CBCS SCHEME

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18EC63

# Sixth Semester B.E. Degree Examination, June/July 2025
## Microwaves 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. Make use of the functional block diagram to explain working of Reflex Klystron Oscillator. **(10 Marks)**

b. Derive the relationship between Reflection coefficient and Transmission coefficient. **(10 Marks)**

**OR**

2 a. Describe the different modes of operation in a Reflex Klystron Oscillator. **(05 Marks)**

b. Assume wave equation and its solution to derive expression for voltage and current at any point on the transmission line **(10 Marks)**

c. A generator of 1 volt, 1000 Hz supplies power to a 100 KM transmission line terminated by $Z_o$ having following parameters.

$R = 10\ \Omega/km$ ; $L = 4$ mts/km ; $G = 0.8 \times 10^{-6}$ ℧/km ; $C = 8nF/km$. Calculate characteristics impedance ($Z_o$) and propogation constant ($\gamma$) **(05 Marks)**

### Module-2

3 a. List out the different types of attenuators. Derive the S matrix for precision type attenuator. **(07 Marks)**

b. Explain different properties of S parameters. **(08 Marks)**

c. Write short notes on Coaxial connector. **(05 Marks)**

**OR**

4 a. Derive S matrix for N – port network. Also list different losses interms of S parameters. **(10 Marks)**

b. Derive S matrix for Magic Tee. **(10 Marks)**

### Module-3

5 a. Discuss the construction and operation of microstrip line. Derive the expression for characteristic impedance Zo of a microstrip line. **(10 Marks)**

b. Discuss briefly : i) Radiation Intensity ii) Beam Area iii) Directivity and Gain iv) Effective Aperture. **(10 Marks)**

**OR**

6 a. Derive characteristic impedance of a parallel strip line. **(06 Marks)**

b. A lossless parallel strip line has copper conducting strip each of width 18 mm separated by quartz dielectric with constant 3.8 and thickness of 2.5 mm. Conductivity of copper is $5.8 \times 10^{-4}$ ℧/m and quartz is $2 \times 10^{-4}$ ℧/m. Frequency of operation is 12 GHz. Find

i) Characteristic impedance Zo ii) Phase velocity of wave propagation
iii) Strip line inductance iv) Strip line capacitance v) Series resistance of dielectric
vi) Shunt conductance of dielectric. **(06 Marks)**

c. Explain radio communication link and derive Friis transmission formula. **(08 Marks)**

## Module-4

7 a. Utilize the concept of arrays of antennas to obtain field pattern for two point source situated symmetric with respect to the origin. Two sources are fed with signals of equal amplitudes and equal phase, assume distance between the two sources is $\lambda/2$. **(10 Marks)**

b. Derive expression for radiation resistance of short dipole with uniform current. **(10 Marks)**

**OR**

8 a. A linear antenna consists of 4 isotropic sources. The distance between the element is $\lambda/2$. The power applied is equal in amplitude and equal in phase. Solve to find HPBW (Half Power Beam Width) and FNBN (Full Null Beam Width). **(10 Marks)**

b. i) Derive the expression for vector retarded potential and Scalar Retarded Potential of an Hertizian Dipole. **(07 Marks)**

ii) A short vertical antenna operates at 900 MHz. If the effective height of antenna is 30m, find the radiation resistance. **(03 Marks)**

## Module-5

9 a. Derive Electric and Magnetic field components of a small loop antenna. **(10 Marks)**

b. Simplify to find the length L , the H plane aperture and flare angles $\theta_E$ and $\theta_H$ of a pyramidal horn antenna for which E – plane aperture is $10\lambda$ fed by a rectangular wave guide with $TE_{10}$ mode. Assume $\delta = 0.2\lambda$ in E-plane and $0.375\lambda$ in the H-plane. Also find E – plane , H – plane beam widths and directivity. **(10 Marks)**

**OR**

10 a. Calculate the parameters of an horn antenna i) Length ii) Width iii) Flare angle ($\theta$) iv) Flare angel ($\phi$) if the mouth height b is $10\lambda$. The horn is fed by a rectangular waveguide with $TE_{10}$ mode. **(05 Marks)**

b. Analyse and explain Helical Geometry and mode of operation of an helical antenna. **(08 Marks)**

c. Analyse and explain constructional features of Yagi Uda Antennas. **(07 Marks)**

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