CBCS SCHEME

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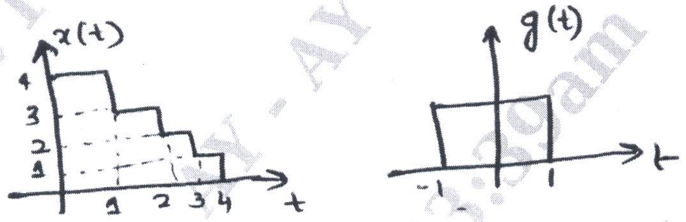
BMT306B

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the basic operations on signals that operations performed on dependent variables.	10	L2	CO1
	b.	For the system given below, determine whether or not the system is linear, time variant causal B1B0 stable and memory: (i) $y(n) = T\{x(n)\} = x(n) + n$ (ii) $y(n) = T\{x(n)\} = x\left(\frac{n}{2}\right)$	10	L3	CO1
		OR			
Q.2	a.	Define signal. Explain the classification of signals with an example.	10	L2	CO1
	b.	Two signals x(t) and g(t) are shown below Fig.Q2(b). Express x(t) signal interms of g(t).  Fig.Q2(b)	10	L3	CO1
		Module – 2			
Q.3	a.	Compute the convolution of two sequences, x1(n) and x2(n), given below: $x_1(n) = (\underset{\uparrow}{1}, 2, 3)$ and $x_2(n) = (1, 2, \underset{\uparrow}{3}, 4)$	10	L3	CO2
	b.	Derive the expression for convolution sum formula.	10	L2	CO2
		OR			
Q.4	a.	Two discrete time LTI systems are connected in cascade. Determine the unit sample response of connection: $h_1(n) = \left(\frac{1}{2}\right)^n u(n)$, $h_2(n) = \left(\frac{1}{4}\right)^n u(n)$	10	L3	CO2
	b.	Explain the commutative and associative property of convolution sum.	10	L2	CO2
		Module – 3			
Q.5	a.	Evaluate the total response of an LTI system described by the differential equation given below: $y''(t) + 4y'(t) + 3y(t) = 36t\,u(t)$; $y'(0) = 1$ and $y(0) = 0$	10	L3	CO3
	b.	For each impulse response listed below, determine whether the corresponding system is memoryless, causal and stable: (i) $h(t) = e^{-2\|t\|}$ (ii) $h(t)=e^{2t} u(t-1)$	10	L3	CO3

		OR			
Q.6	**a.**	Find the total response of the LTI system described by the difference equation given below: $Y(n) + 4y(n-1) + 3y(n-2) = u(n); \quad y(-1) = 0, \quad y(-2) = 1$	**10**	**L3**	**CO3**
	b.	Draw direct form I and direct form II implementations for the following differential equation $y(n) - \frac{1}{9}y(n-2) = x(n) + 2x(n-1)$	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Obtain the modulation or multiplication theorem.	**10**	**L2**	**CO4**
	b.	Find the complex Fourier coefficient for x(t) given below: $x(t) = \cos\left(\frac{2\pi}{3}t\right) + 2\cos\left(\frac{5\pi}{3}t\right)$	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Explain the following properties of Fourier series with proof: (i) Linearity (ii) Time shift (iii) Scaling	**10**	**L2**	**CO4**
	b.	Find the complex Fourier coefficient for x(t) given below: $x(t) = \frac{1}{4} + \sum_{n=1}^{4}\left[\frac{1}{n^2}\cos\left(\frac{nt}{5}\right) + \frac{(-1)^n}{(2n+1)^2}\sin\left(\frac{nt}{5}\right)\right]$	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Using the properties of Fourier transforms, find the Fourier transforms of the following signals: (i) $x(t) = \sin(\pi t)e^{-2t}u(t)$ (ii) $x(t) = e^{-3\|t-2\|}$	**10**	**L3**	**CO5**
	b.	Find the Fourier transform of x(t) = u(t), unit step function.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Explain the following properties of Fourier transform: (i) Frequency shift (ii) Time differential (iii) Time reversal	**10**	**L3**	**CO5**
	b.	Compute the Fourier transform of the following signals: (i) $x(t) = u(-t)$ (ii) $x(t) = e^{at}u(-t)$	**10**	**L3**	**CO5**

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