U.S.N.										

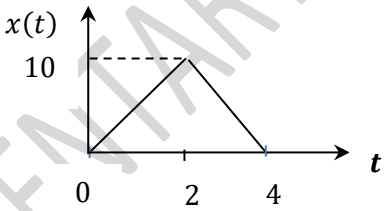
B.M.S. College of Engineering, Bengaluru-560019

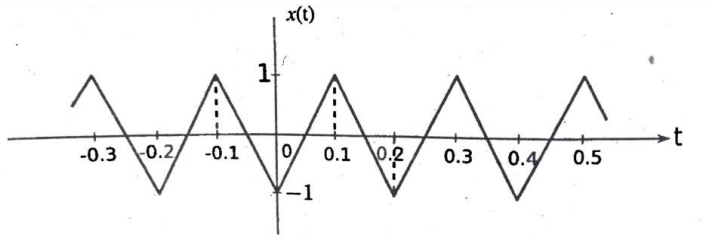
Autonomous Institute Affiliated to VTU

December 2023 Supplementary 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)	Discuss the classifications of signals with a neat plots and expressions.	CO1	PO1	**08**
	b)	For the signal $x(t)$ shown in the Fig.Q1(b), find and plot the following, (i) $x(-2t-4)$ ii) $x(-3t+2)$ iii) $x\left(-\frac{t}{2}-4\right)$  Fig.Q1(b)	CO2	PO2	**06**
	c)	Determine whether the continuous -time signal $x(t) = x_1(t) + x_2(t) + x_3(t)$ is periodic or not. If periodic find the fundamental period where $x_1(t), x_2(t)$ and $x_3(t)$ have periods of $\frac{8}{3}$, 1.26 and $\sqrt{2}$ respectively.	CO2	PO2	**06**
		OR			
2	a)	With a neat plot and expressions, describe the following continuous elementary signals (i) Exponential signals ii) Unit Step function iii) Unit Ramp function	CO1	PO1	**06**

		b)	Compute the average power of the triangular wave shown in the Fig.Q2(b).  Fig.Q2(b)	*CO2*	*PO1*	**06**
		c)	Sketch the following signals, i) $x(t) = -u(t+3) + 2u(t+1) - 2u(t-1) + u(t-3)$ ii) $x(t) = r(t+1) - r(t) + r(t-1)$	*CO1*	*PO1*	**08**
			MODULE - II			
	3	a)	Determine whether the system $y(t) = e^{x(t)}$ is, (i) Linear ii) Time-Invariant iii) Causal iv) Memory	*CO2*	*PO2*	**08**
		b)	Determine whether the system $y(n) = g(n)x(n)$ is, (i) Linear ii) Time-Invariant iii) Causal iv) Memory	*CO2*	*PO2*	**08**
		c)	Find the overall operator of a system whose output signal is given by $y(n) = \frac{1}{3}[x(n+1) + x(n) + x(n-1)$. Also draw the block diagram representation.	*CO1*	*PO1*	**04**
			MODULE - III			
	4	a)	Determine the output $y(t)$ of the LTI system having a unit impulse response, $h(t) = u(t)$ and input $x(t) = e^{-at}u(t); a > 0$.	*CO3*	*PO2*	**08**
		b)	Determine the forced response for the system given by the difference equation, $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1)$ with input $x(n) = \left(\frac{1}{8}\right)^n u(n)$	*CO3*	*PO2*	**08**
		c)	Draw the **direct form-I** implementations for the system, $\frac{d^3y(t)}{dt^3} + 2\frac{dy(t)}{dt} + 3y(t) = x(t) + 3\frac{dx(t)}{dt}$.	*CO2*	*PO2*	**04**
			OR			
	5	a)	Compute the total response of the system given by the differential equation, $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt}$ with $y(0) = 0, \frac{dy(t)}{dt}\Big\|_{t=0} = 1$ *and* $x(t) = 2e^{-t}u(t)$	*CO3*	*CO2*	**10**

		b)	Compute the convolution sum between the impulse response $h(n) = u(n)$ and the input $x(n) = (2, 1, 2, 0)$.	*CO3*	*PO2*	**06**
		c)	Draw the **direct form-II** implementations for the system, $\frac{d^3y(t)}{dt^3} + 2\frac{dy(t)}{dt} + 3y(t) = x(t) + 3\frac{dx(t)}{dt}$.	*CO2*	*PO2*	**04**
			MODULE- IV			
	6	a)	State and prove the following properties of DTFS: (i) Time Shift ii) Convolution in time	*CO3*	*PO2*	**06**
		b)	Find the DTFT of the signal $x(n) = n\left(\frac{1}{2}\right)^{\lvert n \rvert}$ using appropriate properties.	*CO3*	*PO2*	**06**
		c)	The impulse response of a continuous-time LTI system is given by, $h(t) = \frac{1}{RC}e^{-\frac{t}{RC}}u(t)$. Find the frequency response and plot the magnitude and phase response.	*CO4*	*PO2*	**08**
			MODULE - V			
	7	a)	Determine the Z-transform of the signal $x(n) = 7\left(\frac{1}{3}\right)^n u(n) - 6\left(\frac{1}{2}\right)^n u(n)$. Also sketch the ROC with the pole-zero indication.	*CO4*	*PO2*	**08**
		b)	Compute the unilateral z-transform of $x(n) = \left(\frac{1}{4}\right)^n u(3-n)$	*CO4*	*PO2*	**06**
		c)	Using partial fraction expansion method, obtain the time-domain signal corresponding to the z-transform given by, $X(z) = \frac{Z+1}{3Z^2 - 4Z + 1}$; $\lvert z \rvert > 1$	*CO4*	*PO2*	**06**

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