Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 30143

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electronics and Communication Engineering

EC 3452 — ELECTROMAGNETIC FIELDS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours 　　　　　　　　　　　　　　　　Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is divergance of a vector field?

2. Calculate the curl of gradient of the scalar field, $V = 3xy - yz$.

3. Define Gauss's Law.

4. What is the significance of Laplacian Operator?

5. Define Ampere's Law.

6. What is the significance of magnetic vector potential?

7. What is the displacement current?

8. What is the significance of Continuity Equation?

9. Define skin depth

10. "X-rays can penetrate the human body, but light cannot". Justify.

PART B — (5 × 13 = 65 marks)

11. (a) Explain different type of coordinate systems along with examples of their use.

Or

(b) Explain Gradient, Divergence and Curl in detail along with examples.

(3 + 5 + 5 = 13)

PART C — (1 × 15 = 15 marks)

16. (a) Three infinite sheets with charge density of 18 nC/m², 9 nC/m² and −24 nC/m² are located at $x = 4$, $y = -3$ and $z = 0$ respectively. Find the electric field intensity at

   (i) (8, 0, 6) and (7.5)

   (ii) (−2, −7, 1). (7.5)

Or

(b) An EM wave travels from a free space to a dielectric medium with dielectric constant $(\varepsilon_r) = 4$ and it incidents normally on the interface. If the electric field of incident wave in free space is given by :

$E_i = E_0 \cos(\omega t - \beta z)a_y V/m$, where $\omega = 3 \times 10^9 \pi$ and $\beta = 10\pi$.

Then, calculate the value of

   (i) reflection coefficient (Γ_E), (3)

   (ii) transmission coefficient (τ_E), (3)

   (iii) the fraction of power transmitted into the dielectric medium and, (3)

   (iv) derive the expression for electric field of the transmitted wave (E_T). (6)

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