U.S.N.										

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

Autonomous Institute Affiliated to VTU

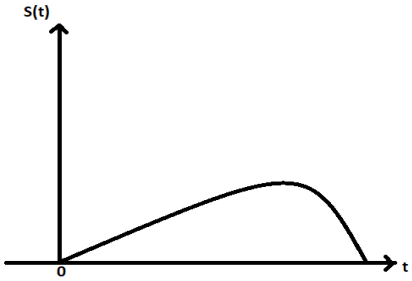
July 2023 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Electronics & Telecommunication Engineering **Duration: 3 hrs.**
Course Code: 19ET6PCMWR **Max Marks: 100**
Course: Microwaves & Radar **Date: 10.07.2023**

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)		Design a quarter wave transformer to match a load of 200Ω to a source resistance of 500 Ω operating at a frequency of 200MHz.	*CO2*	*PO1*	**05**
	b)		Match a complex load impedance of Z_L=200+j200 Ω to 100 Ω using quarter wave line?	*CO3*	*PO2*	**06**
	c)		Determine the length ρ of the horn, H plane aperture and flare angles Θ_E and Θ_H of a pyramidal horn for which E plane aperture is 10λ. The horn is fed with a rectangular waveguide of TE_{10} mode. Let δ = 0.2λ in E-plane and 0.375λ in H plane. Calculate beam width and directivity.	*CO2*	*PO1*	**09**
			UNIT - II			
2	a)		A four-port network has the scattering matrix as follows: $\begin{bmatrix} 0.178\angle 90° & 0.6\angle 45° & 0.4\angle 45° & 0 \\ 0.6\angle 45° & 0 & 0 & 0.3\angle -45° \\ 0.4\angle 45° & 0 & 0 & 0.5\angle -45° \\ 0 & 0.3\angle -45° & 0.5\angle -45° & 0 \end{bmatrix}$ i. Is the network lossless? ii. Is this network reciprocal? iii. What is the return loss at port 1 when all other ports are terminated with matched loads?	*CO3*	*PO2*	**10**
	b)		Design an L-section matching network to match a series RC load with an impedance Z_L = 200-j100Ω to a 100 Ω line at a frequency of 500 MHz.	*CO3*	*PO3*	**10**
			OR			
3	a)		Design a three-section binomial transformer to match a 200Ω load to a 100 Ω line and calculate the bandwidth for Γ_m=0.05.	*CO3*	*PO3*	**10**
	b)		Design a three-section Chebyshev transformer to match a 200 ohm to a 100 Ω line with Γ_m=0.05.	*CO3*	*PO3*	**10**

			UNIT - III			
	4	a)	A lossless T-junction power divider has source impedance of 50Ω. Find the output powers are in the ratio 1:1. Compute the reflection co-efficients seen looking into the output ports. Fig 4a	*CO3*	*PO3*	**08**
		b)	Design an equal split Wilkinson power divider for a 50 Ω system impedance at frequency fo.	*CO4*	*PO3*	**08**
		c)	A 20 dBm power source is connected to the input of a directional coupler having a coupling factor of 20 dB, a directivity of 30 dB, and an insertion loss of 0.5 dB. If all ports are matched, find the output powers (in dBm) at the through, coupled, and isolated ports..	*CO3*	*PO2*	**04**
			OR			
	5	a)	Conduct even-odd mode analysis of the Ring Hybrid.	*CO1*		**07**
		b)	Design a maximally flat LPF with a cut-off frequency of 2 GHz, impedance of 50Ω and at least 15dB insertion loss at 3 GHz. Compute and plot the amplitude response and plot the amplitude response and group delay for f=0 to 4 GHz and compare with an equal ripple (3.0 dB ripple) and linear phase filter having the same order.	*CO3*	*PO3*	**08**
		c)	Design the width of region for an Si Read diode for operation at 10GHz.	*CO3*	*PO3*	**05**
			UNIT - IV			
	6	a)	Derive RADAR Range Equation.	*CO1*		**08**
		b)	The speed of a missile toward a radar is 500 m/s. Assume an X-band radar operating at a frequency of 10 GHz. i) Calculate the exact Doppler frequency at the receiver. ii) Calculate the receiver Doppler frequency assuming $v_r=c$.	*CO2*	*PO1*	**06**
		c)	Consider a low PRF pulsed radar with a PRF of 1500 pps and a bandwidth of 0.5 MHz. Calculate the maximum unambiguous range, pulse width, range resolution, and the duty factor.	*CO2*	*PO1*	**06**
			UNIT -V			
	7	a)	Consider the pulse shape as shown. Obtain the impulse response of the filter matched to this pulse.  	*CO3*	*PO2*	**08**

		b)	If an aircraft is present in a certain area, a radar correctly registers its presence with probability 0.90. if it is not present, the radar falsely registers an aircraft presence with probability 0.2. we assume that an aircraft is present with probability 0.1. What is the probability of false alarm (a false indication of aircraft presence), and the probability of missed detection (nothing registers, even though an aircraft is present)? What is the probability that an aircraft is present given that the radar registers a presence?	*CO2*	*PO1*	**06**
		c)	Differentiate between SW1, SW2 and SW3, SW4 Swerling models.	*CO2*	*PO1*	**06**

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