CBCS SCHEME

USN

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)?

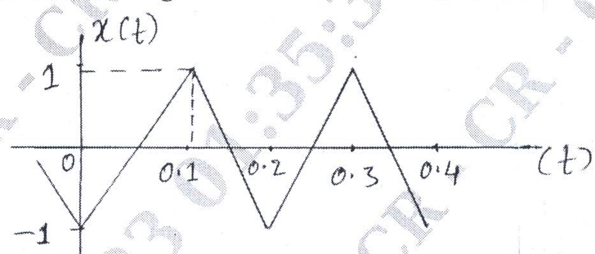

Fig.Q2(b) **(12 Marks)**

Module-2

3 a. Explain distributive property of convolution. **(10 Marks)**

b. Find the forced response for the system described by

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = 2x(t) + \frac{dx(t)}{dt} \quad \text{with input } x(t) = 2e^{-t}u(t)$$ **(10 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 Parsavel'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).

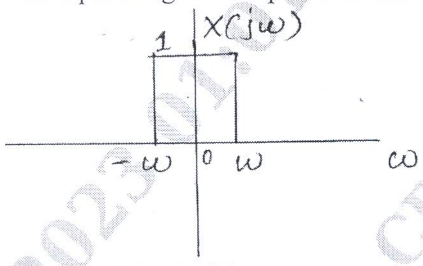

Fig.Q6(b) **(10 Marks)**

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)**

* * * * *