Total number of printed pages: **Programme (UG) 7th Semester/UECE711A**
2022

Microwave Theory and Techniques

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1	(a)	Given for propagating TE $_{10}$ mode in a rectangular waveguide $(a \times b)$ $H_z = A\cos\frac{\pi x}{a}e^{-j\beta z}$ A/m, where symbols have their usual meanings, find the expressions of E_x, E_y & H_x, H_y. Hence, determine the expression of the wave impedance.	10
	(b)	Explain why a rectangular waveguide is preferred over a square waveguide for usual microwave transmission.	5
	(c)	Explain why TM_{10} or TM_{01} is not possible in rectangular waveguide.	5
2	(a)	A 6 GHz electromagnetic wave propagates in a rectangular waveguide, the separation between the planes being 3cms. Determine the cut-off wavelength of the dominant mode, the guide wavelength of the dominant mode, the corresponding group as well as phase velocities, and the characteristic wave impedance.	10
	(b)	Explain why TE_{10} is called dominant mode.	5
	(c)	Explain why TEM is mot supported by a hollow metallic waveguide	5
3	(a)	What is Scattering Matrix and Explain why 'scattering Matrix' representation of a microwave network is preferred over Z-matrix or Y-matrix representation	5
	(b)	Discuss briefly the different properties of S matrix	6
	(c)	Prove that for a reciprocal network the scattering matrix is a symmetrical matrix.	9
4	(a)	Discuss with neat sketch the operation principle of operation of Precision type variable attenuator.	7
	(b)	Discuss the working principle of a 'Magic-T'	5

	(c)	Obtain the scattering matrix equation of a 'Magic-T' by using the necessary properties of the scattering matrix	8
5	(a)	Explain the working principle of a reflex klystron oscillator.	8
	(b)	Explain what is meant by 'velocity modulation' and how this phenomenon is used in the operation of a klystron tube.	5
	(c)	Draw the power vs repeller voltage and frequency vs repeller voltage characteristics of a reflex klystron. Explain qualitatively.	7
6	(a)	Explain with neat sketch the oscillation mechanism of a magnetron	10
	(b)	Derived the expressions of Hull cut-off magnetic field and Hull cut-off voltage in Magnetron oscillator.	10
7	(a)	Explain the slotted line method for the measurement of unknown Impedance.	8
	(b)	Describe the procedure for measuring (i) VSWR (< 20) and (ii) VSWR (>20) using a VSWR meter in a microwave bench.	12