Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐

Total No. of Pages : 02

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B.Tech. (Agriculture Engineering)/ (Automobile Engineering)/ (CSE)/ (ME)/ (Sem–1,2)

ELECTROMAGNETISM

Subject Code : BTPH-103-18

M.Code : 75357

Date of Examination : 22-06-2023

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

1. Write briefly :

    a) What do you mean by gradient of a scalar field?

    b) What are different ways in which an emf is induced around a loop?

    c) What do you mean by solenoidal and irrotational field?

    d) Explain why magnetic monopole cannot exist? Also, write an equation for it.

    e) How is Gauss's law dependent on Ampere's circuital law?

    f) Two straight wires are kept in air 2m apart carrying currents 80A and 30A in the same direction. Calculate the force between them and specify its nature.

    g) State Faraday's laws of electromagnetic induction.

    h) Explain the concept of displacement current.

    i) What is the physical significance Poynting vector?

    j) What do you mean by ferromagnetic material?

SECTION-B

2. Derive and discuss the boundary conditions for the electrostatic field.

3. Show that Coulomb's law can be deduced from Gauss's law using symmetry conditions.

4. a) Explain the concept of Maxwell's displacement current and show how it led to the modification of Ampere's law?

   b) If the charge on a proton is 1.6×10^{-19} Coulomb, find the magnitude of the electric field at a distance of 1 Å from the proton.

5. a) What are atomic magnetic moments? Define the terms magnetization, permeability susceptibility and flux density.

   b) Diamagnetic Al_2O_3 is subjected to an external magnetic field of 10^5 A/m. Evaluate magnetization and magnetic flux density in Al_2O_3 (Susceptibility of $Al_2O_3 = -5 \times 10^{5)}$).

SECTION-C

6. a) What is Lenz's law of electromagnetic induction? Explain how the direction of current in a circular loop can be established with the help of Lenz's law?

   b) A square loop of wire of side 5cms is placed in a uniform magnetic field such that the normal to the loop makes an angle of $60°$ with the direction of B. If the magnetic field strength is given by $(0.5 — 0.002t^2)T$. Find the $e.m.f.$ induced in the loop at $t = 2s$.

7. What are Maxwell's equations? Derive Maxwell's equations (differential form). Discuss the integral form of the above equations. What is the significance of these equations to electricity and magnetism?

8. State and Prove that the power of electromagnetic wave leaving a volume is equal to the difference between the rate of decrease in energy stored in electric and magnetic fields and ohmic power dissipated.

9. Explain the reflection and transmission of an electromagnetic wave incident normally on a plane between media of impedance Z_1 and Z_2. Find out the expressions for the reflection and transmission coefficients.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.