CBCS SCHEME

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18EC63

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Microwave 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. A reflex klystron operates at 8 GHz with DC beam voltage 300 V repeller space 1 mm for 1¾ mode. Calculate maximum RF output power and corresponding repeller voltage for a beam current of 18 mA. **(10 Marks)**

b. Explain the mechanism of reflex klystron oscillator with a suitable diagram. **(10 Marks)**

OR

2 a. Explain the various modes of oscillations in klystron oscillator. **(10 Marks)**

b. Derive an expression for reflection co-efficient, transmission co-efficient of a transmission line terminated by load impedance Z_L. **(10 Marks)**

Module-2

3 a. Describe the characteristics of H-plane Tee and determine the s-matrix. **(10 Marks)**

b. A 20 MW signal is fed into one of the collinear port 1 of lossless H-plane T-junction. Calculate the power delivered through each port when other ports are terminated in matched load. **(05 Marks)**

c. Write short note on variable attenuator. **(05 Marks)**

OR

4 a. The S-parameter of a two-port network are given by

$$\begin{bmatrix} 0.2\angle 0^\circ & 0.6\angle 90^\circ \\ 0.6\angle 90^\circ & 0.1\angle 0^\circ \end{bmatrix}$$

Prove that the network is reciprocal but not lossless and find the returns loss at port 1 when port 2 is short circuits. **(10 Marks)**

b. Explain the phase shifters with necessary diagrams. **(10 Marks)**

Module-3

5 a. A certain shielded strip line has W = 63.5 mm, t = 35 mm and d = 180 mm with a permittivity of 2.56. Determine characteristic impedance K factor and fringe capacitance. **(08 Marks)**

b. With a neat diagram, explain how radiation and reception of EM wave takes place. **(07 Marks)**

c. Write the losses occur in micro strip lines. **(05 Marks)**

OR

6 a. Calculate the HPBW and FNBW for the field pattern $E(\theta) = COS^2(\theta)$ for $0 \le \theta \le 90^\circ$. **(07 Marks)**

b. Calculate the directivity for $U = U_m \sin\theta \sin^2\phi \quad 0^\circ \le \theta \pi, 0^\circ \le \phi \le \pi$ **(07 Marks)**

c. Derive an expression for effective dielectric constant and characteristics impedance of micro strip line. **(06 Marks)**

Module-4

7 a. Show that the radiation resistance of $\lambda/2$ antenna is 73 Ω. **(10 Marks)**

b. Derive an expression for array factor for an array of n-isotropic point sources. **(10 Marks)**

OR

8 a. Given $E = \cos\left(\frac{\pi}{4}\cos\phi + \frac{\pi}{4}\right)$ of two isotropic point source array. Determine direction of peaks, mills, HPBW and draw the radiation pattern. **(10 Marks)**

b. Derive the far field components of short electric dipole. **(10 Marks)**

Module-5

9 a. Derive an expression for radiation resistance of a small loop antenna. **(10 Marks)**

b. Explain the different types of horn antenna with neat diagram and its applications. **(10 Marks)**

OR

10 a. Determine the length L, H plane aperture and flare angles θ_E and θ_H of a pyramidal horn for which E-plane aperture is 10 λ. Horn is fed by rectangular waveguide with TE 10 mode. Assume S = 0.2 λ in E-plane and 0.375 λ in H-plane. Also, find beam width and directivity. **(10 Marks)**

b. Explain the yagi-uda array antenna in detail. **(06 Marks)**

c. Write the applications of loop antenna. **(04 Marks)**

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