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).

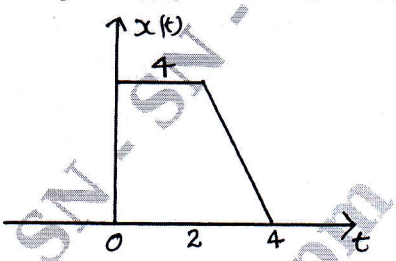

Fig.Q1(b) **(07 Marks)**

c. Given that $x(n) = \{2, \underset{\uparrow}{3}, 4, 6\}$, 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).

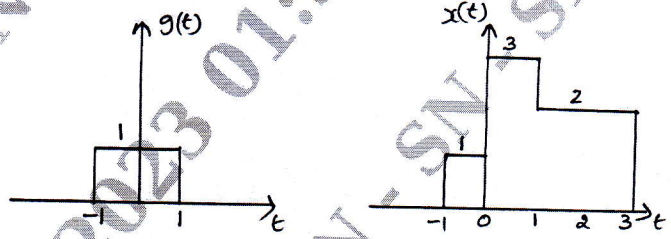

Fig.Q2(a) **(08 Marks)**

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

(ii) Commutative **(10 Marks)**

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

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

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

Find $y(n) = x(u) * h(n)$ 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) $h(n) = a^n\, U(n+3) \quad 0 < a < 1$ **(06 Marks)**

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

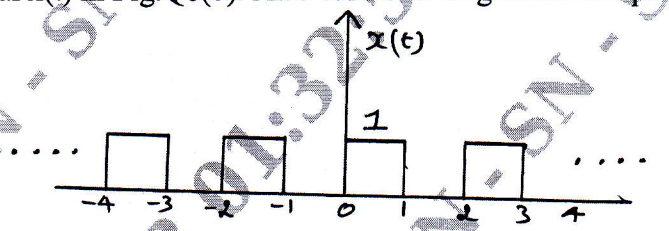

Fig.Q6(b) **(09 Marks)**

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 $X(j\omega) = \dfrac{-j\omega}{(j\omega)^2 + 3(j\omega) + 2}$. **(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 $1 < |z| < 2$ (09 Marks)

OR

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

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

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