U.S.N.										

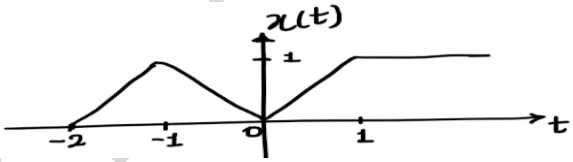
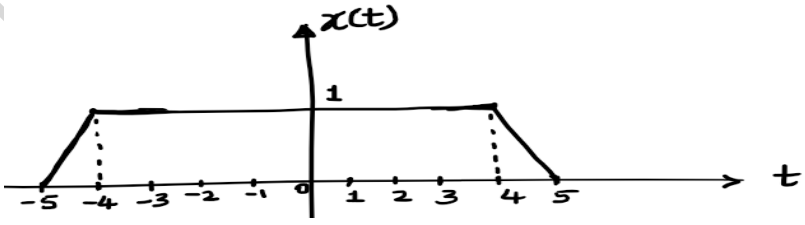
B.M.S. College of Engineering, Bengaluru-560019

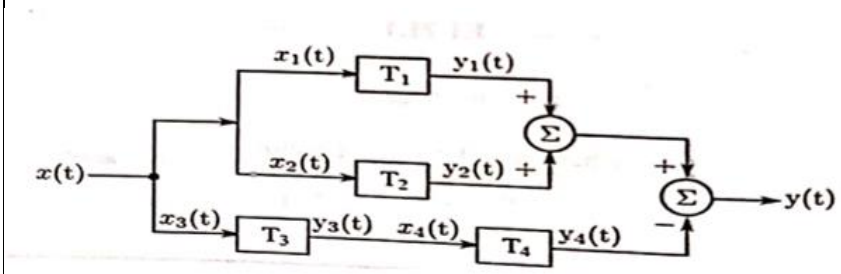
Autonomous Institute Affiliated to VTU

September / October 2023 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.

		MODULE - I	CO	PO	Marks
1	a)	Determine whether the following discrete time signals are periodic or not. If periodic, find its fundamental period. i) $x(n) = \cos\left(\frac{\pi}{2}n\right) - \sin\left(\frac{\pi}{8}n\right) + 3\cos\left(\frac{\pi}{4}n\right)$ ii) $x(t) = 10\cos(\pi t).\sin(4\pi t)$	CO2	PO1	**07**
	b)	Classify each of the following signal as energy signal or power signal or neither of these two i) $x(t) = e^{-at}\,u(t)$ $ii) x[n] = 2e^{j3n}$	CO2	PO1	**06**
	c)	Sketch the even and odd components of the given signal 	CO1	PO1	**07**
		OR			
2	a)	For the trapezoidal pulse shown below find the energy of the signal 	CO2	PO1	**06**
	b)	Sketch the even and odd components of the following signals i) $x[n] = u[n] - u[n-4]$ ii) $x(t) = \begin{cases} t & ; \quad 0 \le t \le 1 \\ 2 - t & ; 1 \le t \le 2 \end{cases}$	CO2	PO1	**08**

		c)	Find the fundamental period of the given signal i) x(n) = $Cos\left(\frac{\pi}{4}n\right) + Sin\left(\frac{\pi}{8}n\right) - 2Cos\left(\frac{\pi}{2}n\right)$ ii) $x(t) = 3cos\sqrt{2}\,t + 4sin5\sqrt{2}\,t$	*CO2*	*PO1*	**06**
			MODULE - II			
	3	a)	A system consists of several subsystems connected as shown in below fig. Find the operator T relating x(t) to y(t) for the subsystem operators given by $T1: y_1(t) = x_1(t)\,x_1(t-1)$ $T2: y_2(t) = \lvert x_2(t)\rvert$ $T3: y_3(t) = 1 + 2x_3(t)$ $T4: y_4(t) = \cos(x_4(t))$  	*CO1*	*PO1*	**06**
		b)	For the following systems, determine whether the system is Linear, Time-Invariant, Memoryless, Causal and Stable. i) $y(t) = t^2.x(t-1)$ ii) $y(n) = n.x^2(n)$	*CO1*	*PO1*	**10**
		c)	Check whether the given systems is invertible? If invertible then finds its inverse. i) $y(t) = x(2t)$ ii) $y[n] = x[\frac{n}{n_0}]$ where n_0 is an integer	*CO2*	*PO1*	**04**
			MODULE - III			
	4	a)	Determine the total response for the system described by the difference equation $y(n) - 0.6y(n-1) = 0.4^n$ & $y(-1) = 10$	*CO2*	*PO2*	**08**
		b)	Represent given equation in Direct form 1 and Direct form 2. $2\frac{dy}{dt} + \frac{1}{3}\int y(t)\,dt + 5\,y(t) = \frac{dx}{dt} + 6x(t)$	*CO2*	*PO2*	**05**
		c)	The impulse response of the circuit is given as $h(t) = e^{-t}\,u(t)$. This circuit is excited by an input of $x(t) = e^{-3t}\{u(t) - u(t-2)\}$. Determine the output of the circuit.	*CO4*	*PO2*	**07**
			OR			

	5	a)	For the system given below evaluate the natural, forced and total response. $y(n+2)+4y(n+1)+4y(n)=2^n\,u(n)$ where, $y(-1)=0$ and $y(-2)=1$	*CO2*	*PO2*	**08**
		b)	Determine the output of the LTI system whose input and impulse response are given as follows: $x(n)=b^n\,u(n)$ *and* $h(n)=a^n\,u(n)$: when a=b and a ≠ b	*CO3*	*PO2*	**08**
		c)	Represent given equation in Direct form 1 and Direct form 2 $\frac{dy(t)}{dt}+5y(t)=3x(t)$	*CO2*	*PO2*	**04**
			MODULE - IV			
	6	a)	State Convolution and Modulation properties of DTFS.	*CO1*	*PO1*	**04**
		b)	Find the DTFT of the signal $x(n)=a^{\lvert n\rvert}$ where |a|<1	*CO2*	*PO1*	**06**
		c)	Evaluate the DTFS representation for the signal $x[n]=\cos(\frac{6\pi}{13}n+\frac{\pi}{6})$ Draw: i) Magnitude Spectrum. ii) Phase Spectrum.	*CO3*	*PO2*	**10**
			MODULE -V			
	7	a)	Solve the following difference equation using unilateral Z-transform. $y(n)-1.5y(n-1)+0.5y(n-2)=x(n)\ for\ n\geq 0$ with initial conditions $y(-1)=4,\ y(-2)=10\ and\ x(n)=\left(\frac{1}{4}\right)^n u(n).$	*CO3*	*PO2*	**08**
		b)	A LTI discrete time system is given by the system function, $H(z)=\frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$ specify the ROC of H(z) and determine h(n) for the following Conditions. (i) System is stable. (ii) System is Causal.	*CO3*	*PO2*	**06**
		c)	Determine the Z-transform of $x(n)=-u(-n-1)+\left(\frac{1}{2}\right)^n u(n)$ Plot the ROC and pole zero locations.	*CO2*	*PO1*	**06**

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