

MASR

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **five** questions including question No. 1
 (3) Assume **suitable** data, if **required**.
 (4) **Figures** to the **right** indicate **full** marks.

1. (a) Discuss the properties of autocorrelation function. 5
 (b) State and explain Nyquist's sampling theorem. 5
 (c) Impulse response of DT-LTI system is 5

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

$$x(n) = \{ -3, -2, -1, 0, 1 \}$$
 Find output $y(n)$ to the input
 (d) Explain any three important properties of the z-transform. 5
2. (a) Determine whether or not the signal below is periodic and determine the fundamental period, if periodic. 5

$$x(n) = \sin(\pi + 0.2n)$$

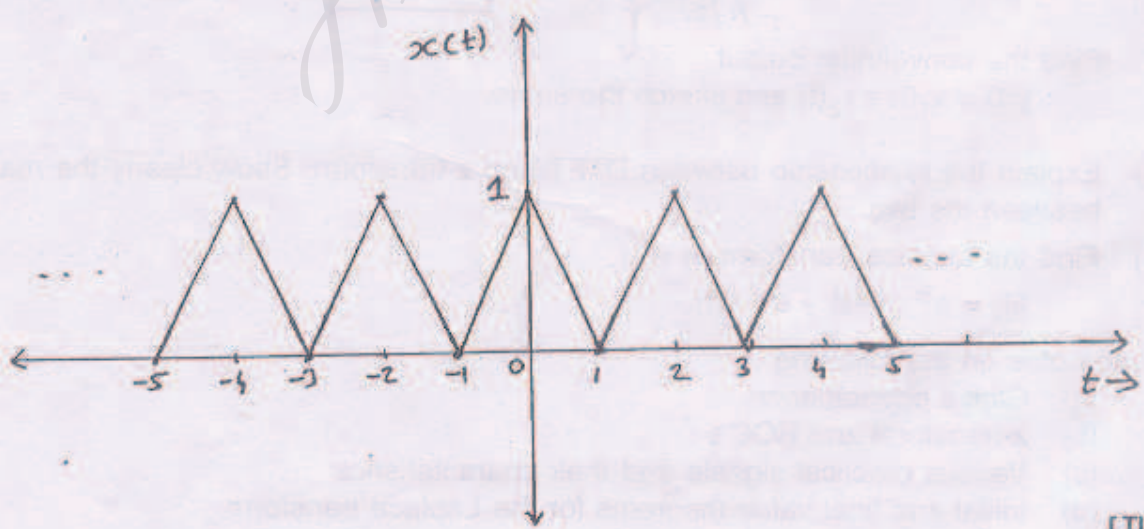
 (b) Find the even and odd parts of 5

$$x(n) = 4(n)$$

 (c) Given the sequence $x(n) = (6 - n) [u(n) - u(n - 6)]$, make a sketch of $y(n) = x(4 - n)$. 5
 (d) Determine whether following system is stable or unstable - 5

$$y(n) = \sum_{k=-\infty}^n x(k)$$

3. (a) Find the exponential Fourier series and plot the magnitude and phase spectrum for 10 the signal $x(t)$ shown in the figure below :-



[TURN OVER

Con. 3295-CO-2659-08.

T.E.C.E. VDIQ Signal & System Analysis
21/10/18

- (b) Find the discrete time Fourier transform of -

10

$$x(n) = \left(\frac{1}{4}\right)^n + 1.$$

4. (a) Consider a system described by the difference equation

10

$$y(n] = y[n - 1] - y[n - 2] + 0.5 x[n] + 0.5 x[n - 1].$$

Find the response of the system to the input

$$x(n) = (0.5)^n u(n)$$

Assume $y(-1) = 0.75$ and $y(-2) = 0.25$.

- (b) Find the inverse of the following z-transform

10

$$X(z) = \log\left(1 - \frac{1}{2}z^{-1}\right), \quad |z| > \frac{1}{2}$$

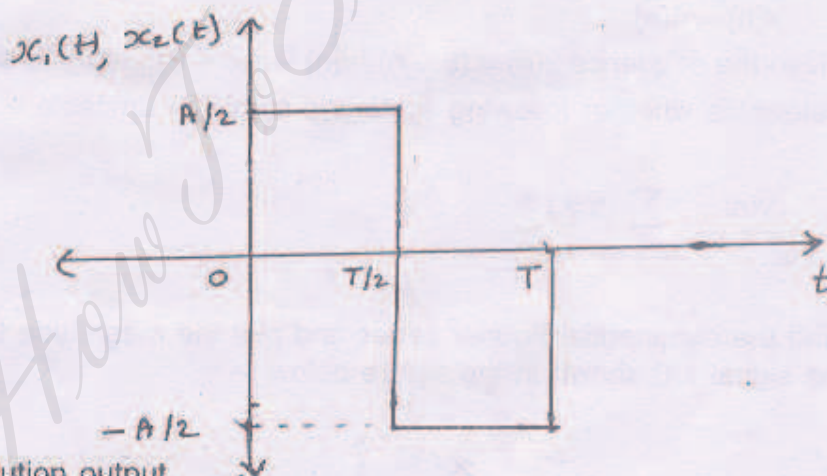
5. (a) Find the impulse response of the system for all the possible ROC for the system transfer function -

10

$$H(s) = \frac{s + 4}{(s + 2)^2 (s + 3)}$$

- (b) Two signals $x_1(t)$ and $x_2(t)$ are same and are shown in a figure below -

10



Find the convolution output $y(t) = x_1(t) * x_2(t)$ and sketch the same.

6. (a) Explain the relationship between DTFT and z-transform. Show clearly the mapping between the two.

10

- (b) Find the Laplace transform of -

10

$$f(t) = e^{3t} u(-t) + e^{-t} u(t).$$

7. Write notes on the following :-

20

- Gibb's phenomenon
- z-transform and ROC's
- Various practical signals and their characteristics
- Initial and final value theorems for the Laplace transform.