CBCS SCHEME

USN | | | | | | | | | | | | 18EC63

Sixth Semester B.E. Degree Examination, Feb./Mar. 2022
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. What are the High frequency limitations of Conventional Vacuum Tube? How these are overcome in Microwave Tubes? **(06 Marks)**

b. Explain the working of Reflex Klystron Oscillator along with its Oscillation mechanism. **(08 Marks)**

c. A Transmission line has the following parameters. $R = 2\Omega/m$, $G = 0.5$ ℧/m , $f = 1GHz$, $L = 8nH/m$ $C = 0.23PF$. Calculate
i) The characteristic Impedance ii) The propagation constant. **(06 Marks)**

OR

2 a. Explain the Mode curve of a reflex Klystron Oscillator with relevant diagram and equation. **(08 Marks)**

b. Deduce the expression for reflection coefficient when the transmission line is terminated by the load impedance Z_L. Also establish the relationship between Reflection coefficient and Transmission coefficient. **(06 Marks)**

c. A certain transmission line has a characteristic impedance of $75 + j0.01\Omega$ and is terminated in a load impedance of $70 + j50\Omega$. Compute
i) The Reflection coefficient ii) Transmission coefficient. **(06 Marks)**

Module-2

3 a. Distinguish the important characteristics between a transmission line and a wave guide. **(08 Marks)**

b. State the properties of S – parameters. Why S – parameters are preferred compared to Z and Y parameters for operation in microwave frequencies. **(08 Marks)**

c. A 20 MW 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. **(04 Marks)**

OR

4 a. Define A two – port network and determine the Z – parameters for the same network. **(08 Marks)**

b. Explain the operation of Magic Tee with relevant diagram, when all the ports are terminated with matched load. **(08 Marks)**

c. Write a note on Attenuators. **(04 Marks)**

Module-3

5 a. Explain Parallel Strip line and Coplanar slip line with relevant diagram. **(06 Marks)**

b. State and prove Radio communication link with relevant diagram and equations. **(06 Marks)**

c. Define Directivity. Determine the directivity of a system with radiation intensity $U = U_m \cos^4\theta \sin^2\phi$ for $0 \le \theta \le \pi/2$ and $0 \le \phi \le 2\pi$ using
i) Exact method ii) Approximate method. **(08 Marks)**

OR

6 a. The antenna in the far field receives a power of 15MW placed at a distance of 2km from the transmitter operating at 1GHz. If the gain value are 35dB and 25dB for transmitting and receiving antenna respectively with reference to isotropic antenna. Calculate tied power. **(06 Marks)**

b. Derive the expression for Maximum effective aperture of a short dipole antenna. Compute its directivity. **(08 Marks)**

c. A lossless parallel strip line has a conducting strip of width 'W'. The substrate dielectric separating the 2 conducting strips has a relative dielectric constant $\in_{rd}$ of 6 and a thickness of 'd' of 4mm. Calculate i) Value of 'W', so that $Z_0 = 50\Omega$ ii) Strip line capacitance iii) Strip line inductance iv) Phase velocity of the wave propagating through the line. **(06 Marks)**

Module-4

7 a. Derive the field expressions for a linear array of n – Isotropic Point Sources of equal Amplitude and Spacing. **(10 Marks)**

b. Compute Peak angles, Null angles , Side lobe angles , HPBW , BWFN and draw the field pattern for n = 6 , d = X/2 , $\delta = 0$. **(10 Marks)**

OR

8 a. Derive the field equations and draw the radiation pattern indicating HPBW and FNBW for two point sources fed with equal amplitudes and opposite phase. **(10 Marks)**

b. Derive an expression for radiation resistance of a short dipole. **(10 Marks)**

Module-5

9 a. Define Horn Antenna. Mention its merits and applications of Horn Antenna. **(06 Marks)**

b. Explain Parabolic Reflector Antenna with relevant diagram. **(08 Marks)**

c. The radius of a circular loop antenna is 0.02λ. How many turns of the antenna will give radiation resistance of 35Ω? **(06 Marks)**

OR

10 a. Describe a helical antenna with the help of a neat diagram. Explain its two modes of operation with relevant equations. **(10 Marks)**

b. Illustrate the behavior of Yagi – Uda array antenna with relevant diagram. **(07 Marks)**

c. Find the radiation efficiency of a 1-m diameter loop (C = πm) of 10mm diameter copper wire at i) 1 MHz ii) 10MHz. **(03 Marks)**

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