

2S-PHY 202 - Physics Paper-II (Electric Currents, Motion of Charged particles in electric and Magnetic fields, Electromagnetic waves)

P. Pages : 2

GUG/W/16/5588

Time : Three Hours



Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. Draw neat labelled diagram wherever necessary.

Either :

1. a) i) Derive the equation for the growth and decay of current in LR circuit. What is meant by the term 'time constant'. **8**
- ii) The current in LR circuit rises to 40% of its final value in 2 second. Find the time constant of the circuit. **2**
- OR**
- b) i) Show that when a beam of electrons moving with uniform velocity enters in a uniform magnetic field in a direction perpendicular to the field, it describes a circular path in the magnetic field. **4**
- ii) Explain velocity selector for charged particle. **3**
- iii) A cathode ray beam is bent in a circle of radius 0.05m by a magnetic field 2.4×10^{-3} wb/m². Determine the velocity of electron (Given: $e = 1.6 \times 10^{-19}$ c, $m = 9.1 \times 10^{-31}$ kg). **3**

Either :

2. a) i) Explain E as an accelerating field. **2**
- ii) Draw the block diagram of a CRO. Explain the function of each block. **6**
- iii) Explain how a CRO is used to determine unknown frequency using Lissajous figures. **2**
- OR**
- b) i) Write the Maxwell's equations. Explain the physical significance of each equations. **6**
- ii) If E and H represent the electric and magnetic field intensities respectively in a plane electromagnetic waves then show that $\frac{E}{H} = \sqrt{\frac{\mu_0}{\epsilon_0}}$ **4**

Either :

3. a) Derive an expression for decay of current in CR circuit. **2½**
- b) Derive an expression for power in a.c. circuit. **2½**
- c) Explain the working of cyclotron. **2½**
- d) Calculate the value of Poynting vector for a 100 watt lamp at a distance 1m from it. **2½**
- OR**
- e) A condenser of capacity 1µf is charged with a battery of emf 4 volt through a resistance of 3.0 MΩ. Calculate the charge on condenser after 3 sec. **2½**

- f) Derive an expression for magnetic deflection sensitivity. 2½
- g) Explain construction and working of linear accelerator. 2½
- h) Prove that electromagnetic wave propagate in free space with speed of light. 2½
 (given $\epsilon_0 = \frac{1}{36 \times 10^9} \text{ c}^2 \text{ s}^2 / \text{kgm}^2$, $\mu_0 = 4 \times 10^{-7} \text{ kgm} / \text{c}^2$)

Either :

4. a) State and explain Kirchoff's current and voltage laws. 2½
- b) A coil has an inductance of 0.5.H. calculate, 2½
 1) its inductive reactance when connected to 240 v (peak), 50 Hz A.C.
 2) its impedance if the resistance of the circuit is 50 ohm.
- c) Explain working of Thomson's parabola method for determination of isotropic masses. 2½
- d) State Poynting theorem and discuss physical meaning of each term involved in it. 2½
- OR**
- e) Using j- operator method, obtain an expression for current in AC circuit containing resistor and inductor in series. 2½
- f) What is series LCR resonant circuit? obtain an expression for resonant frequency. 2½
- g) An electron moving with a speed of $2 \times 10^7 \text{ m/s}$ enters in a magnetic field of magnetic induction 1.5 wb/m^2 . Calculate the force experienced by the electron. 2½
- h) Explain the concept of Maxwell's displacement current. 2½

5. Attempt **any ten** of the following.
- a) What is j operator? 1
- b) State the condition for oscillating charge in LCR circuit. 1
- c) Define time constant of CR circuit. 1
- d) Define Q Factor. 1
- e) Define power factor. 1
- f) Draw series and parallel resonance curve for LCR circuit. 1
- g) State the importance of aquadag coating in CRT. 1
- h) State any two limitations of linear accelerator. 1
- i) What are isotopes? 1
- j) State two characteristics of em wave. 1
- k) Write the equation of continuity for time-varying fields. 1
- l) Define Poynting vector. 1
