

B.Sc. F.Y. (C.B.C.S. Pattern) Sem-II
USPHT04 - Physics Paper-II
(Magnetostatics and Electromagnetic Waves)

P. Pages : 2

Time : Three Hours



GUG/W/19/11591

Max. Marks : 50

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

1. Either:

- a) i) State and prove Ampere's circuital law of magnetic induction. **3**
- ii) Using Biot - Savart's law obtain an equation for magnetic induction at a point due to infinite long straight conductor. **4**
- iii) A very long solenoid has 1000 turns per meter and carries a current of 10 A. Find the magnetic field at the center point on axis, and at the end point on the axis. **3**

OR

- b) a) State & explain Biot – Savart's law. **2½**
- b) Define divergence of magnetic field and show that it is always zero. **2½**
- c) Define paramagnetic substances. State their characteristics. **2½**
- d) A long wire carries a current of 2A. Find the magnetic field at a point at a distance of 10m from it. ($\mu_0 = 4\pi \times 10^{-7} \text{ wb / A m}$). **2½**

2. Either:

- a) i) What is transformer? Describe the construction and working of transformer. **5**
- ii) What are the uses of transformer. **2**
- iii) A transformer converts 200V A. C. to 50V A. C. The secondary has 50 turns and load across it draws 300 mA. Calculate i) The number of turns in the primary
ii) The current in the primary and iii) The power consumed. **3**

OR

- b) a) Define self inductance and mutual inductance of two coil. State their SI Units. **2½**
- b) Obtain the equation for energy stored in the magnetic field. **2½**
- c) What is electromagnetic induction? State faradays laws of electromagnetic induction. **2½**
- d) The back emf in the inductance coil is 200V. When the current in the coil changes from 0 to 2A in 0.01 sec calculate self inductance of coil. **2½**

3. Either:

- a) i) Derive Maxwell's four equations of electromagnetic field. **8**

- ii) The sun radiates the power 3.8×10^{26} watt calculate the poynting vector at the surface of sun if it's radius is 7×10^8 m. 2

OR

- b) a) For propagation of uniform plane wave in free space, prove that $\frac{E}{H} = \sqrt{\frac{\mu_0}{\epsilon_0}}$. 2½
- b) Prove that speed of wave in vacuum is given by $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$. 2½
- c) Obtain the equation of continuity from Maxwell's equations of electromagnetic field. 2½
- d) Calculate the value of poynting vector for a 100 watt lamp at a distance of 0.1 m from it. 2½

4. Either:

- a) i) Derive equation of growth & decay of current in L R circuit. 5
- ii) How much time must we wait for the current in a L R circuit to buildup to 99.9% of it's equilibrium value? 3
- iii) State and explain Kirchoff's voltage law. 2

OR

- b) a) Derive an equation for decay of charges in CR circuit. 2½
- b) When AC voltage $E = E_0 e^{j\omega t}$ is applied to the inductance and resistance in series. Derive the expression for current. 2½
- c) Using J – operator method derive an equation for instantaneous current in L R circuit. 2½
- d) Calculate the importance of a circuit containing resistance of 12Ω and capacitance of $10 \mu F$ When the frequency of the applied emf 50Hz. 2½

5. Attempt **any ten** of the following.

- a) Define magnetic potential. 1
- b) Define susceptibility. 1
- c) Define curl of magnetic field. 1
- d) State Lenz's law of electromagnetic induction. 1
- e) State the relation between self inductance and mutual inductance of two coil. 1
- f) Define efficiency of transformer. 1
- g) What is electromagnetic wave? 1
- h) What is Poynting vector? 1
- i) State the equation for energy density in electromagnetic field. 1
- j) Define time constant in CR circuit. 1
- k) What is J – Operator. 1
- l) Define complex number. 1
