Bachelor of Science (F.Y.B.Sc.) (CBCS Pattern) Second Semester CBCS

USPHT04 - Physics Paper-II (Magnetostatics and Electromagnetic Waves)

P. Pages : 3 **GUG/W/18/11591**

Time : Three Hours * 3 6 6 * Max. Marks : 50

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

1. Either :

A) i) State Biot-Savart's law and derive an expression for the magnetic induction at a point due to a long straight conductor carrying current. **4**

ii) What is solenoid? Derive an expression for magnetic field along the axis of solenoid. **4**

iii) Calculate the magnetic induction $\vec{B}$ at a distance 5 cm from a long conductor carrying a current of 4 ampere. Given :- $\mu_0 = 4\pi \times 10^{-7}$ Wb / Am. **2**

OR

B) a) Using Biot-Savart law obtain an expression for the magnetic field induction at the centre of the circular coil carrying current I. **2½**

b) State and explain Ampere's circuital law. **2½**

c) Show that, the relation between permeability and susceptibility is $\mu_r = 1 + \chi$. **2½**

d) Distinguish between diamagnetic, paramagnetic and ferromagnetic substances. **2½**

2. A) Either :

i) State and explain Lenz's law of electromagnetic induction. **2**

ii) If a conducting rod is moving with velocity $\vec{v}$ in uniform magnetic field $\vec{B}$ then prove that the induced emf is $e = -\frac{d\phi}{dt}$. **4**

iii) Derive the relation between self inductance and mutual induction between the two coils and prove that $M = \sqrt{L_1 L_2}$. **4**

OR

B) a) What is self inductance? Derive an expression for the coefficient of self inductance. **2½**

b) State and explain Faraday's law of electromagnetic induction. **2½**

c) A coil of a wire has 500 turns and has a self inductance of 125 mH. What will be the self inductance of second coil of same magnitude with 600 turns? **2½**

d) What is transformer? Explain its working mechanism. **2½**

3. A) Either :

i) What is Displacement current? Derive an Equation of continuity of current. **2**

ii) Write four Maxwell's equation for free space. Give the physical significance of each equation. **5**

iii) State and prove Poynting theorem. **3**

OR

B) a) Show that, electromagnetic waves are transverse in nature. **2½**

b) If the radius of the sun is 7×10^{8} meter and energy emission is $3.8\times10^{26}\ \text{Watt}/\text{sec}$. Calculate the Poynting vector of propagation of energy on the surface of the sun. **2½**

c) Write Maxwell's four equations in integral form. **2½**

d) State and explain Poynting vector. **2½**

4. A) Either :

i) State and explain Kirchoff's current and voltage law. Apply it to deduce the condition for balance of wheat stone bridge. **4**

ii) Derive Helmholtz growth of current in a circuit with resistance R and self inductance L. What is meant by time constant of the circuit. **4**

iii) A relay having a resistance of 200 Ω and inductance of 4 Henry operated at a current of 2 mA. After applying a potential difference of 1 Volt. Calculate how long will relay take to operate? **2**

OR

B) a) What is dimension and unit of time constant. **2½**

b) Derive an expression for decay of current containing capacitance C and Resistance R. **2½**

c) The capacitor of capacitance 0.1 microfarad is discharged through resistance of 10 Mega ohm. Calculate the time taken by potential difference across the capacitor to fall down to half of its original value. **2½**

d) What is $\vec{j}$ operator? Explain the use of complex number in A.C. circuit. **2½**

5. Answer **any ten** questions.

a) Define Magnetic induction $\vec{B}$. **1**

b) What is Lorentz force? **1**

c) What is Curie's law. **1**

d) State Faraday's law in differential form. **1**

e) What is physical significance of mutual induction? **1**

f) Write an expression for energy stored in the electric field. **1**

g) What is displacement current? **1**

h) Write equation of continuity of current. **1**

i) What is meant by polarization of electromagnetic waves? **1**

j) Define resistivity. State its SI and CGS unit. **1**

k) Write the differential equation of discharge of LCR circuit. **1**

l) Why AC used to operate household appliances? **1**

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