Code No: 113BY

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November - 2015
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) Define electric field intensity. Mention any two sources of electromagnetic field. [2M]
b) Give the relation between electric field intensity and electric flux density. [3M]
c) Define the boundary conditions for the conductor- free space boundary in electrostatic and interface between two dielectrics. [2M]
d) What is polarization? Define polarization and Write mathematical equation for polarization. [3M]
e) Draw the magnetic field pattern in and around a solenoid. [2M]
f) A long straight wire carries a current I = 1 amp. At what distance is the magnetic field H= 1A/m. [3M]
g) Define magnetic dipole moment. Sketch the field due to magnetic dipole. [2M]
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. [3M]
i) What is the significance of the ratio of magnitudes of the conduction current density to the displacement current density? [2M]
j) Determine the e.m.f induced about the path r=0.5, z=0, t=0. If B=0.01sin377t. [3M]

PART-B (50 Marks)

2. Derive an expression for the electric field due to a straight and infinite uniformly charged wire of length 'L' meters and with a charge density of $+\lambda$ c/m at a point P which lies along the perpendicular bisector of wire. [10]

OR

3. 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. [10]

4.a) Explain and derive the boundary conditions for a conductor free space interface.
b) Find the total current in a circular conductor of radius 4 mm if the current density varies according to J = $(10^4/r)$ A/m^2 [5+5]

OR

5.a) Derive the boundary conditions of the normal and tangential components of electric field at the interface of two media with different dielectrics.
b) Find the capacitance of a conducting sphere of 2 cm in diameter, covered with a layer of polyethelene with ϵ_r = 2.26 and 3 cm thick. [5+5]

6.a) Derive the magnetic field intensity in the different regions of co-axial cable by applying Ampere"s circuital law.

b) Derive an expression for magnetic field intensity due to a linear conductor of infinite length carrying current I at a distance, point P. Assume R to be the distance between conductor and point P. Use Biot-Savart"s Law. [5+5]

OR

7. Derive a general expression for the magnetic flux density B at any point along the axis of a long solenoid. Sketch the variation of B from point to point along the axis. [10]

8.a) Calculate the self-inductance of infinitely long solenoid.

b) A solenoid is 50 cm long, 2 cm in diameter and contains 1500 turns. The cylindrical core has a diameter of 2 cm and a relative permeability of 75. This coil is co-axial with a second solenoid, also 50 cm long, but 3 cm diameter and 1200 turns. Calculate L for the inner solenoid and L for the outer solenoid. [5+5]

OR

9.a) Derive the expression for inductance of a toroidal coil carrying current I, with N turns and the radius of toroid R.

b) Show that inductance of the cable $L = \frac{\mu l}{2\pi} \ln b/a$ H. [5+5]

10.a) Derive the wave equation starting from the Maxwell's equation for free space.

b) In a material for which σ=5.0 S/m and ϵ_r = 1, the electric field intensity is E=250sin10^{10} t V/m. Find the conduction and displacement current densities, and the frequency at which both have equal magnitudes. [5+5]

OR

11.a) In free space, $\bar{E} = 50\cos(\omega t - \beta x)\bar{a}_z$ V/m. Find the average power crossing a circular area of radius 2.5m in the plane z=0. Assume Em = Hm. ηo and ηo =120$\pi\Omega$.

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

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