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Sixth Semester B.E. Degree Examination, June/July 2024
Microwave Theory and Antennas

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With the help of drift velocity graph and wave from, explain the constructional feature and working of n-type GaAs diode. (10 Marks)
- b. A transmission line has the following primary constants $R = 2 \Omega/m$, $L = 8 \text{ nH/m}$, $G = 0.5 \text{ mS/m}$, $C = 0.23 \text{ pF/m}$ and $f = 1 \text{ GHz}$. Find :
 - (i) Characteristic impedance Z_0 .
 - (ii) Propagation constant γ
 - (iii) Wavelength λ .
 - (iv) Phase velocity V_p (10 Marks)

OR

- 2 a. Derive the expression for the voltage of current at any point on the transmission line equation and solution starting from the fundamentals. (10 Marks)
- b. Explain the standing waves with neat waveforms. (10 Marks)

Module-2

- 3 a. Derive scattering parameters for a multiport network. (10 Marks)
- b. The transmission lines of characteristic impedances Z_1 and Z_2 are joined at plane PP' . Express S-parameters in terms of impedances. (10 Marks)

OR

- 4 a. Derive S-matrix for a Magic Tee with neat diagram and its applications. (10 Marks)
- b. Explain the working of precision Dielectric Rotary phase shifter. (10 Marks)

Module-3

- 5 a. Discuss the operation of micro strip lines with its structure. Compare strip line and microstrip line. (10 Marks)
- b. Explain the operation of parallel strip line along with a neat diagram. Write down the expression for characteristic impedance. (10 Marks)

OR

- 6 a. Explain the following terms as related to antenna system :
 - (i) Directivity and gain.
 - (ii) Beam area.
 - (iii) Effective height
 - (iv) Bandwidth (10 Marks)
- b. A radio link has a 15 W transmitter connected to an antenna of 2.5 m^2 effective aperture at 5 GHz. The receiving antenna has an effective aperture 0.5 m^2 and is located 15 km line of sight distance from the transmitting antenna. Assuming lossless, matched antenna, find the power delivered to the receiver. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. $42+8=50$, will be treated as malpractice.

Module-4

- 7 a. Explain the field pattern and phase pattern with a neat diagram. (10 Marks)
 b. Derive an expression and draw the field pattern for an array of two isotropic point sources situated symmetrical with respect to origin with equal amplitude and phase spaced $\frac{\lambda}{2}$ apart. (10 Marks)

OR

- 8 a. Derive an expression for field of a dipole in general for the case of thin linear antenna. (10 Marks)
 b. Find the directivity D for the sources with radiation intensity :
 (i) $U = U_m \sin^2 \theta$, $0 \leq \theta \leq \pi$, $0 \leq \phi \leq 2\pi$
 (ii) $U = U_m \cos^2 \theta$, $0 \leq \theta \leq \frac{\pi}{2}$, $0 \leq \phi \leq 2\pi$ (10 Marks)

Module-5

- 9 a. Derive an expression for field strength E_ϕ and H_ϕ in case of small loop antenna. (10 Marks)
 b. Derive an expression for radiation resistance of a small loop antenna. (10 Marks)

OR

- 10 a. Derive an expression for radiation resistance of a short dipole antenna. (10 Marks)
 b. Explain the different types of horn antenna with a diagram. (10 Marks)

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