

CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, June/July 2023 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. 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:
 $R = 2\Omega/m$, $G = 0.5mho/m$, $f = 1GHz$, $L = 8nH/m$ 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 $200 + j300\Omega$ 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 $75 + j0.01\Omega$ and is terminated in a load impedance of $75 + j50\Omega$. 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. Write short notes on :
i) Attenuator
ii) Phase shifters. (08 Marks)
- b. Explain the properties of S-parameters for junction of ports having common characteristic impedance. (08 Marks)

OR

- 4 a. A 20 MW signal is fed into one of the collinear part 1 of a lossless H plane T junction. Calculate the power delivered through each port when other ports are terminated in matched load. (04 Marks)
- b. Write the characteristics of Magic Tee. Also obtain scattering matrix for Magic Tee. (08 Marks)
- c. Write short notes on : Coaxial connectors and adapters. (04 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.

Module-3

- 5 a. A microstrip line is composed of zero thickness copper conductors on a substrate having $\epsilon_r = 8.4$ $\tan \delta = 0.0005$ and thickness 2.4mm. If the line width is 1mm and operated at 10 GHz, calculate :
- The characteristic impedance
 - The attenuation due to conductor loss and dielectric loss. (08 Marks)
- b. Define the following :
- Beam area
 - Radiation resistance
 - Beam efficiency
 - Radiation intensity. (08 Marks)

OR

- 6 a. Obtain effective aperture and directivity of a half wave dipole. (05 Marks)
- b. Derive Friis transmission formula. (05 Marks)
- c. Obtain relationship between directivity and effective aperture. (06 Marks)

Module-4

- 7 a. Derive an expression and draw the field pattern for an array of 2 isotropic point sources with same amplitude and phase spaced $\lambda/2$ apart. (06 Marks)
- b. Show that the radiation resistance of $\lambda/2$ antenna is 73Ω . (06 Marks)
- c. A source has a radiation intensity power pattern given by $U = U_m \sin^2\theta$ for $1 \leq \theta \leq \pi/2$; $0 \leq \theta \leq 2\pi$. Find the total power and directivity. (04 Marks)

OR

- 8 a. Derive the expressions for the far field components of short dipole. (08 Marks)
- b. Explain the principle of pattern multiplication with an example. (08 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 :
- Helical Antenna
 - Yagi-uda-array. (08 Marks)
