

END TERM EXAMINATION

FIRST SEMESTER [BCA] DECEMBER 2017

Paper Code: BCA-109

Subject: Physics

(From 2011 Batch Onwards)

Time: 3 Hours

Maximum Marks: 75

Note: Attempt any five questions including Q.no.1 which is compulsory. Select one question from each Unit. Scientific symbols have their usual meanings. Scientific calculator is allowed.

1. Attempt all the parts: (2.5x10=25)
- (a) State Newton's laws of motion and mention their implications.
 - (b) Mention laws of *limiting friction* and explain how they can be verified experimentally.
 - (c) Write down the laws of resistances connected in series and parallel.
 - (d) What is a Gaussian surface? Mention the one widely used Gaussian surfaces and how it is produced.
 - (e) Explain how a light emitting diode works.
 - (f) State work-energy theorem.
 - (g) Define *equipotential surface* and *equipotential lines*. Schematically show equipotential lines for a point charge and an electric dipole.
 - (h) Four charges of q , $-2q$, $3q$ and $2q$ are placed at the corners of a square of side 1 m. Calculate the electric potential at the centre of the square (Given: $q = 2 \times 10^{-8}$ C).
 - (i) Write down the postulates of Bohr's atomic model.
 - (j) State Lemi's theorem. Give one application of the theorem.

Unit-I

2. (a) Explain the concept of banking of roads. Obtain an expression for the maximum speed a car can safely move on a curved road banked at an angle θ . What is the ideal, or critical speed (the speed for which no friction is required between the car's tires and the surface) for a car moving on a curved road of radius 50 m at a banking angle of 15° ? (9)
- (b) A car of mass 2000 kg travels around a flat circular race track of radius $r = 85$ m. The car starts at rest and its speed increases at the constant rate of 0.6 m/s. What is the speed of the car at the point when its centripetal and tangential accelerations are equal? (3.5)
3. (a) Out of three basic Newton's law of motion, which one is the most fundamental one and why? Discuss with the help of suitable example. (8)
- (b) Discuss various types of friction & their possible causes. Mention some of the advantages of friction. (4.5)

Unit-II

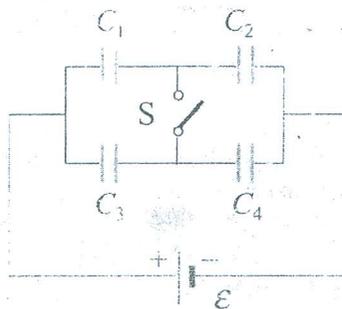
4. (a) Differentiate between *elastic* and *inelastic collisions* and obtain an expression for the velocities after collision and the energy lost in inelastic collision between two bodies. (9)
- (b) A body of mass 50 g moving with speed of 10 m/s undergoes an elastic collision with another body of mass 150 g at rest. Find the kinetic energies of the two bodies after head-on elastic collision. (3.5)
5. (a) Define conservative force and prove that gravitational force is a conservative force. Give one example of non-conservative force. (8)
- (b) Discuss conservation of energy in an inelastic collision. (4.5)

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Unit-III

- Q6 (a) Derive an expression for *electric field strength* at a point due to an *electric dipole*. (8)
- (b) A parallel plate capacitor has a capacitance of 112 pF, a plate area of 96.5 cm² and a mica dielectric ($k_e = 5.4$). At a 55 V potential difference, calculate: (4.5)
- (i) the electric field strength in the mica.
- (ii) the magnitude of the free charge on the plates
- (iii) the magnitude of the induced surface charge
- Q7 (a) What is *Wheatstone bridge*? Explain it using a schematic diagram. Why are Wheatstone Bridge circuits very important in measuring resistance accurately? (6)
- (b) A 12 V battery charges four capacitors are shown in Figure below. (6.5)



If $C_1 = 1 \mu\text{F}$, $C_2 = 2 \mu\text{F}$, $C_3 = 1 \mu\text{F}$, and $C_4 = 4 \mu\text{F}$.

- (i) What is the equivalent capacitance of the group C_1 and C_2 if switch S is open?
- (ii) What is the charge on each of the four capacitors if switch S is open?
- (iii) What is the charge on each of the four capacitors if switch S is closed?

Unit-IV

- Q8 (a) Differentiate between *metal*, *semiconductor* and *insulator*. Draw schematic energy level diagrams. (6)
- (b) Explain the principle of operation of p-n junction diode using energy level diagrams. Draw the current-voltage characteristics of junction diode. (6.5)
- Q9 (a) Explain the principle of operation of p-n-p transistor using schematic diagrams. (6)
- (b) Distinguish between *intrinsic* and *extrinsic* semiconductors. Schematically show the positions of Fermi levels in an intrinsic semiconductor, an n-type and a p-type semiconductor. (6.5)
