U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2025 Semester End Make-Up Examinations

Programme: B.E. **Semester: V**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 23EC5PCMTA / 22EC5PCMTA **Max Marks: 100**
Course: Microwave Theory and Antenna

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	CO	PO	Marks
1	a)	Consider a commercial coaxial cable, which is used to connect the typical dish antenna with the set-top box. Deduce the transmission line equations for this scenario. Also, derive the solution for voltage from first principles		*CO 2*	*PO 2*	**10**
	b)	A transmission line has the following parameters: R = 2Ω/m G=0.5mmho/m, L=8nH/m and C=0.23pF/m. The aforementioned line is operating at 1GHz. Compute the characteristic impedance of the line and the propagation constant of this line.		*CO 1*	*PO 1*	**10**
		OR				
2	a)	Consider a commercial transmission line. Deduce the equation for the input impedance in terms of characteristic impedance, load impedance and length of the line		*CO 2*	*PO 2*	**10**
	b)	A lossline line has a characteristic impedance of 50Ω and is terminated by a load impedance of 75Ω. This line is energized by a generator which has an output impedance of 50Ω and an open circuit voltage of 30V (rms). This line is assumed to be 2.25 wavelengths long. Determine • The input impedance of this line • The magnitude of the instantaneous load voltage (c)The instantaneous power delivered to the load		*CO 1*	*PO 1*	**10**
		UNIT - II				
3	a)	Develop the scattering matrix for a general two-port and N-port system. The deduction must include all the necessary equations and the generalized system sketch.		*CO 2*	*PO 2*	**10**

		b)	A magic-T with ports 1, 2 (collinear) and 4 (difference arm) is terminated by impedances which offer reflection coefficients $\Gamma1= 0.5$, $\Gamma2 = 0.6$ and $\Gamma4 = 0.8$ respectively. If 1W power is fed at port 3 (sum arm). Calculate the power reflected at port 3 and power transmitted to other ports.	***CO 1***	***PO 1***	**10**
			OR			
	4	a)	Prove that the impedance and admittance matrices of a reciprocal network are symmetric from first principles. Imagine a 50 ohm transmission line constructed on the industry standard FR4 substrate. Would the S-matrix of this network be symmetric ?	***CO 2***	***PO 2***	**10**
		b)	Consider a H-plane metallic Tee-junction, compute the power delivered to the loads of 40 ohm and 60 ohm connected to arms 1 and 2, when 10mW power is injected to the matched port 3.	***CO 1***	***PO 1***	**10**
			UNIT - III			
	5	a)	Consider a typical commercial 4G-LTE base station which is connected to a mobile device through line of sight link. Derive the transmission link formula for this scenario. Clearly mention the assumptions made	***CO 2***	***PO 2***	**10**
		b)	Consider a point source radiator placed at the origin of a sphere Prove that the total solid angle subtended by radiation beam is equal to 4π steradians. Draw the relevant diagram	***CO 1***	***PO 1***	**10**
			OR			
	6	a)	Evaluate directivity and gain from first principles. Identify the gain values of the antennas for the following situations, the answer could be one of the following: isotropic/ low gain / moderate gain with unidirectional pattern / high gain with narrow beam • Satellite receiver antenna for TV signal reception • WiFi signal illuminating an indoor environment • Point to Point link between antenna towers for cellular communication	***CO 2***	***PO 2***	**10**
		b)	Mention the various antenna apertures? Arrive at the equations for the same	***CO 1***	***PO 1***	**10**

			UNIT - IV			
	7	a)	A dipole antenna has a length of 1.25mm operating at 2.4 GHz. Identify the type of dipole antenna and deduce the far-field component of the Electric field for the same.	***CO 2***	***PO 2***	**10**
		b)	Analyze the radiation patterns of two isotropic point sources with the following excitations : Source 1 = 1.526 W at a phase of 0.005 degrees and Source 2 = 1.526 W at a phase of 0.005 degrees. The reference axis could be assumed as per your convenience. Also, sketch the pattern when both these antennas are separated by one-half wavelength.	***CO 2***	***PO 2***	**10**
			OR			
	8	a)	Deduce the radiation resistance of a short dipole antenna	***CO 2***	***PO 2***	**10**
		b)	Analyze the radiation patterns of two isotropic point sources with the following excitations : Source 1 = 43.265 W and Source 2 = 43.265 W with opposite phase . The reference axis could be assumed as per your convenience. Also, sketch the pattern when both these antennas are separated by one-half wavelength.	***CO 2***	***PO 2***	**10**
			UNIT - V			
	9	a)	Analyze a typical horn antenna with appropriate mathematical equations including the flare angles.	***CO 2***	***PO 2***	**10**
		b)	Evaluate the various feeding methods for a parabolic reflector.	***CO 2***	***PO 2***	**10**
			OR			
	10	a)	Deduce the far-field Electric field patterns of thin linear antenna	***CO 2***	***PO 2***	**10**
		b)	Analyze the steps to design an inset fed patch antenna on a commercial software. Indicate the numerical values at appropriate points to realize a 2.4 GHz patch antenna.	***CO 2***	***PO2***	**10**

****