

# RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

SECOND YEAR

B.A./B.SC. THIRD SEMESTER (July – December), 2012

Mid-Semester Examination, September 2012

Date : 12/09/2012

Time : 11 am – 12 noon

PHYSICS (General)

Paper : III

Full Marks : 25

Answer any five questions.

- 1.a) Define the electric field due to point charge at a distance  $r$ . 2
- b) Show that electrostatic field is a conservative field. 3
2. State and prove the Gauss's law. 5
3. What is electric dipole ? Find the expression for potential and electric field due to electric dipole. 1+4
- 4.a) Define time constant in CR circuit during discharging. 2
- b) Two long straight wires are kept parallel and separated by 6 cm distance. The currents 3A and 4A are flowing respectively through the wires in opposite direction. Find the force per unit length and nature of the force. 3
- 5.a) A battery of 2V is connected in series with a resistance of 1 ohm and an inductor coil of inductance 1H. Calculate the time when the current becomes half of the final steady current. 2
- b) Draw the graph showing the variation of capacitor voltage ( $V_c$ ) and voltage across the resistance ( $V_R$ ) with respect to time. 2
- c) Write down the value of time constant of a L-R circuit. 1
6. a) Define magnetic permeability and magnetic susceptibility. 2
- b) Deduce a relation between the relative permeability and susceptibility. 3
7. a) Define coefficient of self induction and coefficient of mutual induction. 2
- b) Two coaxial and identical circular coils, each of radius  $a$  and total number of turns  $n$ , are placed  $x$  distance apart in a medium of permeability  $\mu$ . Calculate the coefficient of mutual inductance between the coils. 3
8. a) Explain the meaning of the expression -- *Magnetic effect of electric current*. 1
- b) State and explain Biot - Savart's law for producing magnetic field by electric current. 4
9. a) Find an expression for the magnetic field at a point on the axis of a circular coil carrying electric current.
- b) Find out magnetic dipole moment term within the expression as established. 4+1