B.E. Computer Science & Engineering (Model Curriculum) Semester - V
TEE101CS - Signals and Systems

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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) Determine whether the following signals are periodic or aperiodic, if periodic, Determine its fundamental period. **8**

$x(t) = \sin 12\pi t + \cos 20\pi t$

$x(t) = \sin \pi t \cdot u(t)$

b) Test the following systems for linearity, Causality, time invariance and memory. **8**

i) $y(t) = 2x(t) + 5$ ii) $y(n) = x(n-3) + 2x(n-1)$

OR

2. a) Compute the following convolution – **8**

i) $x(n) = \{\underset{\uparrow}{1}, -2, 2, -1, 0, 1\}$

$h(n) = \{1, 2, 3, 0\}$

ii) $x(n) = \delta(n) + 2\delta(n-1) - \delta(n-3) \, h(n) = 2\delta(n+1) + 2\delta(n-1)$
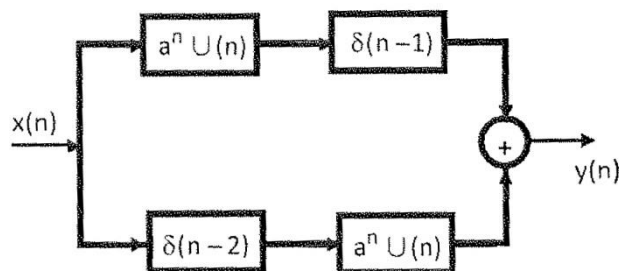
b) Define the following term with example. **8**

i) Energy signal ii) Power signal
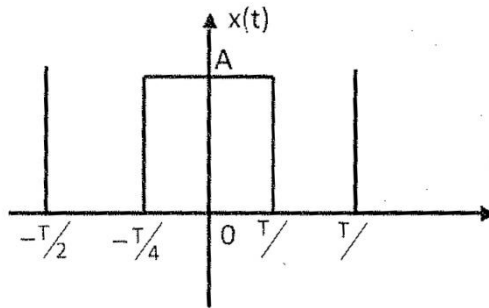
iii) Even signal iv) Odd signal

3. a) Find the overall impulse response of the system shown in fig. **8**

b) List out the properties of LTI system
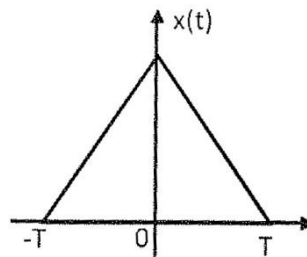Describe any two with details. **8**

OR

4. a) Find the circular convolution of two sequences. **8**

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

  b) Find the convolution using graphical method for the signals. **8**

$x(t) = e^{-3t} u(t); h(t) = u(t+3)$

5. a) State and prove the Parseval's Theorem with respect to Fourier Transform. Comment on it. **8**

  b) Figure shows the periodic rectangular waveform. Obtain its Fourier Series representation. **8**

OR

6. a) Find the Fourier transform of a exponential signals $x(t) = e^{-a|t|}$ **8**

  b) Find the Fourier transform of $x(t) = \sin(w_0 t)$. **4**

  c) Obtain DFT of discrete time signal $x(n) = \{2, 1, 3, 2\}$. **4**

7. a) Compute the Fourier transform for the signal shown in fig. 3. Draw its magnitude response. **8**

  b) Consider the first order difference equation – **8**

$y(n) + 5y(n-1) + 6y(n-2) = x(n)$

Assuming the initial conditions $y(-1) = 1$, $y(-2) = -1$, find the impulse response of a system.

OR

8. a) Prove frequency shifting property of Fourier Transform. Using the property find Fourier Transform of $\cos w_0 t$. **8**

b) Let the Fourier Transform of the signal $x(t)$ be $X(j\omega)$. Using Fourier Transform properties find the Fourier Transform of the following signals. **8**

   i) $x_1(t) = x(2-t) + x(-2-t)$ ii) $X_2(t) = X(2t-3)$

9. a) Determine the Laplace Transform of the signal, **8**

   $x(t) = e^{-2t} u(-t) + e^{-3t} u(-t)$ and find its ROC.

b) Draw and explain the reconstruction of signal from its samples using zero – order hold. **8**

<p style="text-align:center">OR</p>

10. a) Describe any one method of reconstruction of continuous time signal from it's equivalent discrete time signal. **8**

b) A analog signal **8**

   $x_a(t) = \sin(480\pi t) + 3\sin(720\pi t)$

   is sampled 600 times per second.

   i) Determine the Nyquist sampling rate for $x_a(t)$.

   ii) Find the discrete time signal.

   What are the frequencies in radians in resulting discrete time signals $x(n)$.

<p style="text-align:center">**********</p>