B. Tech Odd Semester Examination, February, 2023

Electronics & Communication Engineering

(5th Semester)

Course No.: ECE-501

(Electromagnetic Wave)

Full Marks: 50

Pass Marks: 25

Time: 2 hours

Note:
1. Attempt any five questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the right margin indicate full marks for the question.
6. All the mathematical symbols and abbreviations have their usual meanings.

1. (a) A certain transmission line has a characteristics impedance of 50+j0.01 Ω and is terminated in a load impedance of 70+j50 Ω: Compute

   a. The reflection coefficient

   b. The transmission coefficient 3+3=6

   (b) The characteristic impedance of the line Zo is 50Ω, and the SWR= 2.6 when the line is loaded. When the load is shorted, the minima shift 0.15λ toward the load. Determine the load impedance. 4

2. (a) State the Poynting theorem. Write the electric and magnetic wave equations derived from the Maxwell's equations in time and frequency domain. 2+2+2=6

(b) Discuss the wave propagation in conducting medium. 4

3. (a) Describe the plane wave at dielectric interface. 6

(b) What do you mean by reflection and refraction at media interface? 4

4. (a) Derive the Scattering-parameters for H-plane tee. 6

(b) A rectangular metal waveguide filled with a dielectric material of relative permittivity $\varepsilon_{r=4}$has the inside dimensions 3×1.2 cm^2. Find the cut-off frequency for the dominant mode. 4

5. (a) Define the following in terms of an antenna:

a) Radiation Intensity

b) Directivity

c) Gain

d) Bandwidth

e) Isotropic antenna 5

(b) What are antenna field regions? Explain briefly the properties of antenna field regions. 5

6. Derive the expression of average power density and radiation resistance for Hertzian dipole antenna. 3+7=10

7. (a) Discuss the properties of scattering matrix.5

(b) Derive the expression of reflection coefficient at any point along the transmission line. 5

8. (a) A transmission line has the following parameters:

R=2 Ω/m, G= 0.5×10^{-3} mho/m, f=1GHz, L=8×10^{-9}H/m, C=0.23pF. Calculate:

a) Attenuation constant

b) Phase constant 2.5*2=5

(b) The dimension of a rectangular waveguide is $2\times 1\ cm^2$.The frequency is 9 GHz. Find the following:

a) The cut-off wavelength for TE_{10}, TE_{01}, and TE_{11} modes.

b) Guided wavelength. 2.5

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