B.Tech. (ECE)

Electromagnetic Field Theory

Subject Code: EC-208

Time: 03 Hours Maximum Marks: 60

Section-A

Q. 1

a) Write down the two fundamental laws of electromagnetism.
b) Discuss the inconsistency with Ampere's law.
c) Compare instantaneous, average and complex Poynting vector.
d) Compare a plane wave and uniform plane wave. Write down important properties of plane wave propagating in a free space.
e) Discuss group velocity and phase velocity of a wave inside the waveguide.
f) Define VSWR and reflection coefficient of a transmission line. Also give their minimum and maximum range.
g) Show that a quarter wave transmission line can be an impedance transformer.
h) Define quality factor and its importance in a waveguide.
i) Discuss the limitations of transmission lines at high frequencies.
j) What do you understand by a dielectric slab waveguide?

Section-B

2. State and explain the electrostatic boundary conditions existing at the boundary between two dielectrics.
3. Find the intrinsic impedance, propagation constant and wave velocity for a conducting medium in which σ = 58 MS/m, μ_r = 1, at a frequency of 100×10^6 Hz.
4. Solve the wave equation for uniform plane in an infinitely extending isotropic homogeneous perfect dielectric medium.
5. Derive an expression for the attenuation factor for the TM_{10} wave between parallel conducting planes. Verify that the attenuation is a minimum at frequency which is $\sqrt{3}$ times the cut-off frequency.
6. Measurement on a terminated transmission line gave the following results. VSWR = 3.2. Location of the first voltage minimum = 0.23λ from the load. Characteristic impedance =50 ohm. Calculate the terminating impedance.

Section-C

7. Discuss and derive the reflection by a perfect insulator for normal and oblique incident wave.
8. Derive the Maxwell's equation in differential and integral form; also discuss physical interpretation of Maxwell's field equation.
9. The electric field intensity E in the radiation field of an antenna located at the origin of a spherical co-ordinate system is given by $E = \frac{E_0 sin\theta}{r} \cos(\omega t - \beta r)\, a_\theta$ where E_0, ω and β are constant. Find the power radiated by this antenna placed at the centre of radius r.

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