CBCS SCHEME

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18EC63

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Microwave and Antenna

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the operation of Reflex Klystron with the help of neat sketch. **(10 Marks)**

b. Derive the general transmission line equation to find voltage and current on the line interms of Position 'Z' and time 't'. **(10 Marks)**

OR

2 a. Explain the mechanism of oscillation of reflex Klystron. **(08 Marks)**

b. Define reflection coefficient. Derive the equation for reflection coefficient at the load. **(06 Marks)**

c. A transmission line has a characteristic impedance of $50 + j0.01\Omega$ and terminated in a load impedance of $73 - j42.5\Omega$. Calculate :
i) Reflection coefficient
ii) SWR
iii) Transmission coefficient. **(06 Marks)**

Module-2

3 a. Mention the other name of Magic.Tee. Derive S matrix of Magic Tee. **(08 Marks)**

b. With neat diagram, explain the working of precision type variable attenuator. **(06 Marks)**

c. Discuss the following properties of S parameters i) Symmetry of [S] for a reciprocal network. **(06 Marks)**

OR

4 a. Derive the S matrix of E – plane. **(06 Marks)**

b. With a neat diagram, explain the working of precision rotary phase shifter. **(10 Marks)**

c. Derive Smatrix for multiport network. **(04 Marks)**

Module-3

5 a. Derive the characteristic impedance of microstrip line. **(06 Marks)**

b. Define the following terms with respect to antenna :
i) Beam area
ii) Radiation intensity
iii) Beam efficiency
iv) Directivity
v) Radiation resistance. **(10 Marks)**

c. A certain microstrip has following parameters :
$\epsilon_r = 5.23$, h = 7 mils, t = 2.8 mils, w = 10 mils. Calculate the characteristic impedance Z_0 of the line. **(04 Marks)**

OR

6 a. Explain coplanar strip line and shielded strip line. **(10 Marks)**

b. A coplanar strip line carries an average power of 250 MW and a peak current of 100mA. Determine the characteristic impedance of the coplanar strip line. **(04 Marks)**

c. Define effective aperture. Obtain the relationship between directivity and effective aperture. **(06 Marks)**

Module-4

7 a. Obtain the field pattern for two point source situated symmetrically with respect to the origin. Two sources are fed with equal amplitude and equal phase signals. Assume the distance between two sources $d = \lambda/2$. **(06 Marks)**

b. A source has radiation intensity power pattern given by :

i) $U = U_m \sin^2 \theta \quad 0 < \theta < \pi$

$0 < \phi < 2\pi$

ii) $U = U_m \cos^2 \theta \quad 0 < \theta < \pi/2$

$0 < \phi < 2\pi$. **(08 Marks)**

c. Derive an expression for radiation resistance of a short electric dipole. **(06 Marks)**

OR

8 a. Obtain field expression of two isotropic point source of same amplitude but opposite phase. **(06 Marks)**

b. Explain the principle of pattern multiplication with an example. **(08 Marks)**

c. Prove that directivity for a source with unidirectional pattern $U_m \cos^n \theta$ where 'n' can be any number, expressed as $D = 2(n + 1)$. **(06 Marks)**

Module-5

9 a. Obtain the expression for radiation resistance of small loop antenna. **(08 Marks)**

b. Explain Yagi – Uda array with help of diagram. **(06 Marks)**

c. Calculate BWFN, HPBW, directivity and power gain of a uniformly illuminate circular aperture of diameter 8λ. **(06 Marks)**

OR

10 a. Draw the structure of a pyramidal horn antenna. Use the principle of equality of path length and bring out the optimum horn dimension. **(06 Marks)**

b. Determine the length L, H plane aperture and flare angles θ_E and θ_H of a pyramidal horn for which E-plane aperture $a_1 = 10\lambda$. The horn is fed by a rectangular wave guide with TE_{10} mode. Let $\delta = 0.2\lambda$ in E-plane and 0.375λ in the H-plane.

i) What are the beam widths

ii) What is directivity? **(08 Marks)**

c. Calculate BWFN, HPBW, directivity and power gain of a uniformly illuminated circular aperture of diameter 8λ. **(06 Marks)**

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