CBCS SCHEME

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21EC62

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 he constructional feature and working of n-type GaAs diode. **(10 Marks)**

b. A transmission line has the following primary constants R = 2 Ω/m, L = 8 nH/m, G = 0.5 m ℧/m, C = 0.23 p^F/m and f = 1 GHz. Find :

(i) Characteristic impedance Z_O.
(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 character 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 loss less, matched antenna, find the power delivered to the receiver. **(10 Marks)**

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) $U = U_m \sin^2\theta,\ 0 \le \theta \le \pi,\ 0 \le \phi \le 2\pi$

(ii) $U = U_m \cos^2\theta,\ 0 \le \theta \le \frac{\pi}{2},\ 0 \le \phi \le 2\pi$ **(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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