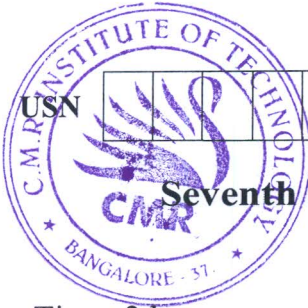


# CBCS SCHEME



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  $400\Omega$  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)

**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  $73\Omega$ . (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  $\theta_E$  and  $\theta_H$  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  $0.375\lambda$  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)

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