

Code No: 153AR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, April/May - 2023

ELECTROMAGNETIC FIELDS

(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

- Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A**(25 Marks)**

- 1.a) State Coulomb's law. [2]
- b) State Gauss's law and give its expression. [3]
- c) What is Capacitance? Give expression. [2]
- d) What are dielectrics? What is the difference between dielectric and insulators? [3]
- e) Define Self-inductance. [2]
- f) Give the expressions relating B and H with the current density J. [3]
- g) What is displacement current? [2]
- h) What are the different types of emf's produced in a conductor placed in a magnetic field? [3]
- i) What are uniform plane waves? [2]
- j) Define characteristic impedance or intrinsic impedance. [3]

PART – B**(50 Marks)**

- 2.a) Derive the expression for energy density in electrostatic fields.
- b) Two point charges $Q_1 = 2\text{nC}$, $Q_2 = 4\text{ nC}$ are located at points (1,1,1) and (1,0,0) respectively. Determine the potential at point (1,1,0). [5+5]

OR

- 3.a) Obtain an expression for potential of a electric dipole in electric field.
 - b) Calculate the force on a unit positive charge at P(x=2m, y=0) due to the charges Q_1 at origin and Q_2 at (x=1m, y=0) where $Q_1=1000\text{ Pico coulombs}$ $Q_2= -2000\text{ Pico coulombs}$. [5+5]
- 4.a) Derive Laplace and Poisson equation.
 - b) State and prove the boundary conditions at the boundary between two dielectrics in electric fields. [5+5]

OR

- 5.a) Briefly explain the behavior of Conductors and Insulators in electric field.
- b) Explain in detail about Equation of continuity. [5+5]

- 6.a) Derive the expression for the magnetic vector potential in the cases of an infinitely long, straight, conductor in free space.
b) Explain in detail about Biot-Savart's law. [6+4]
- OR**
- 7.a) Using Biot-Savart's law, find the magnetic field intensity on the axis of a circular loop with radius R and carrying a steady current I.
b) State and Explain Ampere's Law. [6+4]
- 8.a) Explain the faraday's laws of electromagnetic induction.
b) Write a note on Motional Electromotive forces. [6+4]
- OR**
9. Derive the Maxwell's equations in good conductors for time varying fields and static fields in point and integral forms. [10]
- 10.a) Derive poynting theorem and give its significance
b) Obtain the plane wave equation in lossy dielectrics. [5+5]
- OR**
- 11.a) Deduce the equation of the propagation of the plane electromagnetic waves in free space.
b) Briefly explain the propagation in good conductors. [5+5]

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