CBCS SCHEME

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17EC71

Seventh Semester B.E. Degree Examination, Jan./Feb.2021

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. With neat diagram, explain construction and operation of reflex Klystron. **(10 Marks)**

b. Define and derive an expression for reflection coefficient when the transmission line is terminated by load impedence (Z_L). **(06 Marks)**

c. A transmission line working at RF has following constants, $L = 9\ \mu H/m$, C = 16 PF/m the line is terminated in a resistive load of 1000 Ω. Find the reflection coefficient and standing wave ratio. **(04 Marks)**

OR

2 a. Explain the different mode current of reflex klystron. **(06 Marks)**

b. Show the relationship between standing wave ratio and reflection coefficient. **(06 Marks)**

c. A transmission line has the following primary constants per km of the line, R = 8 Ω, G = 0.1 $\mu\mho$, $L = 3.5$ mH and C = 9 nF. Calculate Z_0, α, β, VP and λ at W = 5000 rad/sec. **(08 Marks)**

Module-2

3 a. Define the following losses in microwave interms of s-parameters, (i) Transmission loss (ii) Reflection loss (iii) Return loss (iv) Insertion loss **(06 Marks)**

b. Explain S-matrix representation for multi port network. **(06 Marks)**

c. State the properties of S-parameters, prove the symmetry property and unitary property of S-parameter. **(08 Marks)**

OR

4 a. With a neat diagram, explain rotary precision phase shifter. **(06 Marks)**

b. What is magic tee? Explain magic tee and derive an S-matrix. Mention its application. **(08 Marks)**

c. Explain different types of co-axial connectors in microwave circuits. **(06 Marks)**

Module-3

5 a. What are the losses in microstrip lines? Explain the radiation losses. **(08 Marks)**

b. Show that the maximum effective aperture of a short dipole is $0.119\lambda^2$. **(06 Marks)**

c. Obtain the expression for inductance, capacitance and hence characteristic impedance of a parallel strip line. **(06 Marks)**

OR

6 a. Derive characteristic impedance of microstrip line with diagram. **(06 Marks)**

b. Using power theorem find the directivity for the source with unidirectional cosine square power pattern. $U(\theta,\phi) = U_m \cos^2\theta$. **(06 Marks)**

c. Explain the following parameters with respect to antenna:
(i) Directivity (ii) Beam area (iii) Radiation intensity (iv) Beam efficiency **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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Module-4

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

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

c. A source has a radiation intensity pattern given by $U = U_m \sin\theta$ for $0 \le \theta \le \frac{\pi}{2}$ and $0 \le \phi \le 2\pi$, find the power and directivity. **(06 Marks)**

OR

8 a. Derive an expression and draw the field pattern of two isotropic point sources of same amplitude and phase. **(08 Marks)**

b. Obtain the expression for field of dipole in general for the case of thin linear antenna. **(06 Marks)**

c. For a short dipole $\frac{\lambda}{15}$ long find the efficiency, radiation resistance if loss resistance is 1 Ω and also find the (i) Maximum effective aperture (ii) Efficiency (iii) Radiation resistance. **(06 Marks)**

Module-5

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

b. Determine the directivity of loop antenna having radius 1.0 m when it is operated at 0.9 MHz. **(04 Marks)**

c. Discuss the following:
   (i) Yagi Uda antenna.
   (ii) Log periodic antenna. **(08 Marks)**

OR

10 a. Explain Helical geometry with diagram and practical consideration for the manofillar axial mode helical antenna. **(08 Marks)**

b. Derive the expression of far field equation of small loop antenna, with diagram. **(08 Marks)**

c. Find the radiation resistance of a loop antenna with diameter 0.5 m operating frequency at 1 MHz. **(04 Marks)**

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