Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40486

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third/Seventh Semester

Electrical and Electronics Engineering

EE 8391 — ELECTROMAGNETIC THEORY

(Common to : Electronics and Instrumentation Engineering/Instrumentation and Control Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the physical significance of div D?

2. Define electric field intensity.

3. Why water has much greater dielectric constant than mica?

4. What are the significant differences between Poisson's and Laplace's equations?

5. State Gauss law for magnetic field.

6. Write down the magnetic boundary conditions.

7. State the principle of superposition of fields.

8. What is the significance of displacement current?

9. Mention the properties of uniform plane wave.

10. Define intrinsic impedance.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Verify that vector field $\overline{A} = yz\overline{a_x} + zx\overline{a_y} + xy\overline{a_z}$ is irrotational and solenoidal. (6)

(ii) Find the divergence and curl of the following function : $\overline{A} = 2xy\overline{a_x} + x^2z\overline{a_y} + z^3\overline{a_z}$. (7)

Or

(b) (i) Calculate the field intensity at a point on a sphere of radius 3 m, if a positive charge of 2μC is placed at the origin of the sphere. (6)

(ii) Show that the divergence of flux density due to point charge and uniform line charge is zero. (7)

12. (a) A total charge of 10^{-8} C is distributed uniformly along a ring of radius 5 m. Calculate the potential on the axis of the ring at a point 5 m from the centre of the ring. If the same charge is uniformly distributed on a disc of 5 m radius, what will be the potential on its axis at 5 m from the centre? (13)

Or

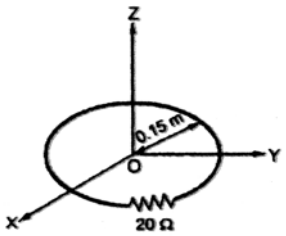
(b) Find the capacitance of (i) Co-Axial Cable (ii) Spherical Capacitor. (13)

13. (a) Find Magnetic field intensity $\overline{H}$, due to a straight conductor of finite length. (13)

Or

(b) Write about the following: (i) Laplace's Equation for scalar magnetic potential, (ii) Vector Magnetic Potential, (iii) Poisson's equation for magnetic field. (5 + 3 + 5)

14. (a) The circular loop conductor having a radius of 0.15 m is placed in X-Y plane. This loop consists of a resistance of 20 Ω as shown in the fig. If the magnetic flux density is $\overline{B} = 0.5\left(\sin 10^3\right)t\overline{a_z}T$. Find current flowing through this loop. (13)



Or

(b) Two parallel conducting plates of area 0.05 m^2 are separated by 2 mm of a lossy dielectric for which $\varepsilon_r = 8.3$ and $\sigma = 8 \times 10^{-4}$ S/m. Given an applied voltage v = 10 sin 10^7 t V. Find total rms current. [13]

15. (a) Derive a wave equation for non dissipative medium making use of Maxwell equations and field vectors E and H. (13)

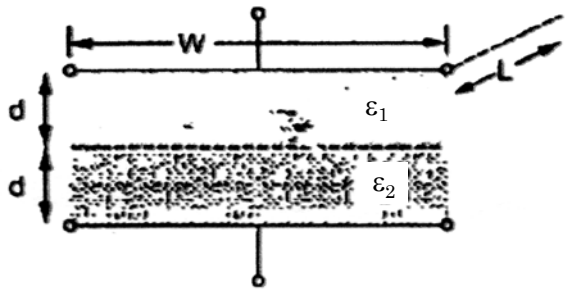
Or

(b) The electric field of a plane electromagnetic wave is given $\overline{E}(z,t) = E_0 \cos(kz - \omega t)\hat{i}$. Find the following quantities: (i) The direction of wave propagation. (ii) The corresponding magnetic field $\overline{B}$. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) For a parallel plate capacitor A = 120 cm^2, d = 5 mm and $\varepsilon_r = 12$. (1) Calculate the capacitance, (2) After connecting a 40V battery across the capacitor, calculate E,D,Q and the total stored energy, (3) The source is now removed and the dielectric is carefully withdrawn from between the plates. Again calculate E, D, Q and the energy, (4) What is voltage between the plates? (8)

(ii) Find the capacitance of the system shown if length of the plate is 'L' meter. (7)



Or

(b) Calculate the internal and external inductances per unit length of a transmission line consisting of two long parallel conducting wires of radius 's' that carry currents in opposite directions. The axes of the wires are separated by a distance d, which is much larger than a. (15)

———————