(Please write your Exam Roll No.) *Exam Roll No. .....*

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: $q = 2x10^{-8}$ 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 15^0? **(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)**

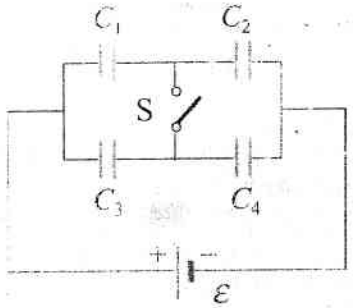
Unit-III

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 cm^2 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 μF, C_2 = 2 μF, C_3 μF, and C_4 = 4 μF.
(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)**

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