CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, June/July 2024
Microwaves and Antennas

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive the general transmission line equation to find voltage and current on the line interms of position 'z' and time 't'. **(07 Marks)**

b. Describe the different mode curve in the case of reflex klystron. **(05 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. **(04 Marks)**

OR

2 a. Define relection coefficient. Derive the equation for reflection coefficient at the load end at a distance 'd' from the load. **(06 Marks)**

b. Describe the mechanism of oscillation of reflex klystron. **(06 Marks)**

c. A transmission line has the following parameters : $R = 2\Omega/m$, $G = 0.5mmho/m$, $f = 1GHz$, $L = 8nH/m$, $C = 0.23pF/m$. Calculate : i) characteristic impedance ii) propagation constant. **(04 Marks)**

Module-2

3 a. For a two port network with mismatched load derive an expression for input reflection coefficient. **(06 Marks)**

b. Draw the diagram of Magic–Tee. Derive S–matrix of Magic Tee. **(10 Marks)**

OR

4 a. What is a reciprocal device? Write five point comparison among [S], [Z] and [Y] matrices. **(06 Marks)**

b. Given $[z] = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$. Find S–matrix. **(05 Marks)**

c. Explain coaxial line fixed alternator with a diagram. **(05 Marks)**

Module-3

5 a. A lossless parallel strip line has a conducting strip width W. The substrate dielectric separating the two conducting strips has a relative dielectric constant ε_{rd} of 6 and a thickness d of 4mm. Calculate: i) The required width W of the conducting strip in order to have a characteristic impedance of 50Ω ; ii) The strip-line capacitance. **(04 Marks)**

b. Discuss different types of losses in microstrip lines. **(06 Marks)**

c. Calculate the exact directivity for 3 dimensional source having the pattern $U = U_m \sin^2\theta \sin^3\phi$ where $0 \le \theta \le \pi$, $0 \le \phi \le \pi$. **(06 Marks)**

OR

6 a. Show that maximum effective aperture of a $\lambda/2$ depole antenna is $0.13\lambda^2$. **(06 Marks)**

b. With the aid of schematic diagram explain coplanar strip line. **(05 Marks)**

c. Compute the power received by receiving antenna kept at a distance of 100km by a transmitter radiating at 3MHz. Assume $G_T = 40$ and $G_R = 15$ and $P_T = 1000$ kW. Derive the relation used. **(05 Marks)**

Module-4

7 a. Obtain the fields pattern for two point source situated symmetrically with respect to the origin. Two sources are feed with equal amplitude and equal phase signals. Assume distance between two sources = $\lambda/2$. **(08 Marks)**

b. Derive the expression for radiation resistance of short electric dipole. **(08 Marks)**

OR

8 a. Derive an array factor expression in case of linear array of 'n' isotropic point source of equal amplitude and spacing. **(08 Marks)**

b. Obtain the expression for field of dipole in general for the case of thin linear antenna. **(08 Marks)**

Module-5

9 a. Find directivity and radiation resistance of a loop antenna with diameter of 2λ. **(06 Marks)**

b. Write a short note on Helical antenna geometry. **(06 Marks)**

c. What is the directivity in dB of a rectangular horn antenna, which has physical aperture of $81\lambda^2$, with aperture efficiency 89%? **(04 Marks)**

OR

10 a. Derive radiation resistance of a small single turn circular loop antenna with uniform phase current. **(08 Marks)**

b. Draw the structure of a pyramidal horn antenna. Use the principle of equality of path length and bring out the optimum horn dimensions. **(08 Marks)**

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