B.Sc. F.Y. (CBCS Pattern) Semester - II

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

P. Pages : 3 **GUG/S/23/11591**

Time : Three Hours * 1 7 2 2 * Max. Marks : 50

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

Either:

1. a) i) State Biot-Savart's law. Hence obtain an expression for magnetic induction at a point due to a long straight conductor carrying current. **4**

ii) Obtain divergence and curl of magnetic field B. **4**

iii) A solenoid 4m long and mean diameter 8 cm has 10^4 turns. If a current of 5A is flowing through it, Calculate the magnetic field at its centre. **2**

OR

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

ii) Explain magnetizing field vector and magnetic induction. **2½**

iii) Find the intensity of magnetic field near a straight conductor carrying current. **2½**

iv) The magnetic field strength in silicon is 1000 A/m. If the magnetic susceptibility is 0.25×10^{-5}. Calculate the magnetization and flux density. **2½**

Either:

2. a) i) Define electromagnetic induction and state the Faraday's law of electromagnetic induction. **2**

ii) Explain the construction and working of transformer. Describe the types of transformer and give it uses. **4**

iii) Derive an expression for energy stored in magnetic field of an inductor. **4**

OR

b) i) What is mutual induction? State the relation between the two coils. **2½**

ii) If current 3A flowing in The Primary coil is made zero in 0.1s, the emf inducing the secondary coils is 1.5v. calculate the mutual induction between the coil. **2½**

iii) State and explain the losses in transformer. **2½**

iv) Show that $M=\sqrt{L1L2}$ **2½**

Either:

3. a) i) Define Poynting vector. Obtain an expression for Poynting vector. **2**

ii) Derive the Maxwell's equation for uniform plane electromagnetic waves in free space. **4**

iii) If 500 watt laser beam is concentrated the Poynting vector by a lens into a cross sectional are of $10^{-10}\,m^2$. Find the value of Poynting vector and the amplitude of electric field. Where $\varepsilon_0 = 9x10^{-12}$ S.I.Unit. **4**

OR

b) i) State the Poynting theorem and give its significance. **2½**

ii) Show that by using mathematical treatment E.M. waves are transverse in nature. **2½**

iii) On the surface of earth the energy received is $1.3\,watt/m^2$ from the sun. Calculate the electric field associated with sunlight on surface earth assuming that it is essentially monochromatic $\lambda = 6000\,A^o$. **2½**

iv) State the characteristics of electromagnetic waves. **2½**

Either:

4. a) i) State Kirchoff's laws. **2**

ii) Derive the equation for growth of current in a circuit with resistance R and inductance L. Define the time constant of the circuit. **4**

iii) A condenser is charged through a $2M\Omega$. Resistance with a.d.c. source of emf 2v. It takes 0.5s to acquire ¼ of its maximum charge. Find the capacity of condenser, time constant of circuit and maximum steady charge on condenser. **4**

OR

b) i) A condenser of capacity $0.5\mu f$ is discharged through a resistance of $10M\Omega$. How much time will it take to discharge to half of its charge? (loge=0.6931). **2½**

ii) What is j operator? Explain the use of complex number in A. C. circuit. **2½**

iii) Obtain an expression for growth of charge on capacitor through resistance. **2½**

iv) Using Kirchhoff's law deduce the balance condition of Wheatstone's bridge. **2½**

5. Attempt **any ten** of the following. **1**

a) The magnetic field strength in silicon is 1100 A/m. if the magnetic susceptibility is 0.35×10^{-5}. Calculate magnetization in silicon.

b) Give the origin of magnetism. **1**

c) Define magnetic susceptibility. **1**

d) Define efficiency of transformer. **1**

e) What are the requirements of ideal transformer? **1**

f) Define Lenz's law. **1**

g) Define displacement current. **1**

h) Draw the wave form representing propagation of electromagnetic wave. **1**

i) Define characteristics impedance of medium. **1**

j) Explain Q value of a circuit. **1**

k) Define sharpness of resonance. **1**

l) If the reactance of the inductor is 10Ω at the frequency of $\left(\frac{1}{\pi}\right)H_2$. What is the inductance of coil. **1**

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