



Sample Paper of Physics (Paper-A) Revised 2016
Examination: B.Sc. Part-I (III Year)

PAPER: Theory (Paper-A)

Time allowed: 3 Hours

Subject: Physics

Max. Marks: 75

Note: Attempt Five (5) questions, selecting not more than Two (2) questions from each section.

SECTION-I

- Q1.** (a) State and prove the Gauss's divergence theorem. (8)
 (b) Given $\phi = 2x^3y^2z^4$ find (i) $\text{div grad } \phi$ (ii) Show that $\bar{\nabla} \cdot \bar{\nabla} \phi = \nabla^2 \phi$. (5)
 (c) Define scalar field and give an example. (2)
- Q2.** (a) What is theory of relativity? State its two basic postulates. Prove the relation $E^2 = p^2c^2 + M^2c^4$ where symbols have usual meanings. (8)
 (b) The electrons are accelerated to a kinetic energy of 50GeV. Find the speed of such an electron as a fraction of c . (5)
 (c) What is relativistic momentum? Give its relation. (2)
- Q3.** (a) Show that the force exerted by a uniform thin spherical sheet of mass 'M' on a point mass 'm' when it is outside, is the same as if all the mass of the spherical shell were concentrated at its center. (8)
 (b) At what altitude above the earth's surface the value of 'g' is $3/4^{\text{th}}$ of its value at the surface of the earth. (5)
 (c) How the value of 'g' vary with height and depth? (2)
- Q4.** (a) What is a conical pendulum? Show that time period of conical pendulum is independent of mass of object. (8)
 (b) What are Lorentz transformations (do not derive)? Discuss one consequence of Lorentz transformation equation. (5)
 (c) Two observers are moving relative to one another. Will they measure their relative speed and time between two events to have same value? (2)

SECTION-II

- Q5.** (a) What is Michelson Interferometer? How Michelson and Morley demise the ether theory from their interferometer? (8)
 (b) If a Mirror M in interferometer is moved through 0.233 mm, 792 fringes are counted with a light meter. What is the wavelength of the light? (5)
 (c) Why the centre of Newton rings is dark? (2)
- Q6.** (a) Define damped harmonic oscillator, derive its equation of motion and find its solution. (8)
 (b) A block of mass 250 g is attached to a spring of stiffness 85 N/m. The block oscillates in a resistive medium with $b = 0.07 \text{ kg/s}$. After what time the mechanical energy of this oscillator drops to one half of its initial value? (5)

- (c) Write relation of time period for a physical pendulum and reduce it to the time period of a simple pendulum. (2)

- Q7.** (a) What is Doppler Effect? Find the apparent frequencies of sound under the following cases:
(i) When the source is at rest in his frame and listener is moving with velocity V_0 .
(ii) When the listener is at rest in his frame and source is moving with velocity V_0 . (8)
- (b) The siren of a police car emits a pure tone at a frequency of 1125 Hz. Find the frequency that you would hear under the following circumstances:
(i) you and police are moving towards each other at 14.5 m/s.
(ii) you are moving at 9 m/s, police car chasing behind you at 3.8 m/s. (take speed of sound $v = 343$ m/s). (5)
- (c) Consider two tuning forks having frequencies 256 Hz and 258 Hz, respectively are sounded together. Find their beat frequency. (2)

SECTION-III

- Q8.** (a) State first law of thermodynamics and apply it to prove $PV^\gamma = \text{constant}$ for an adiabatic process. (8)
- (b) Consider a sample of gas consisting of 0.1 mole with volume $V_i = 4.0 \text{ m}^3$ and $P_i = 10 P_a$. Let the cylinder be removed from the thermal reservoir and let us compress the gas adiabatically until its volume is $V_f = 1.0 \text{ m}^3$. Find the change in internal energy of the gas, assuming it to be helium (a monatomic gas with $\gamma = \frac{5}{3}$) (5)
- (c) Explain why a thermoflask is double-walled, evacuated and silvered. (2)
- Q9.** (a) State Carnot's theorem. How can we find entropy change for an irreversible process? (8)
- (b) An automobile engine, whose thermal efficiency e is 22%, operates at 95 cycles per second and does work at the rate of 120 hp.
(i) how much work per cycle is done on the system by the environment?
(ii) how much heat enters and leaves the engine in each cycle? (5)
- (c) What factors reduce the efficiency of a heat engine from its ideal value? (2)
- Q10.** (a) Evaluate most probable speed and rms speed from Maxwell distribution of molecular speeds. (8)
- (b) Calculate the mean free path for 35 spherical jelly beans in a jar that is vigorously shaken. The volume of the jar is 1.0 liter and the diameter of a jelly bean is 1.0 cm. (5)
- (c) If hot air rises, why it is cooler at the top of mountain? (2)



Sample Paper of Physics (Paper-C) Revised 2016
Examination: B.Sc. Part-I (III Year)

PAPER: Practical (Paper-C)
Subject: Physics

Time allowed: 3 Hours
Max. Marks: 25

Practical: Mechanics, Waves, Oscillations, Optics, Thermodynamics and Kinetic theory of gases.

Note:

- i. Mark at least TWO experiments. The examiner will allot you ONE experiment to perform out of your marked experiments.
- ii. Write down the brief THEORY and PROCEDURE.

Group I

- Q1.** To determine the surface tension by capillary rise method. (20)
- Q2.** To determine wavelengths of sodium D lines by Newton's rings. (20)
- Q3.** To determine the velocity of sound by Kundt's tube. (20)
- Q4.** To determine the resolving power of a diffraction grating. (20)
- Q5.** To determine the mechanical equivalent of heat " J " by Electrical Method (Callender and Barnes Method). (20)
- Q6.** Practical Note Book and Viva Voce. (05)