Total number of printed pages: 2 **UG/4th/UECE401**

2024

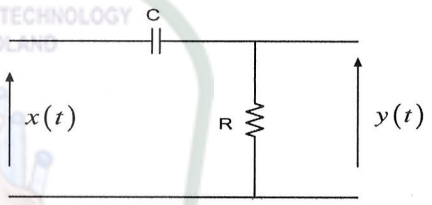
ANALOG COMMUNICATION

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	$x(t)=e^{-\frac{t}{\tau}}\times u(t)$ is applied as input to an L-section high-pass RC filter with a time constant of 'τ' seconds. Find the energy spectral density (ESD) at the output of the filter. Also express the output signal energy as a percentage of the input signal energy. 	7+3
	b)	Prove that the system bandwidth (B) and rise time (t_r) are related by $t_r \cong \frac{0.35}{B}$; where the symbols have their usual meaning.	10
2.	a)	Discuss the operation of a balance modulator in connection with the generation of DSB-SC signal. How the circuit is capable of suppressing the effect of carrier alone? Explain the filtering operation by the output tank circuit.	6+1+3
	b)	What condition is to be satisfied for diagonal clipping not to occur in envelope detector? Hence prove that $R_L \times C \leq \frac{\sqrt{1-m^2}}{m\times\omega_m}$; where the symbols have their usual meaning.	3+7
3.	a)	Show that Hilbert transforming an input signal is equivalent to change its output phase by ± 90 deg. What is the main limitation of the Hilbert transformer?	7+1
	b)	Derive the condition on the filter transfer function necessary to demodulate a VSB signal.	12
4.	a)	Derive the time domain representation of upper single sideband modulated suppressed carrier signal (USSB-SC)	10
	b)	Discuss the direct method of generation of WBFM (Wide Band Frequency	10

		Modulation) using reactance modulator.	
5.	a)	Discuss the operation of a dual-slope balanced discriminator. Hence, discuss the working of a Foster-Seeley discriminator using phasor diagrams.	3+7
	b)	Give the necessary theory behind the demodulation technique of FM signal using a linear phase locked loop (PLL).	10
6.	a)	Show that the FOM (Figure of Merit) for a linear modulation system is given by $FOM = \frac{1}{\gamma} \times \left(\frac{S}{N}\right)_D$; where 'γ' is the channel SNR and the suffix 'D' stands for destination.	8
	b)	Prove that $FOM = 1$ for a DSB-SC system, assume that the zero-mean white noise channel PSD (power spectral density) is '$\frac{\eta}{2}$'.	12

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