U.S.N.										

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

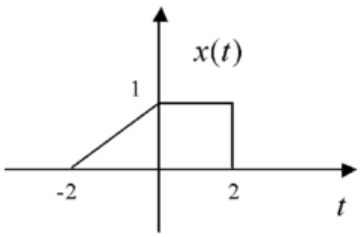
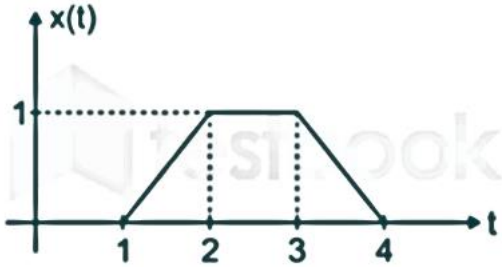
Autonomous Institute Affiliated to VTU

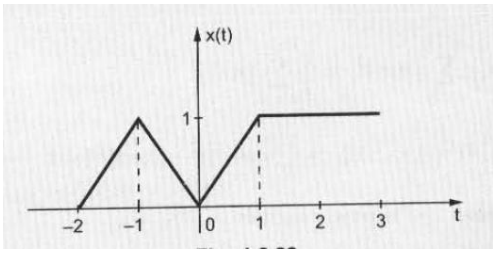
June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 22EI4PCSAS **Max Marks: 100**
Course: Signals and Systems

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.

		MODULE - I	CO	PO	Marks
1	a)	Determine whether the following discrete time signals are periodic or not? If periodic , determine its fundamental period. i) $x(n) = cos\left(\frac{3\pi n}{5}\right) + cos\left(\frac{3\pi n}{7}\right)$ ii) $x(n) = cos\left(\frac{n}{6}\right) cos\left(\frac{\pi n}{6}\right)$ iii) $x(n) = cos\left(\frac{2\pi n}{5}\right) + cos\left(\frac{2\pi n}{7}\right)$ iv) $x(t) = 2\cos(t) + 7\sin(\sqrt{3}\,t)$ v) $x(n) = e^{\left(j\frac{\pi}{4}\right)n}$	CO2	PO1	**10**
	b)	Given the signal x(t), sketch the following signals:  i) $x(-2t+2)$ ii) $x(\frac{t}{3}-3)$	CO2	PO1	**05**
	c)	Find whether the given signal x(t) is energy or power signal and determine its energy or power. 	CO2	PO1	**05**

			OR			
	2	a)	Find and sketch the even and odd part of the following signals: (i) $x(n) = e^{\frac{-n}{6}}\, u(n)$ (ii) 	*CO2*	*PO1*	**08**
		b)	Sketch the following signals: (i) $u(t+2) - 2u(t) + u(t-2)$ (ii) $r(t+1) - r(t) + r(t-2)$	*CO2*	*PO2*	**06**
		c)	Given signal x(n) = {0,0,0,1,2,3,2,1,0,0,0}, plot i) $x(-n-2)$ ii) $x\left(\frac{n}{2}\right)$ iii) $x(2n)$	*CO2*	*PO1*	**06**
			MODULE- II			
	3	a)	Determine whether the following systems are linear, time invariant and stable: i) $y(t) = x(\frac{t}{2})$ ii) $y(n) = nx(n)$ iii) $y(t) = x^2(t)$ iv) $y(t) = e^{x(t)}$	*CO2*	*PO1*	**12**
		b)	Determine whether the following systems are invertible and find their inverse, if they are invertible. i) Y(t)=x(4t) ii) $y(t) = \int_{-\infty}^{t} x(t).dt$ iii) Y(n)=x(n+1) iv) Y(t)= 2 x^2(t)	*CO2*	*PO1*	**08**
			OR			
	4	a)	Check whether the following systems are causal and stable: i) $y(t) = t^2\, x(t)$ ii) $y(n) = x(n) + x(n-3)$ iii) $y(t) = x(t)\sin(100\pi t)$	*CO2*	*PO1*	**06**

		b)	Check whether the following continuous time systems are time Invariant or time variant. i) $y(t) = cosx(t)$ ii) $y(t) = tx(t)$ iii) $y(n) = x(-n)$ iv) $y(n) = x(n) - x(n-1)$ v) $y(t) = x(t^2)$	*CO2*	*PO1*	**10**
		c)	Draw the series and parallel realization for the system whose output signal is given by $y(n) = \frac{5}{6}\{x(n) + x(n-1) + x(n-2)\}$	*CO1*	*PO1*	**04**
			MODULE - III			
	5	a)	The input x(t) and impulse response h(t) of the LTI system are described by $x(t0 = e^{-3t}u(t) and\ h(t) = u(t-1)$. Evaluate the output.	*CO3*	*PO2*	**10**
		b)	Solve the difference equation of the system defined by $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1)$; given that $x(n) = 2^n\, u(n)$ and initial conditions as $y(-1) = 2\ and\ y(-2) = -1$	*CO3*	*PO2*	**10**
			OR			
	6	a)	Consider x(n)={1,1,1,1,1} and h(n)={1,1,1,2,2,2}. Compute $y(n) = x(n) * h(n)$	*CO3*	*PO2*	**08**
		b)	The differential equation of the system is given as $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)$; with $y(0) = 3\ and\ y'(0) = -5$ Determine the total response of the system for step input $x(t) = u(t)$	*CO3*	*PO2*	**07**
		c)	Implement the following LTI system in direct form-I and direct form-II block diagram representation. $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 6y(t) = 2x(t) + 5\frac{dx(t)}{dt}$	*CO3*	*PO1*	**05**
			MODULE - IV			
	7	a)	The impulse response of continuous time system is given by $h(t) = \frac{1}{RC}e^{\frac{-t}{RC}}u(t)$. Determine the frequency response and plot its magnitude and phase response.	*CO4*	*PO2*	**08**
		b)	Determine the DTFS representation of $x(n) = cos\left(\frac{n\pi}{3}\right)$ and plot its spectrum.	*CO2*	*PO1*	**06**
		c)	The differential equation of the system is given as $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$. Determine the impulse response of the system.	*CO4*	*PO2*	**06**

			OR			
	8	a)	State and prove the following FT properties: i) Time shift ii) convolution	*CO1*	*PO1*	**06**
		b)	The impulse response of the systems is given by $h(t) = e^{-t}u(t) + e^{2t}u(t)$ and the input signal is $x(t) = e^{-2t}u(t)$. Find the output of the system.	*CO4*	*PO2*	**08**
		c)	Find the Fourier transform of the following using appropriate properties: i) $x(t) = e^{-3\|t\|} \sin(2t)$ ii) $x(t) = \cos(w_o t)$	*CO2*	*PO1*	**06**
			MODULE - V			
	9	a)	Find the Z-transform and ROC of the following sequences: i) $x(n) = a^n \sin(\Omega_o n)\ u(n)$ ii) $x(n) = n\, a^n\, u(n)$	*CO5*	*PO1*	**06**
		b)	Find the inverse Z-transform of $X(z) = \frac{Z(z^2-4z+5)}{(z-3)(z-1)(z-2)}$ for following ROC: i) $\|Z\| > 3$ ii) $\|Z\| < 1$ iii) $2 < \|Z\| < 3$	*CO5*	*PO2*	**08**
		c)	Draw the direct form-I and direct form-II implementations of the following equation, $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = 2x(n) + 3x(n-1)$	*CO5*	*PO1*	**06**
			OR			
	10	a)	Solve the following difference equation using unilateral Z-transform: $y(n) + y(n-2) = \partial(n); n \geq 0\ and\ y(-2) = 0; y(-1) = 1$	*CO5*	*PO2*	**06**
		b)	Find the inverse Z-transform of the following $X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$	*CO5*	*PO2*	**08**
		c)	A difference equation of the system is given below : $y(n) = 0.5y(n-1) + x(n)$. Determine the following: i) System function ii) Pole zero plot of the system function iii) unit sample response of the system	*CO5*	*PO2*	**06**

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