# BACHELOR OF SCIENCE EXAMINATION, 2017

(2nd year, 1st semester)

PHYSICS(Subsidiary)

Paper : SO5

Time : 2 Hours

Full marks : 50

### *Answer any five questions*

1. a) Explain what is meant by polarization of a dielectric?
   b) Write down the relation between electrical displacement, field and susceptibility.
   c) A parallel plate capacitor with C=13.5 pF is charged by a battery to a potential difference V=20 V between the plates. The battery is disconnected and a porcelain slab with relative permittivity 6.5 is inserted between the plates. What is the potential energy of the device before and after placing the slab?

   (3+2+5)

2. a) A piece of some material is placed in a non-uniform magnetic field. What would you observe if the material is i) diamagnetic and ii) paramagnetic?
   b) Draw a graph showing how the magnetization of a paramagnetic material depends on the ratio of applied magnetic field to absolute temperature. What is Curie's law?
   c) Name some ferromagnetic materials. What is hysteresis?

   (2+5+3)

3. a) What is meant by self and mutual inductance? What is the unit of inductance?
   b) A long solenoid has 220 turns/cm and carries a current i=1.5 A; its diameter D is 3.2 cm. A closely packed coil C of diameter 2.1 cm with 130 turns is placed at its center. The current in the solenoid is reduced to zero at a steady rate in 25 ms. What is the magnitude of the emf in the coil C while the current in the solenoid is changing?

   (4+6)

4. a) What do you mean by resonance in a series LCR circuit? Find the corresponding current resonant frequency.
   b) A series LCR circuit has inductance of 100 mH and capacitance 100 pF. Find the resonant frequency. Given R = 5 ohm.

   (7+3)

5. a) Write down Maxwell's electromagnetic equations in S.I. units. Mention the physical laws from which this equations have been obtained.
   b) Starting from Maxwell's equation derive the wave equation for the electric field in free space.

   (5+5)

6. a) A fully charged capacitor is suddenly connected in parallel to an inductor, of very low resistance. Show that the charge on the capacitor will decay in an oscillatory manner. Find the frequency of this oscillation.
   b) What will happen if R=0 ?

   (7+3)

7. Write notes on (any two):

   (5×2)

   a) Lenz's law of electromagnetic induction.
   b) LC oscillations.
   c) Paramagnetism and Ferromagnetism.
   d) Power factor.