

Roll No.

Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (Mechanical Engg.) (2018 & Onwards) (Sem.-1,2)

ELECTROMAGNETISM

Subject Code : BTPH-103-18

M.Code : 75357

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

Write briefly:

- Q1. From the expression of electric field for a continuous volume charge distribution, prove that $\nabla \cdot E = \frac{1}{\epsilon_0} \rho$, where symbols have their usual meanings.
- Q2. Derive the Laplace and Poisson's equations.
- Q3. What do you understand by Electric displacement?
- Q4. Give the Physical significance of divergence and curl of static magnetic field.
- Q5. Derive the expression $H = \frac{1}{\epsilon_0} B - M$ where symbols have their usual meanings.
- Q6. Mention the importance of Lenz's law in explaining Faraday's law of induction.
- Q7. Derive the continuity equation in terms of volume current density.
- Q8. Differentiate between potential and electromotive force.
- Q9. Write Maxwell's equations in vacuum in their integral form.
- Q10. Differentiate between linear, circular and elliptical polarization.

SECTION-B

- Q11. a) Define Uniqueness theorem for Dirichlet and Neumann boundary conditions. 3
b) Derive the expression for electrostatic energy of a charge distribution in vacuum in terms electric field and comment about its (electrostatic energy) characteristics. 5
- Q12. Derive the expression for potential and electrostatic field due to an electric dipole. 8
- Q13. a) Explain the concept of magnetic vector potential. Under what conditions it can be considered as a scalar? 3
b) Discuss the process of magnetization and derive the expression for associated bound currents due to magnetization. 5
- Q14. a) Make a comparison between the characteristics of diamagnetic, paramagnetic and ferromagnetic materials. 4
b) Derive the expression for magnetic field due to a bar magnet. 4

SECTION-C

- Q15. a) Derive the expression for energy stored in a magnetic field. 5
b) How the Ampere's circuital law $\oint \vec{B} \cdot d\vec{l} = \mu_0 \int \vec{J} \cdot d\vec{A}$ was modified for time-dependent electric field. 3
- Q16. State Poynting's theorem of electromagnetism and prove it. 8
- Q17. a) What do you understand by uniform plane waves, give wave equations in terms of E and B and prove the transverse nature of EM waves. 5
b) Derive the relation between electric and magnetic fields of an EM wave. 3
- Q18. Derive the expressions for Reflection and transmission of EM waves from a non-conducting medium-vacuum interface for normal incidence. 8

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.