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

Autonomous Institute Affiliated to VTU

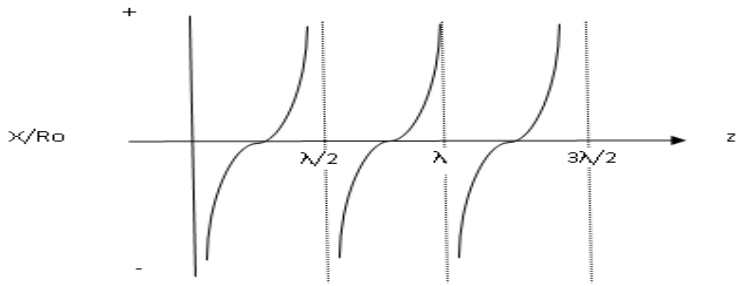
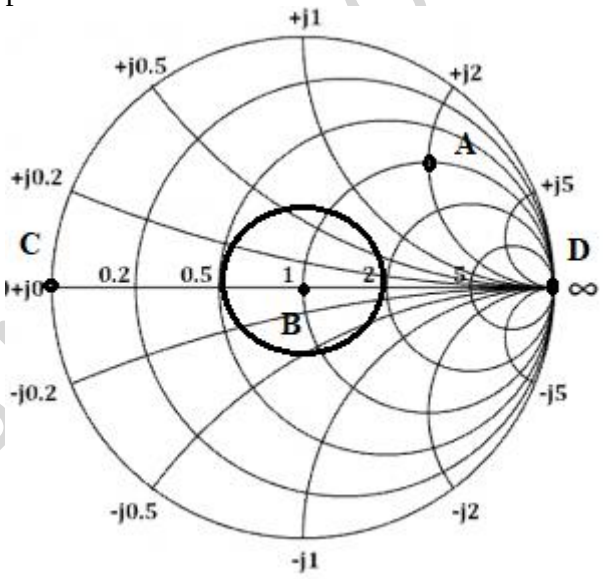
January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Engineering & Telecommunication Engineering **Duration: 3 hrs.**
Course Code: 19ET5PCTLA **Max Marks: 100**
Course: Transmission Lines and Antennas

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)	Show that a line of finite length, terminated in load equivalent to its characteristic Impedance, appears as an infinite line to the sending end generator.	*CO2*	*PO1*	**10**
	b)	The propagation constant of a distortion less line was found to be 0.01+ j0.02. If L=4mH/km and C = 6.25nF/Km, determine the other line constants, phase velocity, characteristic impedance and show that it is a pure resistance.	*CO2*	*PO1*	**10**
		OR			
2	a)	Define insertion loss. Derive the expression for insertion loss of a uniform transmission line.	*CO2*	*PO1*	**10**
	b)	A transmission line of length 15km operated at a frequency of 1kHz has the characteristic impedance of $550\angle -50^{o}$ and the propagation constant of $0.05\angle 25^{o}$. Obtain the equivalent π section of the line.	*CO2*	*PO1*	**10**
		UNIT - II			
3	a)	Derive the expression for the input impedance of a quarter –wave transmission line. Match a load with impedance of 200Ω to be 50Ω using a quarter-wavelength transformer.	*CO2*	*PO1*	**7**
	b)	Explain single stub matching. A dissipation less transmission line is feeding a load impedance in such a way as to produce reflections with reflection coefficient of $0.5\angle 30^{o}$.Calculate the location and length of a short circuited stub so as to match the line to the load, if the line is operated at 1GHz.	*CO2*	*PO1*	**8**

		c)	The plot of the reactance curve as a function of the length of the line is as shown. Analyze the plot to show that the transmission line can be used a reactive circuit elements.  	*CO3*	*PO2*	**5**
			OR			
	4	a)	Discuss how standing waves are formed on an open circuited dissipation less RF line. Determine the load impedance and the standing wave ratio, given that the dissipation- less line has a characteristic impedance of 500Ω and that the reflection coefficient K=0.4∟-50°.	*CO2*	*PO1*	**7**
		b)	Derive the expression for a single stub impedance matching on a transmission line.	*CO2*	*PO1*	**8**
		c)	Analyze the given figure to find the voltage standing wave ratio and the reflection coefficient on the line. Find the impedance at point A. What does point B represent? Identify the short circuit point.  	*CO3*	*PO2*	**5**
			UNIT III			
	5	a	A Coaxial cable of copper is having a conductivity of 5.75 x 10^7 mho/m. The diameter of the inner conductor 4mm and the outer diameter of the outer conductor is 13mm. The space between the two conductors is filled with a dielectric material of ε_r =8.6.The line is said to have a capacitance of 500pf/m and an a.c resistance of 5Ω/km, at a certain frequency. Determine i) the inductance ii)	*CO2*	*PO1*	**10**

			inner radius of the outer conductor, iii) d.c resistance and iv) frequency of operation.			
		b	The ratio of spacing 'd' to the radius 'a' of an open wire dissipation less line is 20 and the space between the conductors has a dielectric of relative permittivity of 6.3. Determine i) inductance ii) Capacitance iii) Characteristic impedance iv) phase velocity when the line is excited by a source.	*CO2*	*PO1*	**6**
		c	Explain the skin effect. What are the measures to reduce it?	*CO1*		**4**
			OR			
	6	a	An open-wire line of 60MHz is to be built of copper wire of radius 1.632mm and have Ro=425ohms a)find the desired spacing between the two wires b) L c) C d) Z0 and e)phase velocity if the line is dissipation less.	*CO2*	*PO1*	**10**
		b	What are the parameters that determine the performance of the transmission line? If the signal level and the noise level on a telephone line of 4000 Hz bandwidth are 20 v and 6 mv respectively, find the channel capacity of the line.	*CO2*	*PO1*	**6**
		c	Compare fiber optic cable over copper as a transmission medium.	*CO1*		**4**
			UNIT - IV			
	7	a)	Derive the expression to show the relation between the directivity and effective aperture. Hence obtain the effective aperture of an isotropic antenna.	*CO2*	*PO1*	**6**
		b)	Find the power radiated by a 10cm dipole antenna operated at 50MHz with an average current of 5mA.How much average current would be needed to radiate power of 1 W.	*CO2*	*PO1*	**6**
		c)	Four isotropic point sources separated by $\lambda/2$ are placed along a linear array. The power applied is of equal amplitude and phase difference $-d_r$. Obtain the field pattern.	*CO2*	*PO1*	**8**
			OR			
	8	a)	Compare the two field zones of an antenna. Let a directional antenna have a maximum electrical dimension of 50m and is operating at 100MHz. A field is measured at 1km from the antenna. Is it near or the far field?	*CO2*	*PO1*	**6**
		b)	Consider an isotropic antenna radiating in the free space. The total electric field measured at a distance of 150m from the antenna is 5.535V/m. Find the power radiated and the power density.	*CO2*	*PO1*	**6**

		c)	Derive Frii's transmission formula. Obtain the maximum power received at a distance of 0.5 km over a free space 1GHz circuit consisting of a transmitting antenna with 25dB gain and receiving antenna of gain 20 dB. The gain is with respect to isotropic Source. The transmitted antenna output is 50watts.	*CO1*	*PO1*	**8**
			UNIT - V			
	9	a)	Derive the expression for the electric and magnetic fields of a short dipole.	*CO2*	*PO1*	**10**
		b)	Derive an expression for radiation resistance of a small loop antenna. The radius of a circular loop antenna is 0.02λ. How many turns of antenna will give a radiation resistance 0f 35Ω.	*CO2*	*PO1*	**10**
			OR			
	10	a)	Derive an expression for radiation resistance of a short electric dipole	*CO2*	*PO1*	**10**
		b)	A dipole antenna of length 5cm is operated at a frequency of 100MHz with terminal current I_o = 120mA. At time t = 1 sec, angle $\theta = 45^o$ and distance r= 3m, find Hφ, Er, and Eθ.	*CO2*	*PO1*	**10**

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