Code No: 133AP **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November/December - 2017
ELECTROMAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) What is Maxwell's First Law? [2]
b) Derive the relationship between potential and electric field intensity. [3]
c) Justify that electric field is conservative. [2]
d) Define current density. Write the relation between current and current density. [3]
e) What is the fundamental difference between static electric and magnetic field lines? [2]
f) A long straight wire carries a current I = 1 amp. At what distance is the magnetic field H= 1A/m. [3]
g) Mention the limitations of scalar magnetic potential. [2]
h) 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. [3]
i) What is the significance of displacement current? [2]
j) Derive Maxwell's equation derived from Ampere's law. [3]

PART-B

(50 Marks)

2.a) If V=2x2y+20z-(4/(x2+y2)) Volts, Find ***E*** and ***D*** at P (6,-2.5,3).
b) Derive Laplace and Poisson equation. [5+5]

OR

3.a) A circular disc of radius 'a' m is charged uniformly with a charge density of σ c/ m^2. Find the electric field at a point 'h' m from the disc along its axis.
b) What is an electric dipole? Obtain expression for torque experienced by an electric dipole in a uniform electric field. [5+5]

4.a) Show the expression of the capacitance for a spherical capacitor consists of 2 concentric spheres of radius 'a'&'b' also obtain the capacitance for an isolated sphere.
b) Find the capacitance of a conducting sphere of 2 cm in diameter, covered with a layer of polyethelene with $\in r = 2.26$ and 3 cm thick. [5+5]

OR

5.a) Derive an expression for capacitance of co-axial cable.
b) In a material for which σ = 5.0 s/m and $\in r$ = 1, the electric field intensity is E = 250 Sin1010t (V/m). Find the conduction and displacement current densities. [5+5]

6.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) Find the magnetic field intensity at the centre of square loop of side 5m carrying 10A of current. [5+5]

OR

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

b) Derive the equation to show that curl of magnetic field intensity in equal to current density. [5+5]

8.a) Show that the force between two parallel conductors carrying current in the same direction is attractive.

b) A magnetic field, $B = 3.5 \times 10^{-2}\ \hat{a}_z$ Tesla, exerts a force on a 0.3m conductor along the x-axis. If the conductor current is 5 A in the $-A_x$ direction, what force must be applied to hold the conductor in position. [5+5]

OR

9.a) Derive the expression for self inductance of a coaxial cable of inner radius 'a' and outer radius 'b'.

b) Determine the inductance of a solenoid of 2500 turns wound uniformly over a length of 0.25m on a cylindrical paper tube, 4 cm in diameter and the medium is air. [5+5]

10.a) Write Maxwell's equations in integral form for time varying Fields.

b) Generalize Ampere's law for time varying fields. [5+5]

OR

11.a) State and explain Faraday's laws of electromagnetic induction.

b) In a material for which $\sigma = 5.0$ s/m and $\epsilon r = 1$, the electric field intensity is $E = 250\ Sin1010t$ (V/m). Find the conduction and displacement current densities, and the frequency at which they have equal magnitudes. [5+5]

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