B.E. / B.Tech. Computer Science & Engineering (Model Curriculum) Semester-V

TEE101CS / SIGNALS1 - Signals and Systems

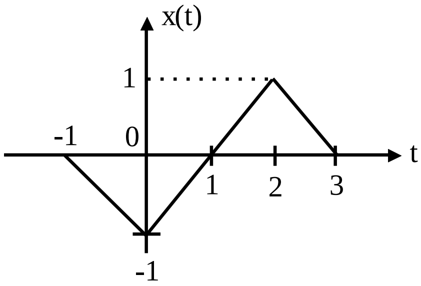
P. Pages : 3 **GUG/S/25/13811**

Time : Three Hours Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Define the following terms with an example: **8**
i) Continuous time and discrete time signals
ii) Energy and power signals
iii) Even and odd signals
iv) Periodic and Non-periodic signals.

b) A continuous time signal x(t) is shown in fig. Sketch the following signals: **8**
i) $x(-t)$
ii) $x(2+t)$
iii) $x(2t)$



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) 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

b) Explain the following properties of convolution. **8**

i) Associative properties
ii) Commutative properties
iii) Distributive properties
iv) Shift property

OR

4. a) Given $x(n) = \delta(n) + 2\delta(n-1) - \delta(n-3)$ and $h(n) = 2\delta(n+1) + 2\delta(n-1)$ Compute and plot each of the following convolutions: **8**

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

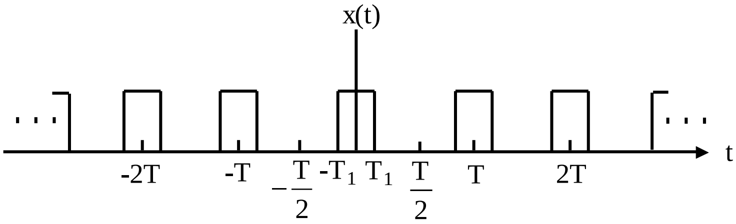
ii) $y_2(n) = x(n+2) * h(n)$

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

b) Find convolution using graphical method **8**

$$x(n) = \left\{ -1, \underset{\uparrow}{2}, 0, 1 \right\} \text{ and } h(n) = \left\{ 1, 3, \underset{\uparrow}{-1}, -3 \right\}$$

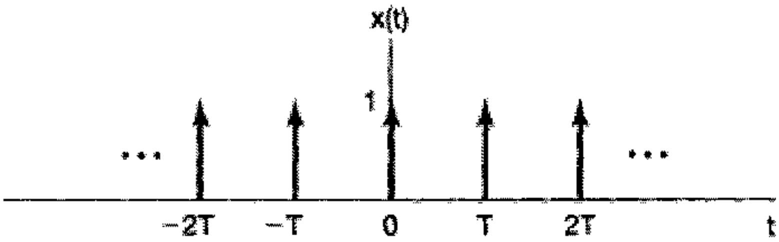
5. a) Find the Fourier series for the periodic square wave shown in figure. **8**



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. **8**

i) $x(n) = a^n u(n-1)$

ii) $x(n) = \left(\frac{1}{2}\right)^n [u(n) - u(n-10)]$

OR

8. a) i) Find Laplace transform of e^{4t} (sin2t. cost) **8**

ii) Find inverse Laplace transform of

$$\frac{5s+3}{(s+1)\,(s^2+2s+5)}$$

b) Determine the z-transform of the following signals along with RoC: **8**

i) $x_1(n) = \left(\frac{2}{3}\right)^n u(n) + \left(-\frac{1}{2}\right)^n u(n)$

ii) $x_2(n) = a^{|n|};\ |a| < 1$

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: **8**

i) $x(t) = \frac{1}{2\pi}\cos(4000\pi t)\cos(1000\pi t)$

ii) $x(t) = 1 + \cos(2000\pi t) + \sin(4000\pi t)$

OR

10. a) Compare ideal sampling, natural sampling and flat top sampling. **8**

b) Consider the analog signal $x_a(t) = 3\cos(100\pi t)$ **8**

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?

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