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

TEE101CS - Signals and Systems

P. Pages : 3 **GUG/W/24/13811**

Time : Three Hours * 5 4 6 7 * 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) Describe in brief following discrete time system with an example. **8**

i) Static and dynamic system.
ii) Time invariant system and time variant systems.
iii) Linear and non-linear system.
iv) Stable and unstable system.

b) Check whether the following systems are linear or not **8**

i) $y(t) = ax(t) + b$ ii) $y(t) = x(t)\cos(\omega_c t)$

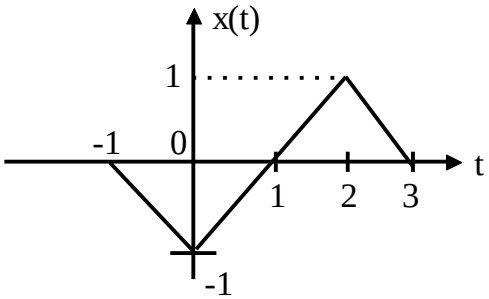
OR

2. a) Define the following terms with an example: **10**

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 **6**

i) $x(-t)$ ii) $x(2+t)$ iii) $x(2t)$



3. a) Find convolution using graphical method **8**

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

b) Test whether the following systems whose impulse response is given below are stable or not **8**

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

OR

4. 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**

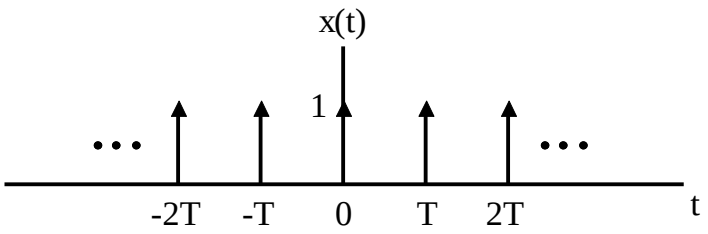
i) Associative properties

ii) Commutative properties

iii) Distributive properties

iv) Shift property

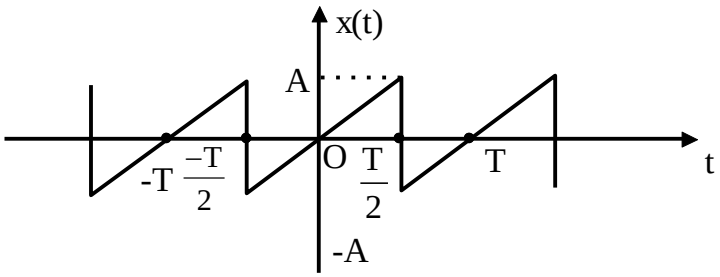
5. a) Find the Exponential Fourier series of the periodic square wave shown in figure. Also plot its magnitude and phase spectrum. **8**



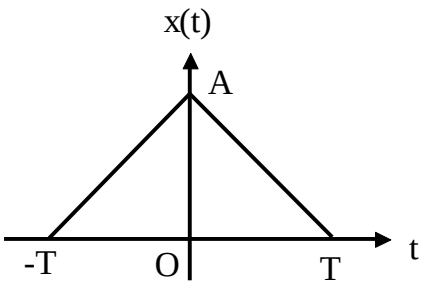
b) What is Discrete-Time Fourier Transform (DTFT)? Explain any 5 properties of DTFT along with mathematical equations. **8**

OR

6. a) Determine the trigonometric form of Fourier series for the signal shown in fig. **8**



b) Compute the Fourier transform for the signal shown in fig. Draw its magnitude response. **8**



7. a) i) Find Laplace transform of $e^{-3t}(2\cos 5t - 3\sin 5t)$ **8**

ii) Find Inverse Laplace transform of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}$

b) Explain the following property of z-transform. **8**

i) Multiplication property.

ii) Co-relation property.

OR

8. a) i) Find Laplace transform of $e^{4t}(\sin 2t . \cos t)$ **8**

ii) Find inverse Laplace transform of $\frac{5s + 3}{(s+1)\left(s^2 + 2s + 5\right)}$

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

9. a) Compare ideal sampling, nature sampling and flat top sampling. **8**

b) Consider the analog signal **8**

$x_a(t) = 3\cos(2000\pi t) + 5\sin(6000\pi t) + 10\cos(12000\pi t)$

i) What is the Nyquist rate for this signal.

ii) Assume now that we sample this signal using a sampling rate Fs = 5000 samples/s. What is the discrete-time signal obtained after sampling?

iii) Assume now that we sample this signal using a sampling rate Fs = 12000 samples/s. What is the discrete-time signal obtained after sampling.

OR

10. a) Explain different type of sampling techniques in details. **8**

b) Determine the Nyquist rate and Nyquist interval for the continuous time signal given below: **8**

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

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

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