Code No: 123BY **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November/December - 2016
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) Write the properties of potential function. [2]
b) What is Maxwell's first law? [3]
c) Define electric dipole. [2]
d) Define Convection and conduction current densities. [3]
e) Define Magnetic field intensity. [2]
f) Write the applications of Ampere's circuital law. [3]
g) Write the vector Poisson's equation. [2]
h) What are the applications of permanent magnets? [3]
i) Define time varying fields. [2]
j) How dynamically induced EMF is produced? [3]

PART-B

(50 Marks)

2.a) State and prove Gauss's law as applied to an electric field and determine the field due to an infinite line charge.
b) Derive Poisson's and Laplace equations starting from point form of Gauss Law. [5+5]

OR

3.a) Show that the electric filed intensity at any point inside a hollow charged Spherical conductor is zero.
b) Three point charges each 5 nC are located on the x-axis at points: -1, 0 and + 1 m in free space. (i) Find E at x=5. (ii) Determine the value and location of the equivalent single point charge that would produce the same field at very large distance. [5+5]

4.a) Establish the electrostatic boundary conditions for the tangential components of electric field and electric displacement at the boundary of two non dielectrics.
b) The relative permittivity of dielectric in a parallel plate capacitor varies linearly from 4 to 8. If the distance of separation of plates is 1 cm and area of cross-section of plates is 12 cm^2, find the capacitance. Derive the formula used. [5+5]

OR

5.a) A spherical capacitor with inner sphere of radius 1.5 cm and outer sphere of radius 3.8 cm has an homogeneous dielectric of $\varepsilon = 10\ \varepsilon_0$. Calculate the capacitance of the capacitor. Derive the formula used.
b) Prove that the derivative of the energy stored in an electrostatic field with respect to volume is ½ D.E, where D and E electric flux density and electric field intensity respectively. [5+5]

6.a) State and explain Biot-Savart's law and derive the expression for the magnetic field at a point due to an infinitely long conductor carrying current.

b) What are the limitations of Amperes current law? How this law can be modified to time varying field? [5+5]

OR

7.a) Derive Maxwell's second equation div (B)=0.

b) Derive magnetic field intensity due to a square current carrying element. [5+5]

8.a) Derive the Neumann's formulae for the calculation of self and mutual inductances.

b) Explain the concept of vector magnetic potentials. [5+5]

OR

9.a) Determine the inductance of a toroid.

b) A rectangular coil of area 10 cm^2 carrying a current of 50 A lies on plane $2x + 6y - 3z = 7$ such that the magnetic moment of the coil is directed away from the origin. Calculate its magnetic moment. [5+5]

10.a) Explain concept of displacement current and obtain an expression for the displacement current density.

b) Explain in detail about modification of Maxwell's equations for time varying fields. [5+5]

OR

11.a) Explain Faraday's laws of electromagnetic induction and derive the expression for induced EMF.

b) Derive Maxwell's equations in integral form for time varying Fields. [5+5]

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