U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

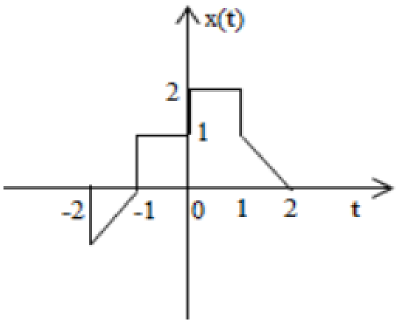
Programme: B.E. — **Semester: III**

Branch: Electronics & Telecommunication Engineering — **Duration: 3 hrs.**

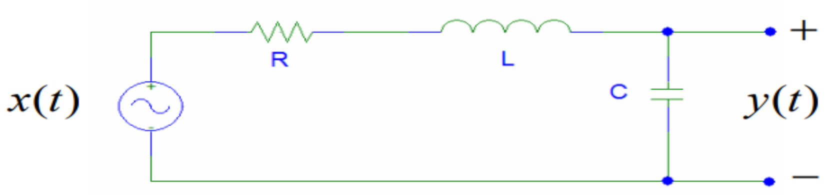
Course Code: 23ET3PCSSA — **Max Marks: 100**

Course: SIGNALS AND SYSTEMS: ANALOG

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			CO	PO	Marks
		UNIT - I			
1	a)	Classify the signals with an example each.	CO1		**10**
	b)	A continuous time signal x(t) is shown in fig (1b).  fig (1b) sketch and label each of the following signal: i) x(t-1) ii) x(2-t) iii)x(t)[δ(t+3/2) - δ(t-3/2)] iv) x(2t+1)	CO2	PO1	**10**
		OR			
2	a)	List the various operations performed on independent and dependent variables with an example.	CO1	-	**10**
	b)	Justify whether the following system are linear or nonlinear, time invariant or not, causal or noncausal, stable or unstable. (i) y(t) = t x(t) (ii) y(t) = x(t) u(t).	CO2	PO2	**10**
		UNIT - II			
3	a)	List the basic properties of convolution integral with example.	CO2	PO1	**04**
	b)	Consider two continuous signals x(t)= e^{-3t}[u(t)-u(t-2)] and h(t)= e^{-t} u(t);	CO2	PO1	**08**

			(i) Evaluate y(t) using convolution integral (ii) Check h(t) is causal or not.			
		c)	The impulse response of a continuous-time LTI system is given by: $h(t)=e^{-t}u(t+1)$ Analyze if the system is causal and explain its stability characteristics.	*CO2*	*PO2*	**08**
			OR			
	4	a)	List the difference between auto correlation and Cross correlation.	*CO2*	*PO1*	**04**
		b)	Perform the convolution operation of the following signals $x_1(t)=e^{-\|t-2\|}$ and $x_2(t)= e^{-2t}u(t+4)$ and plot the output	*CO2*	*PO1*	**08**
		c)	The input x(t) and impulse response h(t) of a continuous time LTI system as x(t)=u(t) and $h(t)=e^{-at}u(t)$. Compute the output y(t)	*CO2*	*PO2*	**08**
			UNIT - III			
	5	a)	Show how to compute the Fourier Transform of a periodic signal using its Fourier series coefficients.	*CO3*	*PO1*	**05**
		b)	Compute the Fourier series coefficients for the periodic square wave given by: $$x(t) = \begin{cases} A, & 0 \le t < T/2, \\ -A, & T/2 \le t < T, \end{cases}$$ where T is the period of the signal.	*CO3*	*PO1*	**08**
		c)	Verify the Parseval's theorem for the signal $x(t)=e^{-t}u(t)$.	*CO3*	*PO2*	**07**
			OR			
	6	a)	Define the magnitude spectrum and phase spectrum of a signal. Explain their significance in analyzing signals.	*CO3*	*PO1*	**05**
		b)	Determine the magnitude and phase spectrum of the signal $x(t)=e^{-2\|t\|}$	*CO3*	*PO1*	**08**
		c)	Find Power spectral density of unit step function.	*CO3*	*PO2*	**07**
			UNIT - IV			
	7	a)	For the transfer function, $$H(s) = \frac{1}{s^2+2s+5}$$ plot the poles and zeros and comment on the damping and oscillatory nature of the system.	*CO3*	*PO2*	**07**

		b)	Derive the transfer function H(s) of a system whose input-output relationship is governed by the differential equation: $$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = 3x(t)$$	CO3	PO1	**05**
		c)	For the transfer function, $$H(s) = \frac{1}{s+2}$$ determine its magnitude and phase response. Plot the frequency response.	CO3	PO2	**08**
			OR			
	8	a)	Find Transfer function of 	CO3	PO2	**07**
		b)	Explain the concept of block diagram representation of systems with respect to direct form-I and direct from-II.	CO3	PO1	**05**
		c)	Solve the differential equation $$\frac{dy(t)}{dt} + 3y(t) = 2x(t) \text{ for } x(t) = e^{-t}u(t)$$ using the Laplace Transform.	CO3	PO2	**08**
			UNIT - V			
	9	a)	Why the Butterworth filter referred to as a "maximally flat" filter? Provide a brief explanation.	CO4	PO1	**04**
		b)	Given the attenuation requirements for a Butterworth filter at fp=3 kHz (passband) and fs=15 kHz (stopband), with Ap=1dB and As=45 dB, calculate the minimum order of the filter.	CO4	PO3	**08**
		c)	Design a first-order Butterworth high-pass filter with a cutoff frequency of 1 kHz. Specify the component values.	CO4	PO3	**08**
			OR			
	10	a)	Explain practical implementation of first order Butterworth Low pass filter.	CO4	PO1	**04**
		b)	A low-pass Butterworth filter has the following specifications: • Cutoff frequency: fc=2 kHz	CO4	PO3	**08**

			• Passband ripple: Ap=1 dB, • Stopband attenuation: As=40 dB at fs=16 kHz Calculate the order of the filter and sketch the approximate magnitude response.			
		c)	Design a first order Butterworth low-pass filter with a cutoff frequency of 2 kHz. Specify the component values.	*CO4*	*PO3*	**08**

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