Roll No. ..... **Total Pages : 04**

BT-4/M-20 **34011**

SIGNALS AND SYSTEMS

EE-208E

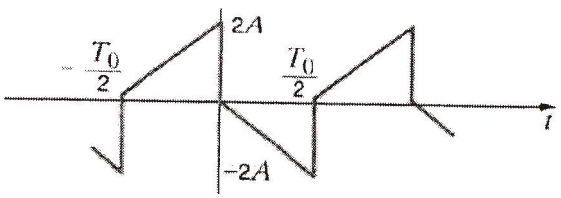
Time : Three Hours] [Maximum Marks : 100

Note: Attempt *Five* questions in all, selecting at least one question from each Section. All questions carry equal marks. Assume missing data if any. Symbols have their usual meanings.

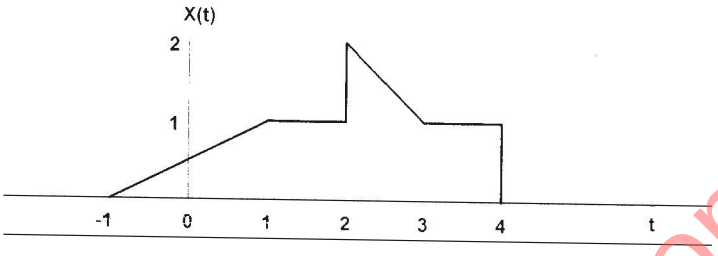
Section I

1. (a) Describe a signal and differentiate the following :
(i) Deterministic and Stochastic Signal
(ii) Periodic and aperiodic signal
(iii) Analog and discrete signal. **8**

(b) Compute Fourier series for the waveform shown in Fig. 1. Plot its magnitude and phase spectrum. **8**



(c) Represent the signal $x(t)$ shown in Fig. 2 as a linear combination of standard test signals. **4**



2. (a) Let $x(t) = u(t - 3) - u(t - 5)$ and $h(t) = e^{-3t}u(t)$. Compute $y(t) = x(t) * h(t)$. **10**

(b) Find the response of the discrete time system with unit impulse response $h(n) = \underset{\uparrow}{2}\ 1\ 3$ the input $x(n) = \underset{\uparrow}{1}\ 2\ 3$. **5**

(c) Determine Fourier transform of the signal $1 + \cos 6\pi t + \frac{\pi}{8}$ **5**

Section II

3. (a) State and prove sampling theorem. Also explain its physical significance. **12**

(b) Determine the continuous time signal corresponding to the following transform :

$$X(j\omega) = \cos\left(4\omega + \frac{\pi}{3}\right)$$ **8**

4. (a) Define random variable. How its pdf and cdf are computed ? Explain by giving physical significance of each. **12**

(b) If $X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$. Obtain its inverse z-transform for $|z| > 1$, $|z| < 0.5$, $0.5 < |z| < 1$. **8**

Section III

5. What do you understand by a linear system ? Explain in detail features and working of SISO, SIMO, MISO and MIMO with suitable examples. **20**

6. (a) Determine whether the given system $y(t) = x(t - 2) + x(2 - t)$ holds the following properties for input $x(t)$ and output $y(t)$ with justification :

(i) Memoryless
(ii) Time-invariant
(iii) Linear
(iv) Causal
(v) Stable. **15**

(b) In a causal LTI system, input and output are related by the difference equation $\frac{1}{2}y(n-1)+x(n)$. Determine $y(n)$ for $x(n) = (n-2)$. **5**

Section IV

7. Obtain complete response of an electromechanical system described by differential equation $2y = f(t)$ using state variable method for the driving force $f(t) = u(t)$ and initial conditions $y(0^-) = 0, y(0^+) = 1$. **20**

8. (a) Obtain impulse response of a causal LTI system characterized by the difference equation

$$y[n]-\frac{1}{2}y[n-1]=x[n]+\frac{1}{2}x[n-1].$$ **10**

(b) Determine differential equation for the causal LTI system shown in the Fig 3. relating its input and output $y(t)$. **10**