B.E. / B.Tech. Electronics & Communication/Telecommunication Engineering
(Model Curriculum) Semester-III

004 / SE104 - Signals and Systems

P. Pages : 3 **GUG/S/25/13909**

Time : Three Hours Max. Marks : 80

Notes : 1 All questions carry marks as indicated
2. Assume suitable data wherever necessary.
3. Illustrate your answers wherever necessary with the help of neat sketches.

1. A) Define energy and power signal. Sketch the following signals and determine whether the signals are energy or power or neither energy nor power: **8**
i) u(t) ii) tu(t)

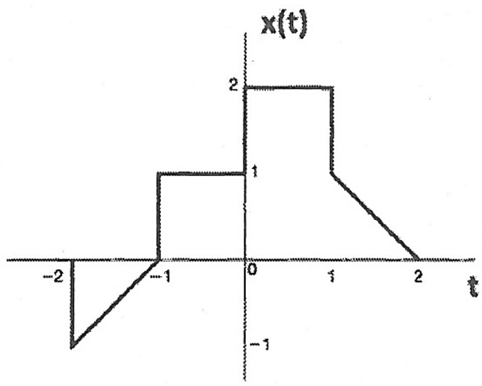
B) A continuous time signal x(t) is shown in fig. Sketch the following signals . **8**

i) $x(t-1)$

ii) $x(2-t)$

iii) $x(2t+1)$

iv) $x\left(4-\frac{t}{2}\right)$



OR

2. A) Define periodic signals. Determine the fundamental period of the following signals: **8**
i) $x(t)=2\cos(10t+1)-\sin(4t-1)$

ii) $x(n)=1+e^{j4\pi n}/7-e^{j2\pi n}/5$

B) Check whether the following systems are linear or not. **8**
i) $y(t)=ax(t)+b$

ii) $y(t)=x(t)\cos(\omega_c t)$

3. A) Test whether the following systems whose impulse response is given below are stable or not. **8**
i) $h(n)=\cos\delta(n)$

ii) $h(n)=\sum_{k=-\infty}^{n+1}\delta(k)$

B) Perform the convolution of the following signals. **8**
i) $x(n)=a^n u(n)$ $h(n)=u(n)$

ii) $x(n)=u(n)$ $h(n)=u(n)$

OR

4. A) Given $x(n) = \delta(n) + 2\delta(n-1) - \delta(n-3)$ and $h(n) = 2\delta(n+1) + 2\delta(n-1)$ **8**

Compute and plot each of the following convolutions:

i) $y_1(n) = x(n) * h(n)$

ii) $y_2(n) = x(n+2) * h(n)$

iii) $y_3(n) = x(n) * h(n+2)$

B) Two systems whose impulse response is given by **8**

$h_1(t) = e^{-2t}u(t)$

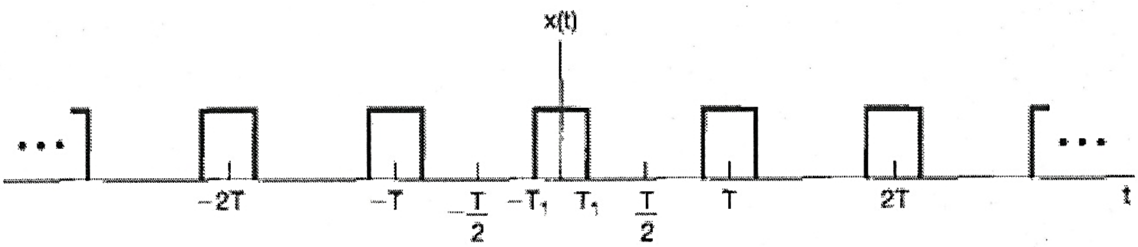
$h_2(t) = 2e^{-t}u(t)$

are connected in cascade.

i) Find the impulse response h(t) of the overall system

ii) Check whether the overall system is stable

5. A) Find the Fourier series of the parodic square wave **8**

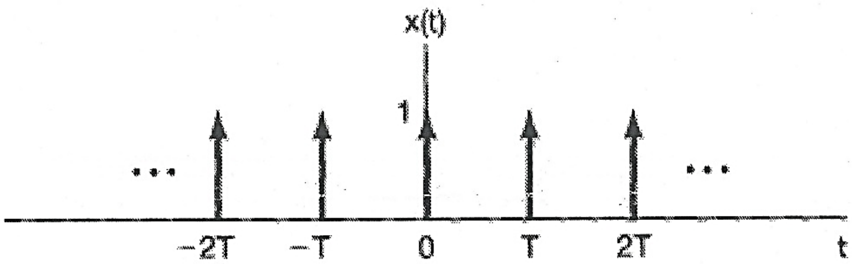


shown in figure

B) State and Prove convolution property of Fourier transform. **8**

OR

6. A) Find the Exponential Fourier series of the periodic square wave shown in figure. Also plot its magnitude and phase spectrum. **8**



B) State and Prove Parseval's theorem of Fourier transform. **8**

7. A) Find the Laplace transform X(s) and sketch the pole-zero plot with RoC for the following signals. **8**

i) $x_1(t) = e^{-3t}u(t) + e^{-4t}u(t)$

ii) $x_2(t) = e^{-4t}u(t) + e^{3t}u(-t)$

iii) $x_3(t) = e^{-3t}u(t) + e^{-4t}u(-t)$

	B)	Find the z-transform and the RoC of the discrete time signals given below i) $x(n) = a^n u(n-1)$ ii) $x(n) = \left(\frac{1}{2}\right)^n \left[u(n) - u(n-10)\right]$	8

OR

8.	A)	Determine the Laplace transform of the signal $x(t) = \left(2 + e^{-3t}\right)u(t)$. After obtaining the Laplace transform find the initial and final values of the function using initial value theorem and final value theorem. Also verify the result by obtaining the initial and final values from time domain.	8
	B)	Determine the z-transform of the following signals along with RoC: i) $x_1(n) = \left(\frac{2}{3}\right)^n u(n) + \left(-\frac{1}{2}\right)^n u(n)$ ii) $x_2(n) = a^{\lvert n \rvert}; \lvert a \rvert < 1$	8
9.	A)	Explain signal reconstruction using zero order hold. Also find its transfer function.	8
	B)	Determine the Nyquist rate and Nyquist interval for the continuous time signal given below: i) $x(t) = \frac{1}{2\pi} \cos(4000\pi t) \cos(1000\pi t)$ ii) $x(t) = 1 + \cos(2000\pi t) + \sin(4000\pi t)$	8

OR

10.	A)	Compare ideal sampling, natural sampling and flat top sampling.	8
	B)	Consider the analog signal. $x_a(t) = 3\cos(100\pi t)$ i) Determine the minimum sampling rate required to avoid aliasing. ii) Suppose that the signal is sampled at the rate Fs = 200 Hz. What is the discrete-time signal obtained after sampling? iii) Suppose that the signal is sampled at the rate Fs ~ 75 Hz. What is the discrete time signal obtained after sampling?	8

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