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3 (Sem-5/CBCS) ELE HC 2

2021

(Held in 2022)

ELECTRONICS

(Honours)

Paper : ELE-HC-5026

(Electromagnetics)

Full Marks : 60

Time : Three hours

**The figures in the margin indicate
full marks for the questions.**

1. Fill in the blanks : 1×7=7

(a) For any vector A , $\nabla \times \nabla \times A$ is _____.

($\nabla \nabla \cdot A - \nabla^2 A / \nabla (\nabla \times A) - \nabla^2 A$)

(b) The electric flux density D is _____.

(ϵE or μE)

Contd.

- (c) Divergence theorem relates surface integral with volume integral as _____.

$$\left(\int_V \nabla \cdot J dV = \oint_S J \cdot dS / \int_V (\nabla \cdot J) dV = J \cdot dS \right)$$

- (d) The characteristics impedance of free space is _____. ($377\Omega / 120\pi^2\Omega$).
- (e) Ampere's circuital law can be derived from _____.
(Gauss's law/Biot-Savart's law)
- (f) The magnetic vector potential is a scalar quantity. (State True or False)
- (g) In a medium if ϵ, μ and σ are constant throughout the medium, then it is known as _____. (dielectric medium / homogeneous medium)

2. Answer the following questions : $2 \times 4 = 8$

- (a) A scalar function V is given by $V = xyz^2$. Find out the gradient of V .
- (b) What do you mean by divergence and curl of a vector ?
- (c) What is a magnetic circuit ?
- (d) State the boundary conditions for an interface between two arbitrary media.

3. Answer **any three** questions from the following : $5 \times 3 = 15$

- (a) Explain in brief the line integral and surface integral.
- (b) What do you mean by uniqueness theorem ?
- (c) State and explain Coulomb's law in electrostatics.
- (d) Write down the statements of the integral form of Maxwell's field equations.
- (e) Derive the wave equations for a conducting medium.

4. Answer **any three** of the following :

$10 \times 3 = 30$

- (a) Derive Laplace's and Poisson's equations. $5 + 5 = 10$
- (b) Explain Gauss's law in electrostatic and also its applications. $7 + 3 = 10$
- (c) What do you mean by uniform plane wave ? Derive the general solution of uniform plane wave equation. $2 + 8 = 10$

(d) State and prove Poynting's theorem. 2+8=10

(e) Describe the equation of continuity for 5+5=10

(i) time-varying electric field

(ii) steady electric field

(f) Write short notes on : 5×2=10

(i) Faraday's law of electromagnetic induction

(ii) Stoke's theorem