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Question Paper Code : 20470

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

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. Transform the Cartesian coordinates x = 2, y = 1, z = 3 into spherical coordinates.

2. Prove that curl gradient is zero.

3. Write down the expression for electric field intensity due to various charge distributions.

4. Write Poisson and laplace equation for electric field.

5. State biot savart law.

6. Calculate force between two wires carrying current of 5 A and 10 A in the same direction are placed with their axis 5 cm apart.

7. Find the amplitude of displacement current density inside a capacitor where $\varepsilon r = 600$ and $D = 3*10^{-6} \sin (6*10^6 t - 3464x)a_z$ c/m^2.

8. State faraday's law.

9. State poynting theorem.

10. Write the relation between reflection coefficient and standing wave ratio.

PART B — (5 × 13 = 65 marks)

11. (a) Why coordinate systems are required? Explain in detail about various coordinates systems.

Or

(b) State and prove divergence and stokes theorem.

12. (a) Derive the expression for electric field intensity due to infinite sheet of charge.

Or

(b) Define electric, dipole and derive an expression for potential of a electric Dipole.

13. (a) State amperes law. Derive expression for magnetic field intensity due to solenoid, toroid and coaxial cable using amperes law.

Or

(b) Show that the inductance of the cable is $L = \mu\, l/2\pi \ln (b/a)$.

14. (a) Derive Maxwell equation in point form, integral form and phasor form/ Harmonically time varying field.

Or

(b) Derive the expression for electromagnetic wave equation for free space.

15. (a) Derive the expression for velocity of a wave when the wave propagates in dielectric medium.

Or

(b) Derive transmission and reflection coefficient for the plane waves that incident oblique on Dielectric boundary.

PART C — (1 × 15 = 15 marks)

16. (a) Four point charges of 5 μC are placed in free space at the point (2, 0,0) (–2, 0, 0), (0,2,0), (0,–2,0) m respectively. Determine force on point charge of 30 μC located at a point (0,0,2).

Or

(b) A capacitor is composed of two parallel sheets separated by a sheet of insulating material 3 mm thick and of relative permittivity $\varepsilon_r = 4$. The distance between plates is increased to allow the insertion of a second sheet 5 mm thick and of relevant permittivity ε_{r2}. If the capacitance so formed is 1/3 times of original capacitance calculate ε_{r2}.

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