B.E.(with Credits)-Regular-Semester 2012-Electronics & Telecommunication-Communication Engg / Electronics Engg / Electrical Engineering & (E. & P.) / Instrumentation Engg. Sem V

EC502/EN502/EP503/IN502 : Signals and Systems

P. Pages : 2 **GUG/W/16/3723**

Time : Three Hours * 3 9 6 3 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and chemical equations should be given wherever necessary.

1. a) Determine whether each of the following sinusoids are periodic. If periodic, determine its fundamental period. **8**

i) $x_1(t) = 3\cos(4t + \pi/3)$ ii) $x_2(n) = \sin\left(\frac{\pi n}{3}\right) \cdot \cos\left(\frac{\pi n}{4}\right)$

b) A continuous time signal is shown in fig. 1 Sketch and label carefully each of the following signals. **8**

i) x(t-2) ii) $[x(t) + x(-t)]u(t)$.

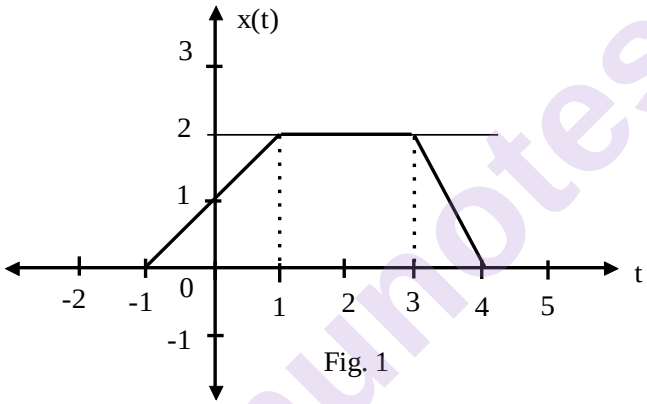

Fig. 1

OR

2. a) Determine and sketch the even and odd parts of the signal x(n) given as - **8**

$x(n) = \left\{-1, -1, \underset{\uparrow}{1}, 1, 1, 1\right\}$

b) Test the following systems for Linearity, causality, memory or memory less and time invariance. **8**

i) y(n) = x(4n + 1) ii) y(n) = n.x (n)

3. a) Compute the linear convolution of following sequences. **8**

$x(n) = \begin{cases} 1 & ; \quad 0 \le n \le 3 \\ 0 & ; \quad \text{otherwise} \end{cases}$ $h(n) = \begin{cases} 1 & ; \quad -1 \le n \le 2 \\ 0 & ; \quad \text{otherwise} \end{cases}$

b) State and explain the properties of of LTI systems. **8**

OR

4. a) The following are the impulse responses of discrete time LTI systems. Determine whether each of the systems is causal and / or stable. **10**

i) $h(n) = (1/5)^n.u(n)$ ii) $h(n) = (-1/2)^n u(n) + (1.01)^n u(n-1)$

b) Compute the convolution $y(n) = x(n) * h(n)$ of the following signals - **6**

i) $x(n) = \{1, 2, 4\}$, $h(n) = \{1, 1, 1, 1\}$

ii) $x(n) = \{0, 1, 4\}$, $h(n) = \left\{1, \underset{\uparrow}{0}, -1, 1\right\}$

5. a) State and prove any two properties of continuous time Fourier series. **8**

b) Find the Fourier series coefficients of the signal **8**
$x(t) = 1 + 2\sin(w_0 t) + \cos(w_0 t) + \cos(2w_0 t + \pi/2)$

OR

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

b) Find the DFT of given sequence $x(n) = \{1, -1, 1, -1\}$ **8**

7. a) State the properties of Z transform. Prove the convolution property of Z transform. **6**

b) If $x(n) = (-1/4)^n u(n) - (1.5)^n u(-n-1)$. Determine the Z.T. also find ROC and draw pole-zero plot. **10**

OR

8. a) Determine the impulse response of DTS described by difference equation **6**
$y(n) - 2y(n-1) = x(n)$ Assume all initial conditions zero.

b) A LTI system is characterized by the system function **10**

$$H(z) = \frac{1}{1 - 1/3z^{-1}} + \frac{2}{1 - 2z^{-1}}$$

specify the ROC of H(z) and determine h(n) for the following conditions.

i) the system is stable ii) the system is causal

iii) the system is anticausal

9. a) An analog signal **10**
$x_a(t) = \sin(480\pi t) + 3\sin(720\pi t)$
is sampled 600 times per second.
Determine :

i) The Nyquist sampling rate for $x_a(t)$

ii) What is the discrete time signal obtained.

iii) If fs = 160 Hz, find the resultant discrete time signal.

b) State sampling theorem. What is aliasing ? Explain with an example. **6**

OR

10. a) Explain the reconstruction of signal from its sample using interpolation. **8**

b) Define following : **8**

i) Zero order hold sampling ii) Flat top sampling

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