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Question Paper Code : 50490

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

Fourth Semester

Electronics and Communication Engineering

EC 8451 — ELECTROMAGNETIC FIELDS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the three types of coordinate system?

2. State divergence theorem.

3. State Gauss law.

4. State Kirchhoff's law.

5. Define torque and write its expression.

6. What is a Ferromagnetic material? Give example.

7. State faraday's law for a moving charge in a constant magnetic field.

8. What is displacement current?

9. Differentiate good conductors and dielectrics.

10. What is group velocity of a wave?

PART B — (5 × 13 = 65 marks)

11. (a) Given the two points $A(x=2, y=3, z=-1)$ and $B=(r=4, \theta = 25°, \varphi =120°)$. Find the spherical co-ordinate of A and Cartesian co-ordinate of B. (13)

Or

(b) Find curl H, if $H = (2\rho\cos\varphi a_\rho - 4\rho\sin\phi a_\varphi + 3a_z)$. (13)

12. (a) Find the total charge inside a volume having a volume charge density as $10z^2 e^{0.1x}\sin\pi y C/m^3$. The volume is defined between $-2\leq x\leq 2$, $0\leq y\leq 1$ and $3\leq z\leq 4$. (13)

Or

(b) If $V=x-y+xy+2z$ V, find E at $(1,2,3)$ and the energy stored in a cube of side 2 m centered at the origin. (13)

13. (a) Derive magnetic field boundary condition, for two different dielectric medias. (13)

Or

(b) Determine magnetic field intensity due to infinitely long conductor using Ampere's law. (13)

14. (a) Derive wave equation and explain the properties of uniform plane waves in free space. (13)

Or

(b) Derive and explain Maxwell's equations both in integral and point forms. (13)

15. (a) Derive pointing vector in integral and point form from Maxwell's equation. (13)

Or

(b) Explain the reflection of plane wave by dielectric medium under normal incidence. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Determine whether the following potential fields satisfy the Laplace's equations:

(i) $V=x^2-y^2+z^2$ (5)

(ii) $V=r\cos\varphi+z$ (5)

(iii) $V=r\cos\theta+\varphi$. (5)

Or

(b) Calculate the inductance of a 10 m length of coaxial cable filled with a material for which $\mu_r=80$ and radii of inner and outer conductors are 1 mm and 4 mm respectively. (15)

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