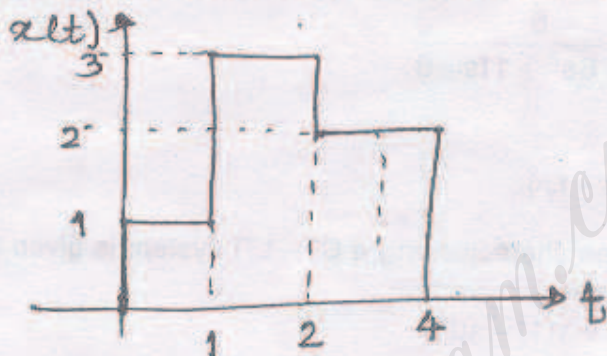


MASTER

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any four questions out of remaining six questions.
 (3) Figures to the right indicate full marks.
 (4) Assumptions made should be clearly stated.

7.5 (CE) I Rev signal processing-I 716108.

1. (a) Prove the BIBO stability condition for DT-LTI system. 4
 (b) Find Z-transform of periodic sequence :- 4
 $x(n) = \{-1, 4, -2, 6\}$
 (c) Determine whether following signals are energy/power. Find its energy/power :- 4
 (i) $x(t) = 3 \cos \left(4\pi t + \frac{\pi}{4} \right)$
 (ii) $x(n) = (3)^n u(-n-1)$.
 (d) Classify systems below for linearity/causality/time-invariance :- 4
 (i) $y(t) = [2 \cos(t^2)] u(t)$ (ii) $y(n) = x(2n)$
 (e) Express $x(t)$ in terms of unit step functions and obtain Laplace Transform. 4



2. Difference equation of DT-LTI system is :

$$y(n) = \frac{-4}{3} y(n-1) - \frac{1}{3} y(n-2) + x(n) + \frac{1}{2} x(n-1).$$

Find :

- (i) Transfer function and impulse response of the system for stable case. 7
 (ii) Realize the system using Direct form-II 5
 (iii) Find zero state and zero input response if input applied, $x(n) = (5)^n u(n)$ and initial conditions are $y(-1) = 1, y(-2) = -1$. 8

3. (a) Compute following integrals :

10

(i) $\int_0^5 \sin 2t \delta(t-3) dt$

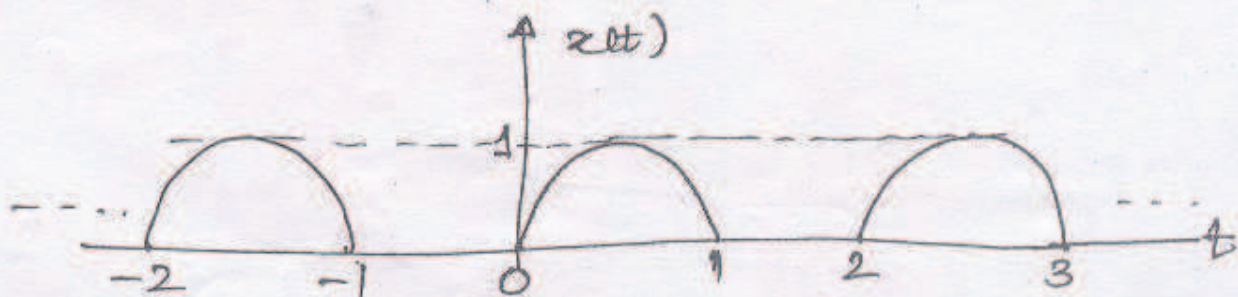
(iii) $\int_0^{\infty} t^2 \delta(t-3) dt$

(ii) $\int_{-\infty}^{\infty} (4-t^2) \delta(t+3) dt$

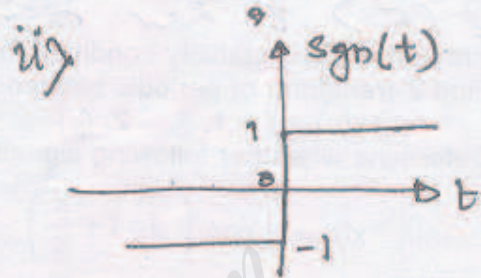
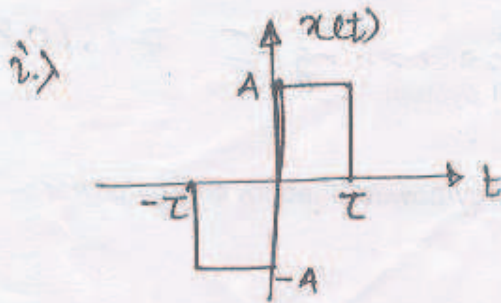
(b) Obtain linear convolution using circular convolution for $x(n) = \{1, -2, 2, 3\}$, and $h(n) = \{-1, 3, 1\}$

10

4. (a) State Dirichlet conditions for the existence of Fourier series. 5
 (b) Find exponential Fourier series of the waveform. 15



5. (a) Find DTFT of $x(n) = \{-2, 1, -1\}$ and sketch its magnitude and phase plot. 10
 (b) Find Fourier Transform of following signals :- 10



6. (a) Develop the block diagram and state variable model of the system 10

$$\frac{Y(s)}{X(s)} = \frac{6}{s^3 + 6s^2 + 11s + 6}$$

- (b) Convolve : 10
 (i) $x(t) * \delta(t - t_0)$
 (ii) $\delta(t - t_1) * \delta(t - t_2)$.

7. (a) The differential equation characterizing a CT-LTI system is given by— 10

$$2 \frac{d^2 y}{dt^2} + 3 \frac{dy}{dt} + y(t) = u(t)$$

with initial conditions $y(0^-) = -1, y'(0^-) = 1$

Determine zero input and zero state response.

- (b) Write short note on Power Density Spectrum of periodic signal. 5
 (c) State and prove modulation property of Fourier Transform. 5