U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main 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.

		UNIT - I	*CO*	*PO*	Marks
1	a)	List out the various applications of microwaves in both military and commercial domains	*CO 1*	*PO 1*	**06**
	b)	Consider a commercial HDMI cable rated for transmission of 4K videos and Dolby Atmos sound. Identify the transmission line model for this situation and illustrate the appropriate transmission line model with the necessary circuit diagram and voltage equations.	*CO 2*	*PO 2*	**08**
	c)	Derive the relationship between Voltage Standing wave ratio and input reflection coefficient. Consider a commercial WiFi antenna operating at 2.4GHz, this antenna has an input reflection coefficient of -15dB. Compute the corresponding VSWR. Is this a good antenna?	*CO 2*	*PO 2*	**06**
		OR			
2	a)	Elaborate the merits and demerits of microwaves. Analyze the correlation between the microwave oven and SAR values for cellular communication	*CO 1*	*PO 1*	**06**
	b)	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*	**08**
	c)	Two identical 30dB directional couplers are used to sample incident and reflected power in a waveguide. The value of VSWR is 6 and the output of the coupler sampling incident power is 5mw. What is the value of the reflected power?	*CO 1*	*PO 1*	**06**

			UNIT - II			
	3	a)	Explain the construction of an E-plane Tee junction with a rough sketch. Also, deduce the S-parameters for this junction.	***CO 2***	***PO 2***	**10**
		b)	Analyse an isolator based on the concept of Farady rotation with a neat sketch	***CO 2***	***PO 2***	**10**
			OR			
	4	a)	Analyse the working of a H-plane Tee junction with a rough sketch. Also, deduce the S-parameters for this junction.	***CO 2***	***PO 2***	**10**
		b)	A shunt impedance 'Z' is connected across a transmission line with characteristic impedance Z0. Arrive at the S-matrix for this two port network.	***CO 2***	***PO 2***	**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)	Imagine that a 4G LTE wireless network needs a narrow-beam radiation pattern. Sketch the radiation pattern for this scenario and identify the half-power beamwidth and Beam Width between first nulls	***CO 2***	***PO 2***	**10**
			OR			
	6	a)	Explain the physical concept of a dipole antenna and elaborate on its radiation with appropriate sketches and equations.	***CO 2***	***PO 2***	**10**
		b)	What are the various antenna apertures? Arrive at the appropriate equations.	***CO 2***	***PO 2***	**10**
			UNIT - IV			
	7	a)	Deduce the radiation resistance of an antenna whose length is equal to half of wavelength, operating at 2.4GHz.	***CO 2***	***PO 2***	**10**
		b)	Derive the far-field radiation pattern of N isotropic point sources with equal amplitude and energized with opposite phase. Spacing = Half wavelength.	***CO 2***	***PO 2***	**10**

			OR			
	8	a)	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**
		b)	Arrive at the radiation resistance of an antenna charged at its extreme ends and its length is very much less than wavelength.	***CO 2***	***PO 2***	**10**
			UNIT - V			
	9	a)	Deduce the far-field Electric field patterns of thin linear antenna	***CO 2***	***PO 2***	**12**
		b)	Explain the various feeding methods to design a resonant PCB (printed circuit board) antenna operating in the WLAN bands .	***CO 2***	***PO 2***	**08**
			OR			
	10	a)	Analyze a typical horn antenna with appropriate mathematical equations including the flare angles.	***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**

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