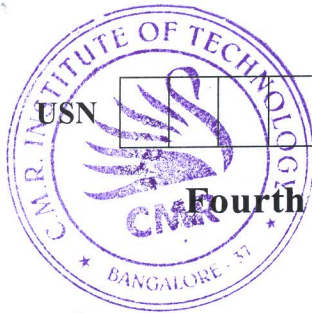


CBCS SCHEME



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17EC42

Fourth Semester B.E. Degree Examination, June/July 2023 Signals and Systems

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Check for periodicity and find its time period for the signal $x(n) = \cos \frac{\pi}{2}n \cdot \cos \frac{\pi}{3}n$. (07 Marks)
- b. Calculate energy or power for the signal $x(t)$ given in Fig.Q1(b).

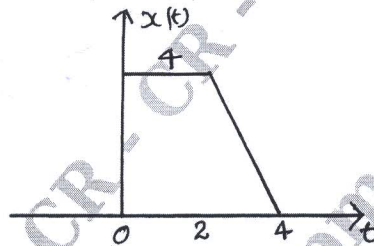


Fig.Q1(b)

(07 Marks)

- c. Given that $x(n) = \{2, 3, 4, 6\}$, sketch $x(-2n + 1)$. (06 Marks)

OR

- 2 a. Represent the signal $x(t)$ in terms of $g(t)$ given in the Fig.Q2(a).

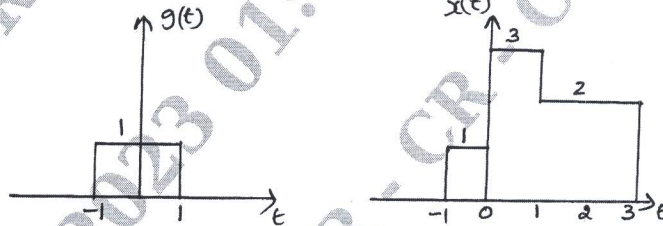


Fig.Q2(a)

(08 Marks)

- b. Given that signal $x(n) = 2n[u(n-1) - u(n-7)]$. Sketch the signals $x(2n-3)$ and $x(n+4)$. (06 Marks)
- c. Check for Linearity and Time invariance for the given system equation:

$$y(t) = x(t) + \frac{1}{x(t-1)}$$

(06 Marks)

Module-2

- 3 a. Given that
 - $x(t) = e^{-at}$ for 0 to T
 - $h(t) = 1$ for 0 to $2T$
 Calculate $y(t) = x(t) * h(t)$ (10 Marks)
- b. Prove the following properties of convolution in continuous domain:
 - (i) Associative (10 Marks)
 - (ii) Commutative

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. Given that $x(t) = 3U(t) - 3U(t - 4)$, $h(t) = 2\delta(t - 1) + \delta(t - 3)$. Calculate $y(t) = x(t) * h(t)$ using properties. (10 Marks)

b. Given that

$$x(n) = \alpha^n \quad 2 \leq n \leq 6 \quad \text{for } 0 < \alpha < 1$$

$$h(n) = 1 \quad 0 \leq n \leq 4$$

Find $y(n) = x(n) * h(n)$ by proper graphs. (10 Marks)

Module-3

5 a. Find step response for the given impulse response

(i) $h(t) = e^{-at} U(t - 2)$

(ii) $h(n) = \left(\frac{1}{2}\right)^n U(n - 3)$

(iii) $h(t) = t U(t)$

(09 Marks)

b. Derive the formula to calculate step response in terms of impulse response. (05 Marks)

c. Find CTFS coefficient for the signal $x(t) = \sin 2\pi t + \cos 3\pi t$. (06 Marks)

OR

6 a. Define the causality for impulse response representation of the system and check the same for the following:

(i) $h(t) = e^t U(t - 2)$

(ii) $h(n) = a^n U(n + 3) \quad 0 < a < 1$

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(06 Marks)

b. Find FS for the signal $x(t)$ in Fig.Q6(b). Also calculate magnitude and phase angle.

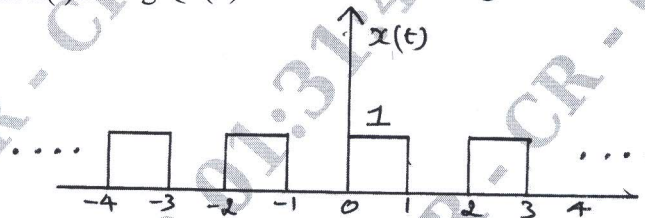


Fig.Q6(b)

(09 Marks)

c. Find DTFS coefficient for the signal $x(n) = \cos\left(\frac{2\pi}{3}n + \frac{\pi}{3}\right)$. (05 Marks)

Module-4

7 a. Find DTFT for the following signal using appropriate properties:

(i) $x(n) = e^{-j2n} (3)^n U(n)$

(ii) $x(n) = 2^n U(n - 1)$

(10 Marks)

b. Find IFT for the spectrum $X(j\omega) = \frac{-j\omega}{(j\omega)^2 + 3(j\omega) + 2}$. (10 Marks)

OR

8 a. Find IDTFT for the spectrum using convolution property

$$X(e^{j\Omega}) = \frac{1}{(1 - ae^{-j\Omega})^2}$$

(10 Marks)

b. Find FT of the signal $x(t) = e^{-at} U(t)$ and calculate magnitude and phase angle. (10 Marks)

Module-5

- 9 a. Give all ROC properties of Z-transform. (05 Marks)
 b. Find z-transform for the signal and plot ROC $x(n) = (n-2)(3)^{n-2}U(n-2)$. (06 Marks)
 c. Find Inverse Z-transform using partial fraction method:

$$X(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2}z^{-1}\right)(1 - 2z^{-1})(1 - z^{-1})}$$

for the ROC $1 < |z| < 2$

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(09 Marks)

OR

- 10 a. Find transfer function and impulse response for the causal system for the given input and output signals:

$$x(n) = \left(-\frac{1}{3}\right)^n U(n); \quad y(n) = 3(-1)^n U(n) + \left(\frac{1}{3}\right)^n U(n) \quad (10 \text{ Marks})$$

- b. Find z-transform and plot ROC with poles and zeros for the given signal
 $x(n) = (2)^n U(n) + (-3)^n U(-n)$ (10 Marks)
