources, elementary ideas of production and uses.

Group-C. Communications and Computers. (35)

Communications: (20)

1. Propagation of electromagnetic waves in atmosphere, various layers of atmosphere, ground and sky waves.
2. Transmission of electromagnetic waves- amplitude and frequency modulation, calculation of power in amplitude modulation, sideband generation in frequency modulated wave, demodulation- linear diode detector, detection of FM waves, signal to noise ratio.

3. Transmission of electromagnetic waves through material media- coaxial cables, optical fibre-cladding, energy loss, band width and channel capacity, information carrying capacity of light waves (qualitative); satellite communication, microwave link, modem and internet.

Computers: (15)

1. Computer Fundamentals: Block diagram, CPU, Memory, I-O devices, software-hardware, concepts of operating system (OS)- DOS, WINDOWS.
2. Programming in C: Variables type, operators and expressions, if-else, else-if, switch, loops-while, for and do, break and continue, go to and labels, array- one and two-dimensional.

Practical Papers

PAPER -VIII **Marks- 40** **Time: 4 Hours**

One experiment to be performed during the B.Sc. Part-II (General) Practical Examination. (Distribution of Marks: LNB-5; Viva-5; Experiment- 30).

2. Adjustment of a spectrometer by Schuster's method and hence to calibrate the spectrometer (D - λ curve)
3. Determination of the width of a narrow slit using Fraunhoffer diffraction.
4. Determination of the radius of curvature of a plano-convex lens using Newton's rings.
5. To determine the number of rulings per cm of a transmissioin grating using a monochromatic source of known wavelength.
6. To calibrate a polarimeter and hence determine the concentration of sugar solution.
7. To draw the voltage – current characteristic of a bridge rectifier with and without using a filter. (The bridge rectifier is to be fabricated by the student using four diodes. Percentage voltage regulation has to be calculated from each graph for given load currents).
8. To draw the output characteristics of a transistor in C-E configuration (for at least five base currents) and hence to determine the AC current gain from the active region of the characteristics.
9. To measure the internal resistance of an analog voltmeter and to increase its internal resistance using an OPAMP.
10. To use OPAMP as inverting, non-inverting, differential amplifier and as an adder.
11. To develop a photo sensor using a phototransistor followed by an amplifier and to use the same to control the switching of a bulb.
12. To write simple programs in C and to execute them.

Reference Books.

Mathematical Methods.

1. Mathematical Methods for Physicists	G. Arfken	Academic Press
2. Introduction to Mathematical Physics	C. Harper	Schaum's Outline Series
3. Mathematical Methods	M. C. Potter & J. Goldberg	Prentice Hall of India.
4. Mathematical Physics	P. K. Chattopadhyay	Prentice Hall of India.
5. Mathematical Physics	D.P.Roychoudhury	Chayan Publishers
6. Mathematical Physics	Satya Prakash	S. Chand & Sons.
7. Vector Analysis	M. R. Spiegel	Schaum's Outline Series.
8. Vector Analysis	B. Spain	ELBS
9. Vector and Tensor Analysis	H. Lass	McGraw Hill
10. Matrix Methods	Richard Bronson	Academic Press
11. Elements of Partial DifferentialEquations	I. Snedden.	McGraw Hill
12. 'Tattiyo Padarthabidyar Bhumika'	S. Sengupta, A. Ghosh & D.P. Roychaudhuri	W.B. State Book Board.

Classical Mechanics.

1. Mechanics	K. R. Symon	Addison-Wesley.
2. Classical Mechanics	Rana & Joag	TMH edition
3. Classical Mechanics	Goldstein,H	Addison-Wesley
4. Introduction to Classical Mechanics	R. G. Takwale & P. S. Puranik	TMH edition
5. Classical Dynamics	D. T. Greenwood	Prentice Hall
6. Classical Mechanics	J.C.Upadhyay	Himalaya Publishing
7. Classical Mechanics	A.K.Roychaudhuri	Oxford Univ. Press
8. 'Ucchatara Gatibidya'	A. K. Roychaudhuri	W.B. State Book Board.

General Properties of Matter.

1. General Properties of Matter	Newman & Searle	Radha Publ. House
2. General Properties of Matter	C. J. Smith	Radha Publ. House
3. General Properties of Matter	Champion & Davy	Blackie & Sons
4. General Properties of Matter	R.Sengupta & H. Chatterjee	New Central.
5. Mechanics and General Properties of Matter	D. P. Roycahaudhuri & S. N. Maity	Book Syndicate
6. The Feynman Lectures on Physics – Vol. I.		Addison-Wesley
7. 'Padarther Dharma'	D. P. Roycahaudhuri	W.B. State Book Board

Oscillations, Waves & Acoustics.

1. Waves- Berkeley Physics Course, Vol. III	Crawford	
2. Waves and Oscillations	A. P. French	
3. Fundamentals of Acoustics	Kinsler and Frey	
4. Advanced Acoustics	D. P. Roycahaudhuri	Chayan - Kolkata

5.	Waves and Oscillations	R. N. Chaudhury	New Age Publication
6.	Physics of vibration & Waves	H.J.Pain	Wiley
7.	'Ucchatara Swanabidya'	J. K. Mukhopadhyay	W.B. State Book Board

Heat & Thermodynamics.

1.	Heat and Thermodynamics	Zemansky and Ditman	McGraw Hill
2.	A Treatise on Heat	Saha and Srivastava	The Indian Press Ltd.
3.	Thermodynamics	H. B. Callen	Wiley
4.	Kinetic Theory of Gases	Loeb	Radha Publication
5.	Thermodynamics, Statistical Mechanics and Kinetic Theory	Sears and Salinger	-
6.	Thermal Physics	S. Garg, R. M. Bansal, C. K. Ghosh	Tata McGraw Hill
7.	Thermal Physics	A. B. Gupta and H. P. Roy	Books & Allied (P) Ltd.
8.	'Gaser Anobik Tatta'	Pratip Kumar Chaudhuri	W.B. State Book Board
9.	'Tap Gati Tatta'	Ashoke Ghosh	W.B. State Book Board

Optics. (Geometrical and Physical).

1.	Fundamentals of Optics	F.A.Jenkins and H.E.White	McGraw Hill
2.	Geometrical and Physical Optics	B. S. Longhurst	Orient Longmans
3.	Optics	A. K. Ghatak	Tata McGraw Hill
4.	Introduction to Classical and Modern Optics	Jurgen R.Meyer-Arendt	Prentice Hall of India
5.	Optics	Hecht anfd Zajac	-
6.	Optics	Ditchburn	-
7.	Optics	Rossi	McGraw Hill
8.	Principles of Optics	B. K. Mathur	New Gopal Printing Press
9.	'Bhouto Alok Bigyan'	B. S. Basak	W.B. State Book Board
10.	'Jyamitiyo Alok Bigyan'	Arabinda Nag	W.B. State Book Board
11.	'Aloker Samabartan'	Suhas Bandopadhyay	W.B. State Book Board

Electricity and Magnetism and Electromagnetic Theory.

1.	Electricity and Magnetism	Purcell	Berkely Series Vol. II.
2.	Physics. Vol. II.	Halliday and Resnick	Wiley Eastern Limited
3.	The Feynman Lectures on Physics- Vol. II		Addison - Wesely
4.	Electricity and Magnetism	Mahajan and Rangwala	Tata McGraw Hill
5.	Classical Electricity and Magnetism	Panofsky & Phillips	India Book House
6.	Electricity and Magnetism	Fewkes and Yarwood	Oxford Univ. Press
7.	Electricity and Magnetism	C. J. Smith	Radha Publication
8.	Introduction to Electrodynamics	D. J. Griffith	Prentice Hall of India
9.	Electromagnetic Theory	Reitz, Milford and Christy	Addison - Wesley
10.	Electricity and Magnetism	Chatterjee and Rakshit	New Central
11.	Classical Electromagnetic Radiation	J. B. Marion	Academic Press.