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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: 22ET3PCSSA **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.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Give the classification of signals and systems with an example each	*CO1*	-	**10**
	b)	Determine whether the following signals are periodic or not periodic (i) $\cos t + \sin\sqrt{2}t$ (ii) $e^{-2t}u(t+2)$ (iii) $2u(t) + 2\sin 2t$ (iv) $u(t) - u(t-2)$ (v) $\cos^2 t$	*CO3*	*PO2*	**10**
		OR			
2	a)	Prove the following with respect to convolution operation (i) $x(t) * \delta(t) = x(t)$ (ii) $x(t) * \delta(t-t_0) = x(t-t_0)$ (iii) $x(t) * u(t) = \int_{-\infty}^{t} x(\tau)d\tau$ (iv) $x(t) * u(t-t_0) = \int_{-\infty}^{t-t_0} x(\tau)d\tau$	*CO2*	*PO1*	**10**
	b)	Determine whether following signals are energy or power (i) $x(t) = e^{3t}u(t+2)$ (ii) $x(t) = u(t)$	*CO3*	*PO2*	**6**

		c)	Evaluate the following integrals (i) $\int_{-\infty}^{\infty} \delta(t-5)e^{-2t}dt$ (ii) $\int_{-\infty}^{\infty} (t+2)^2 \delta(t-3)dt$	*CO3*	*PO2*	**4**
			UNIT - II			
	3	a)	If $x(t) = \begin{cases} 1; 1 \le t \le 3 \\ 0; otherwise \end{cases}$ and $h(t) = \begin{cases} 1; 2 \le t \le 3 \\ 0; otherwise \end{cases}$ Evaluate x(t)*h(t)	*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 (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)	Derive expression for orthogonality of two signals. Write the expression for Hilbert transform and explain the terms used .	*CO2*	*PO1*	**10**
		b)	If $x(t) = u(t) - u(t-3)$ and $h(t) = 3x(t)$ Evaluate x(t)*h(t)	*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 (i) $x(t) = e^{-2t}u(t)$ (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. Also draw the magnitude and phase spectrum.	*CO3*	*PO2*	**10**
			UNIT - IV			
	7	a)	A system is given by following equation $2\frac{d^2}{dt^2}y(t) + 3\frac{d}{dt}y(t) + y(t) = 2x(t)$. (i) Find the impulse response of the system (ii) Find the output of the system if input is given by $x(t) = e^{-2t}u(t)$	*CO3*	*PO2*	**10**
		b)	Draw RC first order high pass filter and find the following (i) Transfer function (ii) Impulse response (iii) Frequency response (iv) Pole zero plot	*CO2*	*PO1*	**10**
			OR			
	8	a)	Draw the Direct form I and Direct form II structure for the following system $5\frac{d^2}{dt^2}y(t) + 3\frac{d}{dt}y(t) + y(t) = 2x(t) + 3\frac{d^2}{dt^2}x(t)$	*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 pass band 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)	Give practical realization of first order Butterworth Low pass filter. Also derive the expression for order of the filter	*CO2*	*PO1*	**10**

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