



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

Max. Marks: 100

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

Module-1

- 1 a. With a neat diagram, explain construction and operation of reflex klystron. (10 Marks)
b. A line of $R_0 = 400\Omega$ is connected to a load of $200 + j300\Omega$ and is excited by a matched generator at 800MHz. Find the location and length of a single stub nearest to the load to produce an impedance match. (10 Marks)

OR

- 2 a. Derive transmission line equations in voltage and current forms. (10 Marks)
b. A telephone line has $R = 6\Omega/\text{km}$ $L = 2.2\text{mh}/\text{km}$ $C = 0.005\mu\text{F}/\text{km}$ and $G = 0.05 \mu \text{ mho}/\text{km}$. Determine z_0 , α , β at 1 kHz. (06 Marks)
c. Define reflection coefficient and standing wave. (04 Marks)

Module-2

- 3 a. Explain the operation of a precision type variable attenuator with a neat sketch. (10 Marks)
b. Draw the diagram of magic tee and derive S-matrix of magic tee. (10 Marks)

OR

- 4 a. Draw the diagram of H-TEE and derive S-matrix for H-tee. (08 Marks)
b. A 20MN signal is fed into one of the collinear port 1 of a lossless H-plane T-junction. Calculate the power delivered through each port when other ports are terminated in matched load. (04 Marks)
c. For a two port network with mismatched load derive an expression for input reflection coefficient. (08 Marks)

Module-3

- 5 a. Define the following terms with respect to antenna:
i) Beam area
ii) Radiation intensity
iii) Directivity
iv) Beam efficiency
v) Effective aperture. (10 Marks)
b. What are the losses in microstrip lines and briefly explain the same? (10 Marks)

OR

- 6 a. Obtain an expression for FRIS transmission formula used in radio communication link. (08 Marks)
b. A radio link has a 15W transmitter connected to an antenna of 2.5m^2 effective aperture at 5GHz. The receiving antenna has an effective aperture of 0.5m^2 and is located at a 15km line of sight distance from the transmitting antenna. Assuming lossless matched antennas find the power delivered to the receiver. (06 Marks)

- c. A source has a radiation intensity pattern given by $U = U_m \sin\theta$. The radiation intensity 'U' has a value only in the upper hemisphere ($0 \leq \theta \leq \pi$) and ($0 \leq \phi \leq 2\pi$). Find total power radiated by the source and directivity. (06 Marks)

Module-4

- 7 a. State and explain the power theorem. (08 Marks)
 b. Derive an expression for total field in case of two isotropic point sources of same amplitude and phase. Plot the relative field pattern when these two isotropic sources are spaced $\lambda/2$ apart. (12 Marks)

OR

- 8 a. Derive an expression for total field for linear array of n isotropic point sources of equal amplitude and spacing. (10 Marks)
 b. Derive the expression for the radiation resistance of short dipole. (10 Marks)

Module-5

- 9 a. Obtain the expression for radiation resistance of small loop antenna. (10 Marks)
 b. With a neat diagram, explain the operation of log 'periodic antenna'. (10 Marks)

OR

- 10 a. Discuss the following antenna types:
 i) Helical antenna
 ii) Yagi uda antenna. (10 Marks)
 b. Explain rectangular horn antenna with a neat diagram. (10 Marks)

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