CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. List four applications of Reflex Klystron. **(04 Marks)**

b. Derive transmission line equations in voltage and current forms. **(06 Marks)**

c. A transmission line is terminated in a resistive load of 1000Ω and has L = 9μH/m and C = 100pF/m. Calculate reflection coefficient and standing wave ratio. **(06 Marks)**

OR

2 a. Define reflection coefficient. Derive an expression for reflection coefficient at load in terms of characteristic impedance and load impedance. **(08 Marks)**

b. Explain microwave system with the aid of a diagram. **(08 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. Derive characteristic impedance of micro-strip lines. **(08 Marks)**

b. Define the following terms with respect to antennas :
i) Beam area
ii) Radiation intensity
iii) Beam efficiency
iv) Directivity. **(08 Marks)**

OR

6 a. Describe ohmic skin losses and radiation losses in micro-strip lines. **(10 Marks)**

b. A parabolic reflector antenna is circular in cross section with a diameter of 1.22m. If the maximum effective aperture is 55% of the physical aperture, calculate gain of the antenna in dB at 20 GHz. **(06 Marks)**

Module-4

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

b. Obtain filed expression of two isotropic point sources of same amplitude and phase. **(10 Marks)**

OR

8 a. State and explain power theorem. **(06 Marks)**

b. Derive an expression for radiation resistance of short electric dipole. **(10 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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