CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Mircrowave 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. Discuss mechanism of oscillation in Reflex Klystron with schematic. **(06 Marks)**

b. A Reflex Klystron is to be operated at 10GHz with dc beam voltage 300V, repeller space 0.1cm for $1\frac{3}{4}$ mode. Calculate P_{RFmax} and corresponding repeller voltage for a beam current of 20mA. **(05 Marks)**

c. A transmission line has the following parameters:
R = 2Ω/m, G = 0.5mho/m, f = 1GHz, L = 8nH/m and C = 0.23 PF.
Calculate its characteristics impedance and propagation constant. **(05 Marks)**

OR

2 a. A line of 400Ω is connected to a load of 200 + j300Ω which is excited by a matched generator at 800MHz. Find the location and length of a single stub nearest to the load to produce an impedance match. **(08 Marks)**

b. A certain transmission line has a characteristic impedance of 75 + j0.01Ω and is terminated in a load impedance of 75 + j50Ω. Compute: i) Reflection coefficient ii) The transmission coefficient. **(04 Marks)**

c. What are the high frequency limitations of conventional vacuum tube / transistors? **(04 Marks)**

Module-2

3 a. State and explain the properties of S – matrix. **(07 Marks)**

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

c. A 20mW signal is fed into one of the collinear port 1 of a lossless H-plane T junction. Calculate the power delivered through each port when other ports are terminated in matched load. **(03 Marks)**

OR

4 a. What is magic Tee? Derive its scattering matrix. **(06 Marks)**

b. Discuss different types of coaxial connectors. **(04 Marks)**

c. 2 transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane PP′. Express S–parameters in terms of impedance when each line is matched terminated. **(06 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. Obtain the expression for radiation resistance of small loop antenna. **(08 Marks)**

b. With neat diagram explain the operation of log-periodic antenna. **(08 Marks)**

OR

10 a. Determine the length L_1 H-plane aperture and flare angle θ_E and θ_H of a pyramidal horn for which the E-plane aperture $a_E = 10\lambda$. The horn is fed by a rectangular waveguide with TE_{10} mode. Let $\delta = 0.2\lambda$ in the E plane and 0.375λ in the H plane. Also find what are beam widths and what is the directivity. **(08 Marks)**

b. Discuss the following antenna types (i) Helical Antenna (ii) Yagi-uda-array. **(08 Marks)**

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