MARWARI COLLEGE, RANCHI

(AN AUTONOMOUS UNIT OF RANCHI UNIVERSITY FROM 2009)

DEPARTMENT OF PHYSICS

COURSES OF STUDY FOR PHYSICS SUBSIDIARY

Number of Papers: 8
(4 Theory papers & 4 Practical Papers)

Full Marks: 400
(Theory: 300, Practical: 100)

Number of Semesters: 4

B. Sc. Part - I: 200 Marks
(Theory: 150, Practical: 50)

B. Sc. Part - II: 200 Marks
(Theory: 150, Practical: 50)

DISTRIBUTIONS OF MARKS IN PHYSICS SUBSIDIARY

SEMESTER	PAPER	FULL MARKS	PASS MARKS	DURATION
I, II, III & IV	Theory	75	25	3 Hrs.
	Practical	25	10	3 Hrs.

B.Sc - I
SEMESTER – I
Paper: 1 (50 lectures)
(Mathematical Physics, General Properties of Matter & Thermal Physics)

Full Marks: 75   **Time: 3 Hrs.**   **Pass Marks: 23**

Instructions to Paper Setter

In this paper, questions to be set in four groups, A, B, C & D.

Group A: All ten objective type questions, i.e., 10 x 1 = 10. Compulsory.

Group B: Out of four short answer type questions, any two to be anwered, i.e., 2 x 5 = 10. Compulsory.

Group C: Out of six long answer type questions, any four to be answered, i.e., 4 x 10 = 40.

Group D: Out of five Numerical problems, any three to be sloved, i.e., 3 x 5 = 15.

MATHEMATICAL PHYSICS: **(10)**

Scalar and vector fields, differentiation of a vector, idea of line, surface and volume integrals, gradient, divergence and curl and their expression in rectangular Cartesian co-ordinate systems, Gauss, Stoke's and Green's theorems.

GENERAL PROPERTIES OF MATTER: **(20)**

   a)   **ELASTICITY:** Elastic constants and their inter relations, calculation of torque on a cylinder, Torsional oscillations.

   b)   **SURFACE TENSION:** Excess pressure on curved surface of a liquid from the principle of virtual work, Ripples and gravity waves, Surface tension and evaporation, Determination of surface tension by   Quincke's method.

   c)   **VISCOSITY:** Viscosity of liquids by Poiseuille's method, Rotatory viscometer.

THERMAL PHYSICS: **(20)**

   a)   **MEASUREMENTS:** Measurement of thermal conductivity of solids, Forbe's and Lee's method.

   b)   **LAWS OF THERMODYNAMICS:** Carnot's engine, Carnot's theorem, The second law of thermodynamics, Absolute scale of temperature, Entropy, Entropy changes in reversible and irreversible processes.

   c)   **KINETIC THEORY OF GASES:** Derivation of Maxwell's velocity distribution law and its verification by Stern's method, Mean free path and principle of equipartition of energy (deduction not required).

   d)   **REAL GASES:** Deviation from ideal gas equation, Van der Waal's equation of state and its derivation, Critical constants, Joule-Thomson effect, Liquefaction of gases (air and hydrogen).

   e)   **RADIATION PHYSICS:** Black body radiation, Kirchoff's law, Stefan and Stefan-Boltzmann laws, their deduction and verification, Qualitative explanation of black body radiation by Wein's law, Rayleigh-Jean's law and Plank's law, Solar constant.

Books Recommended:
   1.   Mathematical Physics by Rajput, B.S.
   2.   Mathematical Physics by Gupta, B.D.
   3.   General Properties of Matter by Mathur, D.S.
   4.   Heat & Thermodynamics by Brijlal & Subramanyam.
   5.   Treatise on Heat by Saha and Shrivastava.

B.Sc - I
SEMESTER – I
Paper: 2 (Practical)

Full Marks: 25   **Time: 3 Hrs.**   **Pass Marks: 10**

1. Determination of G using Bar pendulum.
2. Determination of Rigidity Modulus by Statical method.
3. Determination of Rigidity Modulus by dynamical method.
4. Determination of Surface Tension by capillary rise method.
5. Determination of Viscosity Coefficient of water by capillary flow method.
6. Determination of Thermal Conductivity of copper using Searle's apparatus.

B.Sc - I
SEMESTER – II
Paper: 3 (50 lectures)
(Acoustics, Optics, Electrostatics)

Full Marks: 75   **Time: 3 Hrs.**   **Pass Marks: 23**

Instructions to Paper Setter

In this paper, questions to be set in four groups, A, B, C & D.

Group E: All ten objective type questions, i.e., 10 x 1 = 10. Compulsory.

Group F: Out of four short answer type questions, any two to be anwered, i.e., 2 x 5 = 10. Compulsory.

Group G: Out of six long answer type questions, any four to be answered, i.e., 4 x 10 = 40.

Group H: Out of five Numerical problems, any three to be sloved, i.e., 3 x 5 = 15.

ACOUSTICS: (10)

a) **THEORY OF VIBRATIONS:** Analytical treatment of free, damped, forced and resonant vibrations.

b) **INTENSITY AND LOUDNESS OF SOUND:** bel, phon, measurement of intensity by Rayleigh disc method, Reverberation time, deduction of Sabine's law, determination of absorption coefficient.

OPTICS: (25)

a) **COHERENCE:** Temporal and spatial coherence, Interference in thin films, Newton's rings, Michelson's interferometer.

b) **DIFFRACTION:** Fresnel and Fraunhoffer diffraction, half-period zones, Zone plate, Plane diffraction grating.

c) **POLARISATION OF LIGHT:** double refraction, Nicol's prism, Construction of wave fronts in uniaxial crystals, Quarter wave plate, Production and detection of plane, circularly and elliptically, polarized light, Rotatory polarization and porarimeters.

d) **VELOCITY OF LIGHT:** Group and phase velocity(concept to be brought by superposition of two waves), Kerr cell method for determining the velocity of light.

ELECTROSTATICS: (15)

Electric polarization and displacement vectors, $\dot{D}=\varepsilon_o\bar{E} + \dot{P}$ relation (by simple method-slab placed in electric field between plates.) Energy density(by simple spherical distribution of charge), Dielectric constant and measurement by Hopkinson's null method, Quadrant and attracted disc electrometer.

Books Recommended:

1. Introduction to Geometrical & Physical Optics by Mathur, B.K.
2. Optics by Ghatak, A.
3. Fundamentals of Magnetism & Electricity by Vasudeva, D.N.
4. Textbook of Sound by Khanna & Bedi.

B.Sc - I
SEMESTER – II
Paper: 4 (Practical)

Full Marks: 25   **Time: 3 Hrs.**   **Pass Marks: 10**

1. Kundt's tube method of measuring the velocity of sound.
2. Determination of frequency of a tuning fork using Melde's experiment.
3. Spectrometer : refractive index of a prism by symmetry method.
4. High resistance measurement.
5. Low resistance measurement.

B.Sc - II
SEMESTER – III
Paper: 5 (50 lectures)
(Magnetism, Curent Electricity, Classical Mechanics & Quantum Physics)
Full Marks: 75   **Time: 3 Hrs.**   **Pass Marks: 23**
Instructions to Paper Setter

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Group A All ten objective type questions, i.e., 10 x 1 = 10. Compulsory.

Group B Out of four short answer type questions, any two to be anwered, i.e., 2 x 5 = 10. Compulsory.

Group C Out of six long answer type questions, any four to be answered, i.e., 4 x 10 = 40.

Group D Out of five Numerical problems, any three to be sloved, i.e., 3 x 5 = 15.

MAGNETISM: (15)

Gauss' law, Ampere's circuital law, Magnetic induction, $\dot{B}=\mu_o \dot{} (\dot{H}+\dot{M})$ relation (by Rowland ring method), Energy density of magnetic field (by simple solenoid method), Hysteresis and hysteresis loss and measurements by magnetometer and ballistic galvanometer methods, Dia-,para- and terro- magnetic substances, Magnetic circuits, Design of permanent magnets by the concept of magnetic circuits, Susceptibility and permeability and their measurements for dia-, para- and ferromagnetic materials.

CURRENT ELECTRICITY: (18)

Field due to a solenoid, Theory of moving coil ballistic galvanometer and its uses.

a) **TRANSIENTS:** Growth and decay of current in L-R, R-C and L-R-C circuits, Simple application of these circuits, Measurement of L by Rayleigh's method.
b) **ALTERNATING CURRENT CIRCUIT:** Power and power factor of ac circuits, Wattmeter, Vector diagram method j-operator method for ac circuits, Analytical treatment of series and parallel circuits including sharpness of resonance, Transformer and its principle by vector diagram method, Polyphase current, Rotating magnetic fields, induction motor.

CLASSICAL MECHANICS: (10)

Generalized co-ordinates and momenta, Largrange's and Hamilton's equations from D'Alembert's principle, Applications to simple pendulum, Compound pendulum and projectiles, Motion in a central field, Kepler's laws-their deductions from law of gravitation and vice-versa.

QUANTUM PHYSICS: (07)

Wave-particle duality, de Broglie's relation and experimental verification of matter waves, Uncertainty principle.

Books Recommended:
1. Classical Mechanics by Gupta & Kumar.
2. Electricity and Magnetism by Tayal, D.C.
3. Quantum Mechanics by Satya Prakash.

B.Sc - II

SEMESTER – III
Paper: 6 (Practical)

Full Marks: 25   **Time: 3 Hrs.**   **Pass Marks: 10**

1. Young's modulus of a beam by bending method.
2. Determination of wavelength of sodium light using Newton's ring method.
3. Determination of refractive index of the material of a prism using i-δ graph.
4. Resistance of a galvanometer by half deflection method.
5. Figure of merit of a galvanometer.

B.Sc - II
SEMESTER – IV
Paper: 7 (50 lectures)
(Special theory of relativity, atomic physics, nuclear physics, solid state physics & elctronics and digital electronics)
Full Marks: 75   **Time: 3 Hrs.**   **Pass Marks: 23**
Instructions to Paper Setter

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Group A All ten objective type questions, i.e., 10 x 1 = 10. Compulsory.

Group B Out of four short answer type questions, any two to be anwered, i.e., 2 x 5 = 10. Compulsory.

Group C Out of six long answer type questions, any four to be answered, i.e., 4 x 10 = 40.

Group D Out of five Numerical problems, any three to be sloved, i.e., 3 x 5 = 15.

SPECIAL THEORY OF RELATIVITY: (10)
Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformation, Simultaneity and order of events, Lorentz contraction and time dilation, Addition of velocities, Velocity dependence of mass, Equivalence of mass and energy.

ATOMIC PHYSICS: (8)
Bohr's theory of hydrogen atom, Discrete levels in atoms, Critical potentials, Moseley's law, Compton effect, Bragg's law.

NUCLEAR PHYSICS: (10)
Basic properties and structure of nuclei, Elementary ideas about nuclear forces, nuclear disintegration, Cosmic rays and elementary particles, Geiger-Muller counter.

SOLID STATE PHYSICS AND ELECRONICS: (12)
a) p-n junction (calculation of conduction current by concept of Fermi level), Zener diode, Tunnel diode, Photo-diode, Diode as a rectifier, Half-wave and full-wave rectifier circuits, Calculation of ripple factor, Transistor and its characteristics and constants, Photo-transistor, Transistor as an amplifier.

b) Qualitative idea about amplitude modulation and detection, Simple transmitter and receiver through block diagram, Propagation of radio waves through ionosphere.

c) Electron microscope, Cathode rays oscilloscope, Elementary idea about TV.

DIGITAL ELECTRONICS: (10)
Basic logic gates, Boolean algebra and its application to simple logic circuits (half adder), Realization of basic logic gates from NAND gates.

Books Recommended:
1. Elements of Spectroscopy by Gupta & Kumar.
2. Introduction to Theory of relativity by Robert Resnick.
3. Relativistic Kinematics by Satya Prakash.

4. Solid State Physics by Gupta & Kumar.
5. Principles of Electronics by Mehta, V.K.
6. Digital Electronic by Malvino and Leach.

B.Sc - II
SEMESTER – IV
Paper: 7 (Practical)

Full Marks: 25   **Time: 3 Hrs.**   **Pass Marks: 10**

1. Determination of Temperature coefficient of resistance of a wire.
2. Calibration and use of a thermocouple.
3. Determination of angle of dip using Earth inductor.
4. Comparison of capacitors using De Sauty's bridge.
5. To study the characteristics of a transistor.