U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 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.

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.

			CO	*PO*	Marks
		UNIT - I			
1	a)	List out the various applications of microwaves in both military and commercial domains	*CO 1*	*PO 1*	**10**
	b)	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*	**4**
	c)	A commercial coaxial cable has a characteristic impedance of 75Ω. This cable is integrated with a load of 50-j25 Ω. What is the value of the input reflection coefficient of this line ? Do pure standing waves exist on this line ?	*CO 2*	*PO 2*	**6**
		OR			
2	a)	A LAN cable has a characteristic impedance of 50Ω and is terminated in a load impedance of 75+40j Ω. Calculate the reflection coefficient and VSWR	*CO 1*	*PO 1*	**6**
	b)	Compute the input reflection coefficient and the Voltage standing wave ratio of a 75Ω line, terminated with a 100Ω amplifier. Does the amplifier receive maximum power from the source through this transmission line ?	*CO 2*	*PO 2*	**6**
	c)	List the various IEEE microwave frequency bands. In addition to this list out the carrier frequencies and/or bands for the following commercial services i).WiFi ii). GPS iii). 4G-LTE iv).5G FR1 v).5GFR2 bands	*CO 1*	*PO 1*	**8**

			UNIT - II			
	3	a)	Illustrate the concept of a Faraday rotation isolator with necessary diagrams.	***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**
			OR			
	4	a)	A magic-T with ports 1, 2 (collinear) and 4 (difference arm) is terminated by impedances which offer reflection coefficients $\Gamma 1 = 0.5$, $\Gamma 2 = 0.6$ and $\Gamma 4 = 0.8$ 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**
		b)	Prove that it is impossible to construct a perfectly matched, lossless, reciprocal three-port junction from first principles. Clearly state the properties used to prove this statement	***CO 1***	***PO 1***	**10**
			UNIT - III			
	5	a)	Explain the physical concept of radiation with appropriate sketches and equations.	***CO 2***	***PO 2***	**8**
		b)	Apply the concept of Power theorem to an isotropic point source, and hence deduce the Poynting vector in terms of the radiated power from first principles.	***CO 2***	***PO 2***	**6**
		c)	Define the terms (i) Radiation intensity and (ii) Beam efficiency. Also, evaluate the maximum permissible value for beam efficiency	***CO 1***	***PO 1***	**6**
			OR			
	6	a)	Derive the effective height of the antenna in terms of radiation resistance and effective aperture	***CO 2***	***PO 2***	**10**
		b)	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**

			UNIT - IV			
	7	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 = 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 an antenna whose length is equal to half of wavelength , operating at 2.4GHz.	***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 .The sources are energized at 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)	Analyse the construction and working principle of a typical Yagi Uda antenna	***CO 1***	***PO 1***	**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***	***PO 2***	**10**
			OR			
	10	a)	Illustrate and explain the various feeding methods for a parabolic reflector.	***CO 1***	***PO 1***	**10**
		b)	Illustrate with a neet diagram, the working of Horn Antenna and parabolic Reflectors.	***CO 2***	***PO2***	**10**

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