

B.E. Electronics & Communication/Telecommunication Engineering (Model Curriculum)  
Semester - III  
**004 - Signals and Systems**

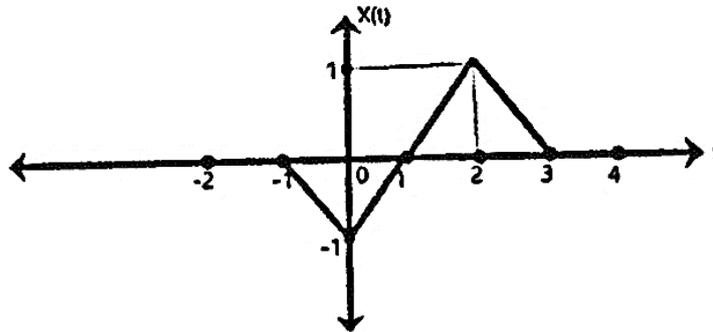
P. Pages : 3  
Time : Three Hours



**GUG/S/23/13909**  
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) Given the signal  $x(t)$ . Sketch the following signals. 8
- i)  $x(-t)$ ;
  - ii)  $x(t+2)$ ;
  - iii)  $x(2t)$ ;
  - iv)  $x(t-3)$



- b) Determine whether the following systems are periodic or not. If periodic, then determine the fundamental time and frequency. 8
- i)  $X(t) = \sin 12\pi t + \cos 20\pi t$
  - ii)  $X(t) = \cos(10\pi t + \pi/2) + 2\sin 6\pi t$

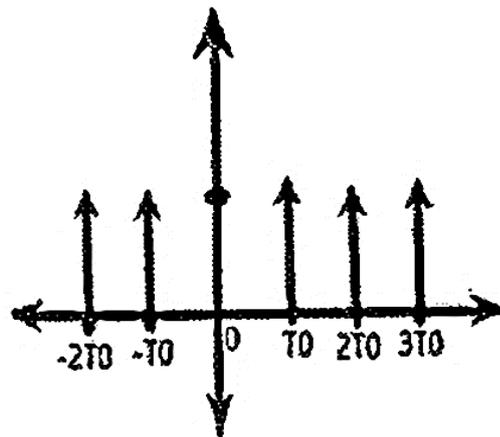
**OR**

2. a) Define energy and power signal. Determine whether following signal is energy signal or power signal. 8
- $$X(n) = n; n \geq 0$$
- $$= 0; n < 0$$
- b) Test the following systems for Linearity, Causality, Time invariance and Memory. 8
- i)  $Y(t) = 2x(t) + 5$
  - ii)  $Y[n] = x[n-3] + 2x[n-1]$
3. a) State and prove the following property of LTI system 8
- i) Associative
  - ii) Distributive
  - iii) Scaling
  - iv) Commutative

- b) Obtained the linear convolution of the given signals  $x[n] = \{1, 2, 1, 2\}$   $h[n] = \{1, 1, 1\}$  using convolution using. 8
- i) Tabular method.
  - ii) Multiplication method.

**OR**

4. a) Find the circular convolution of the sequence  $x[n] = \{3, 2, -1, -2, 3, 2\}$   $h[n] = \{3, 2, 2\}$  8
- b) Given  $h[n] = \{1, 3, 1, 2\}$  is the impulse response of LTI system. Determine response of the system to the input signals  $[n] = \{2, 1, 1, 2\}$ . 8
5. a) Obtain Fourier Transform of impulse train shown in figure. 8



- b) Obtain DFT of discrete time signal  $x[n] = \{2, 1, 3, 2\}$  8

**OR**

6. a) State & derive the convolution property of DFT. 5
- b) Determine Fourier coefficient for given signal 5  
 $X(t) = 3 \sin 3\omega_0 t + \frac{1}{2} \cos \omega_0 t - \frac{1}{3} \sin (7\omega_0 t + \pi/3)$
- c) State & prove time reversal property of Fourier transform. 6
7. a) Determine the step response of the following causal system. 8  
 $y(n) = \frac{3}{4} y(n-1) - \frac{1}{8} y(n-2) + x(n)$
- b) What is ROC of Laplace transform? State its properties. 8

**OR**

8. a) State and prove the convolution property of Z-Transform. 8

b) If **8**

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

Find the inverse Z-Transform if –

- i) System is stable
- ii) System is causal
- iii) System is anticausal.

9. a) Analog signal is given as  $x_a(t) = \sin 5\pi t + 2\sin 10\pi t + 2\cos 15\pi t$ , Determine **8**

- i) Nyquist rate of signal
- ii) If signal is sampled with  $f_s = 20\text{Hz}$ , find discrete time signal obtained after sampling?

b) Explain the properties of Laplace transform. **8**

- i) Time shifting.
- ii) Transform of derivative property.

**OR**

10. a) State and prove sampling theorem. **8**

b) Write a short note on. **8**

- i) O-order hold sampling.
- ii) Interpolation.

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