Code No: 183AU **R22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, February - 2024
ELECTRO MAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a) State Coulumb's Law and mention its limitations. [1]
b) Define electric dipole. [1]
c) Differentiate between conductors and insulators. [1]
d) Define current density. [1]
e) State Biot-savant's law. [1]
f) A solenoid has an inductance of 20 mH. If the length of the solenoid is increased by two times and the radius is decreased to half of its original value, find the new inductance. [1]
g) What is Displacement current? [1]
h) State Faraday's law of electromagnetic induction. [1]
i) Write Maxwell's equation in Phasor form. [1]
j) Write the electromagnetic wave equation. [1]

PART-B

(50 Marks)

2.a) Obtain an expression for potential of a electric dipole in electric field.
b) State Gauss law and mention few applications of it. Find the total charge Q with in the sphere of radius r = 4 m if its volume charge density is $\rho_v = \frac{15}{r\sin\theta}$ C/m^3. [5+5]

OR

3.a) Determine the electric field intensity due to infinite line charge, at a point perpendicular to its plane and at a given distance from the line charge from first principles.
b) Obtain the expression for electric field intensity due to an electric dipole. [5+5]

4.a) Derive Laplace and Poisson equation.
b) A homogeneous dielectric (ε_r= 3) fills region 1(x<0) while region 2 (x>0) is free space. If $\vec{D}_1 = 10\,\mathbf{a_x} - 10\,\mathbf{a_y} + 4\,\mathbf{a_z}$ nC/m^2, find $\vec{D}_2$. [5+5]

OR

5. Derive the Expressions for the Boundary conditions between two perfect dielectrics. [10]

6.a) State Ampere's circuital law and explain any two applications of Ampere's Circuital law.

b) What is the magnetic field, H in Cartesian coordinates due to z-directed current element? Find **J** if I=2A. [5+5]

OR

7.a) Define Magnetic flux, Magnetic flux line and Magnetic flux density and state the relation between Magnetic flux and Magnetic flux density.

b) Explain Scalar and Vector Magnetic potential and their limitations. [5+5]

8. Derive the Maxwell's equations both in integral form and differential form for Time varying fields. [10]

OR

9.a) Write a note on Motional Electromotive forces.

b) A parallel plate capacitor with plate area of 10 cm^2 and a plate separation of 8 mm has a voltage 60 Sin1200t V applied to its plates. Calculate the displacement current if the relative permittivity of the dielctric between the plates is 8. [5+5]

10.a) Deduce the equation of the propagation of the plane electromagnetic waves in free space.

b) Derive Wave equation in Phasor form. [5+5]

OR

11.a) Define poynting vector and derive the expression for poynting theorem.

b) Briefly explain the propagation in good conductors. [5+5]

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