

B.Sc. F.Y. (NEP) Semester-II  
**BSCPH601 - Core : Magneto Statistics and Electromagnetic waves**

P. Pages : 3

Time : Two Hours



**GUG/S/25/16777**

Max. Marks : 40

- Notes :
1. All questions are compulsory.
  2. Scientific calculator is allowed.

**Either:**

1. A) i) State and explain Biot-Savart's law. Write it in vector form. 3
- ii) Derive an expression for magnetic field due to long straight conductor or wire carrying current using Biot-savart's law. 3
- iii) Find the magnetic field due to circular coil of radius 0.1m and having 200 turns at the centre of coil when the current circulated in it is 500mA. 2

**OR**

- B) a) What are ferromagnetic materials? Mention their characteristics. 2
- b) Derive the relation between permeability and susceptibility. 2
- c) Distinguish between diamagnetic and ferromagnetic material. 2
- d) The maximum value of permeability of material is  $0.126 \text{ N / A}^2$ . What is relative permeability and magnetic susceptibility? 2

**Either:**

2. A) i) What is transformer? Explain step-up and step-down transformer. 3
- ii) Explain any three energy losses in transformer. 3
- iii) A transformer has 300 secondary turns and 400 primary turns. If secondary voltage is 300V. Calculate primary voltage. 2

**OR**

- B) a) State and explain Faraday's law of electromagnetic induction. 2
- b) Differentiate between self-inductance and mutual inductance. 2
- c) Derive an expression for energy stored in inductance. 2
- d) The back e.m.f. in the inductance coil is 200V. When the current in the coil changes from 0 to 2A in 0.01s. Calculate the self inductance of coil. 2

**Either:**

3. A) i) Derive an expression for energy density in electromagnetic field. 4
- ii) Derive  $\vec{\nabla} \times \vec{H} = \mathbf{J} + \frac{\partial \vec{D}}{\partial t}$  2
- iii) If the radius of sun is  $7 \times 10^8$  m and energy emission is  $3.8 \times 10^{26}$  watt / sec. 2  
Calculate the Poynting vector of propagation of energy on surface of the sun.

**OR**

- B) a) Show that electromagnetic waves are transverse in nature. 2
- b) Write Maxwell's equation in differential form in free space. 2
- c) Show that  $\vec{\nabla} \cdot \vec{D} = \rho$ . 2
- d) Define Poynting vector. Write its S.I. unit. 2

**Either:**

4. A) i) Obtain the balancing condition for Wheatstone bridge. 4
- ii) Define capacitive time constant. Show that at capacitive time constant, charges in CR-circuit decreases to 0.3679 of its initial maximum charge 2
- iii) A capacitor of capacitance  $1\mu\text{F}$  is discharged through a resistance of  $1\text{M}\Omega$ . Find the time in which the capacitor charge falls to 50% of its initial value. 2

**OR**

- B) a) Derive an expression of complex impedance in CR circuit. 2
- b) Draw phasor and impedance diagram for an A.C. Circuit containing L and R. 2
- c) What is J-Operator? Explain it. 2
- d) Calculate the impedance of a circuit containing resistor of resistance  $12\Omega$  connected in series with a capacitor of capacity  $25\mu\text{F}$  when the applied emf is domestic A. C. Main. 2

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

- a) What is Lorentz force? 1

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| b) Define Curie temperature.                                       | 1 |
| c) What is magnetic susceptibility?                                | 1 |
| d) What is efficiency of transformer?                              | 1 |
| e) What is ideal transformer?                                      | 1 |
| f) Define electromagnetic induction.                               | 1 |
| g) Write SI unit of magnetic flux density.                         | 1 |
| h) Write equation of continuity.                                   | 1 |
| i) Calculate the frequency of EM wave having wavelength $10^4$ m . | 1 |
| j) Show that unit of L/R is second.                                | 1 |
| k) State Kirchoff's current law.                                   | 1 |
| l) Write the application of Carey-Foster bridge.                   | 1 |

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