

B.Sc. F.Y. (CBCS Pattern) Semester-II
USPHT04 - Physics Paper-II - Magnetostatics and Electromagnetic Waves

P. Pages : 3

Time : Three Hours



GUG/W/24/11591

Max. Marks : 50

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

Either:

1. a) i) State and explain Biot-Savart's law and write it in vector form. 2
- ii) Using Biot Savart's law, obtain an expression for magnetic induction at a point on the axis of circular coil carrying a steady current. 5
- iii) In hydrogen atom, electron is revolving in circular orbit of radius 0.5 \AA with frequency 0.8×10^{15} rps. Find magnetic induction at the centre. 3
Given $q = 1.6 \times 10^{-19} \text{ C}$.

OR

- b) i) Obtain the relation $\mu_r = 1 + x$. 2½
- ii) State and explain Ampere's circuital law. 2½
- iii) Distinguish between diamagnetic, paramagnetic and Ferromagnetic substance. 2½
- iv) What current should be flow in a long wire to produce magnetic field of $0.5 \times 10^{-5} \text{ N / Am}$ at a distance of 20cm from the wire. 2½

Either:

2. a) i) What is transformer? Describe construction and working of transformer. 5
- ii) What are the characteristic of ideal transformer ? 2
- iii) A step down transformer converts a voltage of 2400 volt to 240 volt in transmission line, primary has 1000 turns and efficiency of transformer is 80% and output power is 8 k watt. Calculate (i) number of turns of secondary (2) input power. 3

OR

- b) i) Obtain an expression for self inductance (L) of a single coil. 2½
- ii) Show that mutual inductance $M = \sqrt{L_1 L_2}$ where L_1 and L_2 are self inductance of two closely wound coils. 2½

iii) Show that energy stored in inductor is $\frac{1}{2}LI^2$. 2½

iv) The magnetic flux associated with a coil moving in a magnetic field changes according to equation. 2½

$$\phi = \frac{3t^2}{5} + 10t + g \text{ where } \phi \text{ is in milliweber and time in sec.}$$

Calculate the induced e.m.f in the coil when $t = 10\text{sec}$.

Either:

3. a) i) Write Maxwell's equations. Explain physical significance of each one. 4

ii) State and derive Poynting's theorem. 6

OR

b) i) State characteristics of electromagnetic waves. 2½

ii) Define energy density. Derive the expression for magnetic energy density. 2½

iii) Prove that speed of electromagnetic wave in free space is $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$. 2½

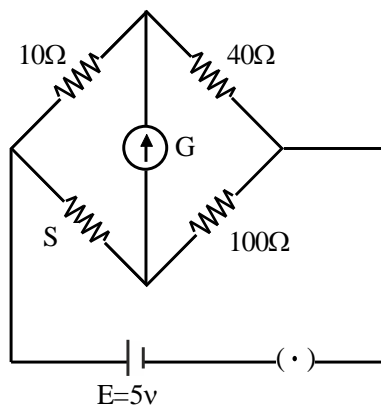
iv) Calculate the value of Poynting vector for a 100 watt lamp at a distance of 1.0m from it. 2½

Either:

4. a) i) Explain construction and working of Carey-Foster bridge. 4

ii) Derive equation of growth and decay of current in LR circuit. 4

iii) Find the unknown resistance from following circuit, when current through galvanometer is zero. 2



OR

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|-------|--|----|
| b) i) | Derive an expression for decay of charges in CR circuit. | 2½ |
| ii) | State and explain Kirchhoff's current and voltage law. | 2½ |
| iii) | Using J-operator method, derive an expression for A-C current in CR circuit connected to emf $E = E_0 \sin \omega t$. | 2½ |
| iv) | A condenser of capacity $1\mu\text{F}$ is charged with a battery of emf 4 volt through $3\text{M}\Omega$ resistance. Find the charge on capacitor after 3 sec. | 2½ |

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

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|----|--|---|
| a) | What is solenoid? State formula for magnetic induction of solenoid along the axis. | 1 |
| b) | Define magnetic permeability. | 1 |
| c) | Define divergence of magnetic field. | 1 |
| d) | State Lenz's law. | 1 |
| e) | State uses of transformer. | 1 |
| f) | Write the name of any two energy losses in transformer. | 1 |
| g) | Write any two uses of electromagnetic waves. | 1 |
| h) | What is displacement current? | 1 |
| i) | What is Poynting vector? | 1 |
| j) | If the pure inductance of coil is 10H and operating frequency is $\frac{1}{\pi}\text{Hz}$. Find inductive reactance. | 1 |
| k) | What is J-operator? | 1 |
| l) | What is time constant of LR circuit? | 1 |
