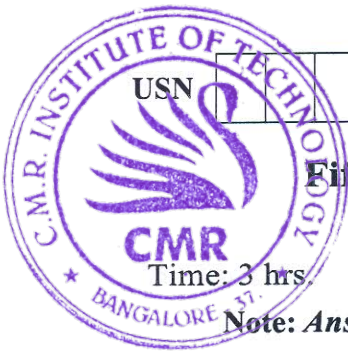


CBCS SCHEME



USN

--	--	--	--	--	--	--	--	--	--

18EE54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Signals and Systems

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Describe the classifications of signals. (06 Marks)
- b. Is the signal shown in Fig.Q1(b) in power or energy signal? Given reasons for your answer and further determine its energy or power.

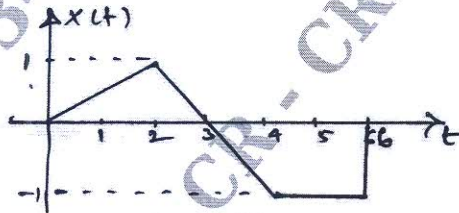


Fig.Q1(b)

(06 Marks)

- c. Determine whether the following signal are periodic, if periodic determine the fundamental period :
 - i) $x(t) = \cos 2t + \sin 3t$
 - ii) $x(n) = \cos(\frac{1}{5}\pi n) \sin(\frac{1}{3}\pi n)$.(08 Marks)

OR

- 2 a. Sketch the following signals and determine their even and odd signals
 $r(t+2) - r(t+1) - r(t-2) + r(t-3)$. (08 Marks)
- b. Given signal $x(t)$ as shown in Fig.Q2(b). Sketch the following : i) $x(-2t+3)$ ii) $x(t/2-2)$.

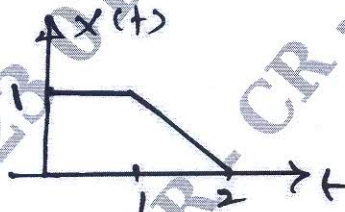


Fig.Q2(b)

(06 Marks)

- c. For each of the system, state whether the system is linear, shift variant, stable, causal and memory. i) $y(n) = \log[x(n)]$ ii) $y(t) = x(t^2)$. (06 Marks)

Module-2

- 3 a. Compute the convolution of two sequences $x_1(n)$ and $x_2(n)$ given below :
 $x_1(n) = \{1, 2, 3\}$ $x_2(n) = \{1, 2, 3, 4\}$. (06 Marks)
- b. Convolute the following two signals
 $x(t) = 1 ; 0 < t < T$ $h(t) = t ; 0 < t < 2T$
 0 ; otherwise 0 ; otherwise
 Obtain expression for the output $y(t)$. (08 Marks)
- c. An LTI system represented by the impulse response :
 i) $h(t) = e^{t^2} u(t-1)$ ii) $h(n) = a^n u(n+2)$
 Determine whether its stable, causal and memory. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 4 a. Find the forced response for the system described by

$$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = 2x(t) + \frac{dx(t)}{dt}$$

with input $x(t) = 2e^{-t} u(t)$.

(08 Marks)

- b. Find the natural response of the system described by difference equation :

$$y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1) \text{ with } y(-1) = 0 \text{ and } y(-2) = 1.$$

(06 Marks)

- c. Draw the direct form I and II realization for the following system :

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

(06 Marks)

Module-3

- 5 a. What are the properties of continuous time Fourier transform and prove Parseval's theorem.

(08 Marks)

- b. Obtain the Fourier transform of the signal :

i) $x(t) = e^{-at} u(t)$

ii) $x(t) = e^{-a|t|}$

(06 Marks)

- c. Using convolution theorem, find the inverse Fourier transform of

$$X(\omega) = \frac{1}{(a + j\omega)^2}.$$

(06 Marks)

OR

- 6 a. Using partial fraction expansion, determine the inverse Fortier transform

$$X(j\omega) = \frac{5j\omega + 12}{(j\omega)^2 + (5j\omega) + 6}$$

CMRIT LIBRARY
BANGALORE 560 037

(08 Marks)

- b. Find the Fourier transform of the following signal using appropriate properties.

$$x(t) = \sin(\pi t) e^{-2t} u(t).$$

(06 Marks)

- c. Consider the continuous time LTI system described by

$$\frac{dy(t)}{dt} + 2y(t) = x(t).$$

Using Fourier transform, find the output $y(t)$ with input signal $x(t) = e^{-t} u(t)$.

(08 Marks)

Module-4

- 7 a. Describe the following properties of DTFT

i) Frequency differentiation

ii) Scaling

iii) Modulation.

(06 Marks)

- b. Find the DTFT of the following signals :

i) $x(n) = (0.5)^{n+2} u(n)$

ii) $x(n) = n(0.5)^{2n} u(n)$

(06 Marks)

- c. Find the inverse DTFT

$$X(\Omega) = \frac{3 - \frac{5}{4} e^{-j\Omega}}{\frac{1}{8} e^{-j2\Omega} - \frac{3}{4} e^{-j\Omega} + 1}.$$

(08 Marks)

OR

- 8 a. Find the frequency response and the impulse response of discrete time system described by difference equation :

$$y(n-2) + 5y(n-1) + 6y(n) = 8x(n-1) + 18x(n) \quad (10 \text{ Marks})$$

- b. Determine the difference equation for the system with following impulse response

$$h(n) = \delta(n) + 2\left(\frac{1}{2}\right)^n u(n) + \left[-\frac{1}{2}\right]^n u(n). \quad (10 \text{ Marks})$$

Module-5

- 9 a. Explain the properties of ROC. (06 Marks)

- b. For the signal $x(n] = 7\left(\frac{1}{3}\right)^n - 6\left(\frac{1}{2}\right)^n u(n)$, find the Z - transform and ROC. (06 Marks)

- c. By using suitable properties of Z - transform find the Z - transform and ROC of the following :

i) $x(n) = \left(\frac{1}{2}\right)^n u(n) - 3^n u(-n-1)$

ii) $x(n) = n a^n u(n-3)$. (08 Marks)

OR

- 10 a. Find the inverse Z - transform of the sequence $x(z) = \frac{z}{3z^2 - 4z + 1}$, for the following :

i) $|z| > 1$ ii) $|z| < \frac{1}{3}$ iii) $\frac{1}{3} < |z| < 1$. (06 Marks)

- b. Solve the following linear constant co-efficient difference equation using unilateral Z - transform method.

$$y(n) = \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = \left(\frac{1}{4}\right)^n u(n), \text{ with I.C. } y(-1) = 4, y(-2) = 10. \quad (08 \text{ Marks})$$

- c. A system has impulse response $h(n) = \left(\frac{1}{2}\right)^n u(n)$. Determine the input to the system if the output is given by $y(n) = \frac{1}{3}u(n) + \frac{2}{3}\left(-\frac{1}{2}\right)^n u(n)$. (06 Marks)
