CBCS SCHEME

USN | | | | | | | | | | | **18EE54**

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
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. Explain the signals and systems with the help of suitable examples. **(05 Marks)**

b. Obtain the even and odd part of the given signal x(t) shown in Fig.Q1(b).

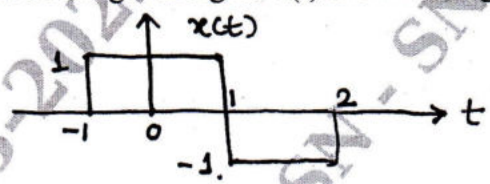

Fig.Q1(b) **(05 Marks)**

c. For the following system, determine whether the system is (i) Linear (ii) Time invariant (iii) Memoryless (iv) Causal (v) Stable.
(A) $y(n) = n\,x(n)$ (B) $y(t) = x(t/2)$ **(10 Marks)**

OR

2 a. Whether the signal shown in Fig.Q2(a) is energy or power signal? Determine energy or power.

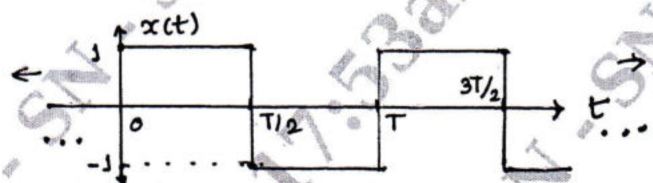

Fig.Q2(a) **(05 Marks)**

b. Check whether the following signals are periodic or not. If periodic, find the fundamental period
(i) $x(n) = \cos 2\pi n$ (ii) $x(t) = \cos 2t + \sin 3t$ **(05 Marks)**

c. For the continuous time signal x(t) shown in Fig.Q2(c). Sketch the following:
(i) $x(2t)$ (ii) $x(t+2)$ (iii) $x(-2t+1)$
(iv) $2x(t-3)$ (v) $x(t+2) + x(t-2)$

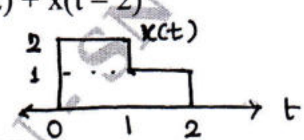

Fig.Q2(c) **(10 Marks)**

Module-2

3 a. Consider a LTI system with unit impulse response, $h(t) = e^{-t} \cdot u(t)$. If the input applied to this system is $x(t) = e^{-3t}[u(t) - u(t-2)]$, find the output y(t) of the system. **(10 Marks)**

b. Find the total response of the system given by $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = 2.x(t)$

with $y(0) = -1$; $\left.\frac{dy(t)}{dt}\right|_{t=0} = 1$ and $x(t) = \cos t \cdot u(t)$ **(10 Marks)**

OR

4 a. Find the natural response of the system described by difference equation,

$$y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1)$$

with $y(-1) = 0$ and $y(-2) = 1$ **(08 Marks)**

b. Draw the direct form I and direct form II of the given system function

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{d^2x(t)}{dt^2} + 3\frac{dx(t)}{dt} + 2x(t)$$ **(06 Marks)**

c. Check whether the LTI system which has impulse response given by,

i) $h(t) = \cos(\pi t)\cdot u(t)$ ii) $h(n) = \sin(\frac{1}{2}\pi n)$

is memoryless, causal or stable. **(06 Marks)**

Module-3

5 a. State and prove the following continuous time fourier transform :

(i) Convolution property (ii) Time shift property **(10 Marks)**

b. Find the fourier transform of the following :

(i) $x(t) = e^{-a|t|}$; $a > 0$ (ii) $x(t) = \delta(t)$

Draw the spectrum. **(10 Marks)**

OR

6 a. Using partial expansion, determine the inverse fourier transform of

$$X(jw) = \frac{5jw + 12}{(jw)^2 + 5jw + 6}$$ **(05 Marks)**

b. Find the frequency response and the impulse response of the system having the output y(t) for the input x(t) as given below:

$x(t) = e^{-t}u(t)$ and $y(t) = e^{-3t}u(t) + e^{-2t}u(t)$ **(07 Marks)**

c. Find the frequency response and the impulse response of the system described by the differential equation.

$$\frac{d^2y(t)}{dt^2} + 5\cdot\frac{dy(t)}{dt} + 6y(t) = -\frac{dx(t)}{dt}$$ **(08 Marks)**

Module-4

7 a. Using the appropriate, find the DTFT of the following signal

(i) $x(n) = \left(\frac{1}{2}\right)^n.u(n-2)$ (ii) $x(n) = \sin\left(\frac{\pi}{4}n\right)\left(\frac{1}{4}\right)^n.u(n-1)$ **(10 Marks)**

b. Find the inverse DTFT of

(i) $X(e^{j\Omega}) = \frac{6}{e^{-j2\Omega} - 5e^{-j\Omega} + 6}$

(ii) $X(e^{j\Omega}) = 1 + 2\cos\Omega + 3\cos 2\Omega$ **(10 Marks)**

OR

8 a. State and prove the following properties of DTFT :

(i) Linearity property (ii) Frequency shift (iii) Parseval's theorem. **(10 Marks)**

b. Obtain the frequency response and the impulse response of the system having the output y(n) for the input x(n) as given below,

$x(n) = (1/2)^n . u(n)$, $y(n) = \frac{1}{4}(\frac{1}{2})^n . u(n) + (\frac{1}{4})^n . u(n)$ **(10 Marks)**

Module-5

9 a. State and prove the following property of z-transform:
(i) Initial Value theorem (ii) Differentiation in the z-domain. **(08 Marks)**

b. For the signal $x(n) = 7(1/3)^n u(n) - 6(½)^n . u(n).$, find the z-transform and ROC. **(06 Marks)**

c. List the ROC (Region Of Convergence) of z-transform. **(06 Marks)**

OR

10 a. Using partial fraction expansion method, obtain the time domain signal corresponding to the z-transform given below.

$$X(z) = \frac{1 - \frac{1}{2}z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}} \quad ; |z| > \frac{1}{2}$$ **(06 Marks)**

b. Determine the impulse response h(n) and the system function H(z) of the system, if the input

$$x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$$

$$y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$$ **(06 Marks)**

c. A causal LTI system is described by difference equation

$$y(n) - \frac{1}{4}y(n-1) - \frac{3}{8}y(n-2) = -x(n) + 2x(n-1)$$

find the system function H(z). Also determine the impulse response of the system. **(08 Marks)**

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