Roll No ....

MEMT-102
M.E./M.Tech., I Semester
Examination, December 2014
Electromagnetic Field Theory

Time : Three Hours

Maximum Marks :70

Note : i) Attempt any five questions.

ii) All the questions carry equal marks.

1. Find the capacitance Co of unit length of the cylindrical capacitor two long concentric cylinders with radii 'a' and 'b' ($b > a$). The boundary conditions for the potential are $V(\rho = a) = V_0$ and $V(\rho = b) = 0$.

2. Find the condition under which voltage distribution
    $V(x, y) = a + bx + cy + dx^2 + exy + fy^2$

    Where a, b, c, d, e and f are constants is a solution of Laplace's equation.

3. Given $\overline{E} = E_o \cos(\omega t - ky)\overline{u_z}$ and $\overline{H} = \left(\dfrac{E_o}{Z_o}\right)\cos(\omega t - ky)\overline{u_x}$ in

    a vacuum, find Z_o in terms of E_o and μ_o so Maxwell's equations are satisfied.

4. An air filled rectangular waveguide is needed for operation at 10,000 MHz. It is desired to have single mode operation over 2:1 frequency range, with center frequency 10,000 MHz. It is also desired to have maximum power handling capacity under these conditions. Determine the waveguide dimensions and the attenuation constant of the propagating mode for copper walls.

5. Show that $\psi = (\log \rho)e^{-jkz}$ is a solution to the scalar Helmholtz equation.

6. a) Discuss the properties of Green's function.

    b) Starting from Maxwell's equations, derive the equation of continuity.

7. A circular waveguide has a dominant mode cutoff frequency of 9000 MHz. What is its inside diameter if it is air filled?

8. Write short notes:

    a) Spherical wave function

    b) Reciprocity theorem.

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