U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 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.

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)	A signal is defined as follows : $x(t)=\begin{cases}1;-1\le t\le 0\\(t+1);0\le t\le 1\\(-t+3);1\le t\le 2\\1;2\le t\le 3\\0;elsewhere\end{cases}$ sketch (i) x(t) (ii) $x(-\frac{1}{2}t+2)$ (iii) x(-2t-3)	CO3	PO2	**10**
	b)	Determine whether the following signals are periodic or not periodic. (i) $\cos t+\sin\sqrt{2}t$ (ii) $e^{-3t}u(t-2)$ (iii) $2u(t)+2\sin 2t$ (iv) $u(t)-\frac{1}{2}$ (v) $\sin^2 t$	CO3	PO2	**10**
		OR			
2	a)	Prove the following with respect to convolution operation: (i) $x(t)*\delta(t)=x(t)$ (ii) $x(t)*\delta(t-t_0)=x(t-t_0)$	CO2	PO1	**10**

			(iii) $x(t)*u(t)=\int_{-\infty}^{t}x(\tau)d\tau$ (iv) $x(t)*u(t-t_0)=\int_{-\infty}^{t-t_0}x(\tau)d\tau$			
	b)		Determine whether following are energy or power signals. (i) $x(t)=e^{-3t}u(t-2)$ (ii) $x(t)=tu(t)$	*CO3*	*PO2*	**06**
	c)		Evaluate the following integrals (i) $\int_{-\infty}^{\infty}\delta(t+3)e^{-t}dt$ (ii) $\int_{-\infty}^{\infty}(t-3)^2\delta(t-3)dt=0$	*CO3*	*PO2*	**04**
			UNIT - II			
3	a)		If $x(t)=\begin{cases}1;0\le t\le 2\\0;otherwise\end{cases}$ and $h(t)=\begin{cases}1;0\le t\le 3\\0;otherwise\end{cases}$ Evaluate x(t)*h(t) and plot the output	*CO3*	*PO2*	**10**
	b)		An overall impulse response of a system is given by $h(t)=h_1(t)*[h_5(t)+h_2(t)*\{h_3(t)+h_4(t)\}]$ (i) Draw block diagram of the system (ii) Find h(t) if $h_1(t)=h_2(t)=5\delta(t)$ and $h_3(t)=h_4(t)=h_5(t)=u(t)$	*CO3*	*PO2*	**10**
			OR			
4	a)		Explain autocorrelation and cross correlation with relevant equations. Derive expression for orthogonality of two signals.	*CO2*	*PO1*	**10**
	b)		If $x(t)=u(t+1)-u(t-1)$ and $h(t)=2x(t)$ Evaluate x(t)*h(t) plot input and output signals.	*CO2*	*PO1*	**10**
			UNIT - III			
5	a)		A signal is given by $x(t)=2+\cos(\frac{2\pi}{3}t)+4\sin(\frac{5\pi}{3}t)$. Determine fundamental frequency and Fourier series coefficients.	*CO3*	*PO2*	**10**

		b)	Find the Fourier transform of the following (i) $\text{sgn}(t)$ (ii) $u(t)$	*CO3*	*PO2*	**10**
			OR			
	6	a)	State and prove the following properties with respect to Fourier transform (i) Duality (ii) Time scaling (iii) Differentiation in frequency (iv) Frequency shifting	*CO2*	*PO1*	**10**
		b)	A signal is given by $x(t) = \cos(3\pi t) + \sin(2\pi t)$. Determine Fourier series coefficients. Draw the magnitude and phase spectrum.	*CO3*	*PO2*	**10**
			UNIT - IV			
	7	a)	A system is given by following equation $\frac{d^2}{dt^2} y(t) + 6\frac{d}{dt} y(t) + 8y(t) = 2x(t)$. (i) Find the impulse response of the system (ii) Find the output of the system if input is given by $x(t) = te^{-2t}u(t)$	*CO3*	*PO2*	**10**
		b)	Draw RC first order lowpass filter and find the following (i) Transfer function (ii) Impulse response (iii) Frequency response (iv) Pole zero plot			**10**
			OR			
	8	a)	Draw the Direct form I and Direct form II structure for the following system $\frac{d^3}{dt^3} y(t) + 2\frac{d}{dt} y(t) + 3y(t) = x(t) + 3\frac{d}{dt} x(t)$	*CO2*	*PO1*	**10**
		b)	A system is given by $\frac{d^2}{dt^2} y(t) + 4\frac{d}{dt} y(t) + 3y(t) = 4x(t) + 2\frac{d}{dt} x(t)$. Using Fourier transform find the output y(t) if $x(t) = e^{-2t}u(t)$	*CO2*	*PO1*	**10**

			UNIT - V			
	9	a)	Design a Butterworth filter for the following specifications $0.8 \le \lvert H(s) \rvert \le 1;\ for 0 \le F \le 1000Hz$ $\lvert H(s) \rvert \le 0.2;\ for F \ge 5000Hz$	*CO4*	*PO3*	**10**
		b)	Describe analog to analog frequency transformations using relevant expressions and graphs.	*CO1*	-	**10**
			OR			
	10	a)	Design a Butterworth filter with maximally flat response in passband and an acceptable attenuation of -2dB at 20 rad/sec. The attenuation in stop band should be more than 10dB beyond 30 rad/sec.	*CO4*	*PO3*	**10**
		b)	List the characteristics of Butterworth filter	*CO1*	-	**05**
		c)	Give practical realization of first order Butterworth Low pass filter.	*CO2*	*PO1*	**05**

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