

CBCS SCHEME

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18EE54

Fifth 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. Define signal and system. Explain real-life examples for each. (08 Marks)
b. Prove that :

i) $\int_{-a}^a x(t)dt = 2 \int_0^a x(t)dt$; if $x(t)$ is even

ii) $\int_{-a}^a x(t)dt = 0$; if $x(t)$ is odd (12 Marks)

OR

- 2 a. Sketch the following elementary signals:
(i) Unit-step (ii) Unit-Impulse function
(iii) Ramp-function (iv) Exponential damped sinusoidal (08 Marks)
b. What is the average power of triangular wave shown in Fig.Q2(b)?

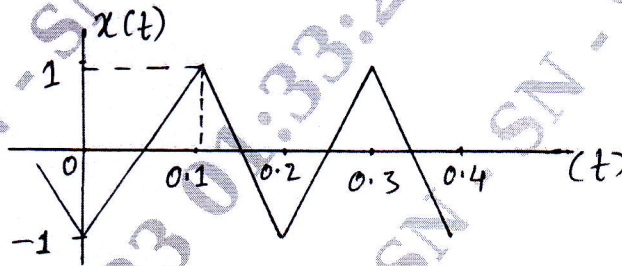


Fig.Q2(b) (12 Marks)

Module-2

- 3 a. Explain distributive property of convolution. (10 Marks)
b. Find the forced response for the system described by

$$\frac{d^2y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = 2x(t) + \frac{dx(t)}{dt} \quad \text{with input } x(t) = 2e^{-t}u(t) \quad (10 \text{ Marks})$$

OR

- 4 a. Explain associative property of convolution. (10 Marks)
b. Find the zero-input response for the system described by the difference equation
 $y(n) + \frac{9}{16}y(n-2) = x(n-1)$ with initial conditions $y(-1) = 1$ and $y(-2) = -1$. (10 Marks)

Module-3

- 5 a. State and prove the Parseval's theorem of CTFT. (10 Marks)
b. Obtain the Fourier transform of the signal, $x(t) = e^{-at}u(t)$; $a > 0$. Draw its magnitude and phase spectra. (10 Marks)

OR

- 6 a. State and prove Scaling property of CTFT. (10 Marks)
 b. Find the time-domain signal corresponding to the spectrum shown in Fig.Q6(b).

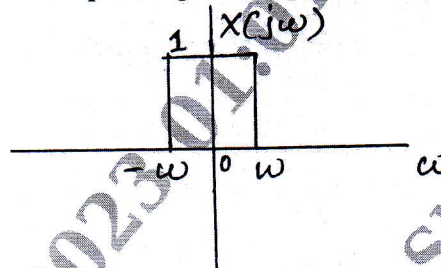


Fig.Q6(b)

(10 Marks)

Module-4

- 7 a. State and prove frequency-differentiation property of DTFT. (10 Marks)
 b. Find the DTFT of the signal,
 $x(n) = \alpha^n u(n)$; $|\alpha| < 1$
 Draw the magnitude spectrum. (10 Marks)

OR

- 8 a. State and prove symmetry property of DTFT. (10 Marks)
 b. Find the inverse DTFT of the following:
 i) $X(e^{j\Omega}) = 1 + 2 \cos \Omega + 3 \cos 2\Omega$
 ii) $Y(e^{j\Omega}) = j(3 + 4 \cos \Omega + 2 \cos 2\Omega) \sin \Omega$ (10 Marks)

Module-5

- 9 a. What are the properties of the region of convergence? (10 Marks)
 b. Determine the z-transform and ROC for the signal $x(n) = \left(\frac{1}{2}\right)^n u(n-2)$ and sketch the ROC, poles and zeros in the z-plane. (10 Marks)

OR

- 10 a. List the properties of Z-transform. (10 Marks)
 b. Find the inverse z-transform of

$$X(z) = \frac{z^3 + z^2 + \frac{3}{2}z + \frac{1}{2}}{z^3 + \frac{3}{2}z^2 + \frac{1}{2}z}; \quad \text{ROC: } |z| < \frac{1}{2}$$

by partial fraction expansion method. (10 Marks)
