CBCS SCHEME

USN

18EC45

Fourth 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. Given the signal x(t) as shown in the Fig.Q1(a) sketch the following signal.
i) $x(2t-2)$ ii) $x(-2-2t)$ iii) $x(0.5t)$ iv) $x(-t)\cdot u(t)$.

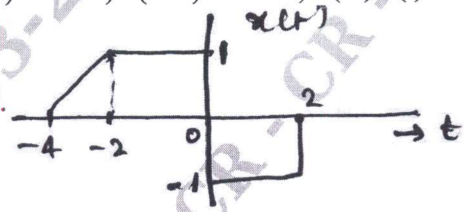

Fig.Q1(a) **(08 Marks)**

b. Determine the even and odd components of

i) $x(n) = \sin\left(\frac{2\pi n}{7}\right)(1+n^2)$

ii)

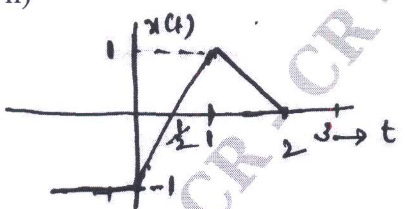

Fig.Q1(b) **(08 Marks)**

c. Define signal and systems with examples. **(04 Marks)**

OR

2 a. Categorize each of the following signals as power or energy signals and find the energy or power of the signal. i) $x(n) = (\frac{1}{4})^n u(n)$ ii) $x(t) = A\cos(2\pi f t + \theta)$. **(06 Marks)**

b. Determine whether the following signals are periodic or not. If periodic, determine the fundamental period.

i) $x(n) = \cos\left(\frac{\pi}{2}n\right)\cos\left(\frac{\pi}{4}n\right)$ ii) $x(n) = \sin(\pi + 0.2n)$. **(06 Marks)**

c. Fig.Q2(c)(i) shows a pulse x(t) that may be viewed as super position of three rectangular pulses. Starting with the rectangular pulse g(t) of Fig.Q2(c)(ii). Construct this waveform and express x(t) interms of g(t).

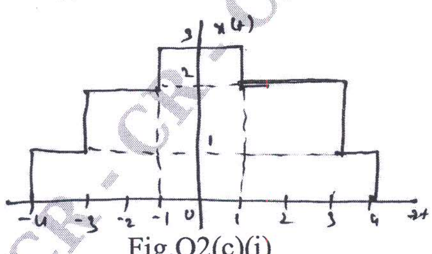

Fig.Q2(c)(i)

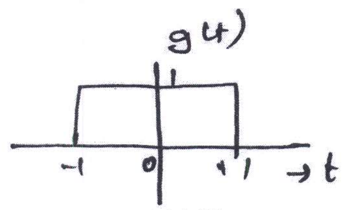

Fig.Q2(c)(ii) **(08 Marks)**

Module-2

3 a. Define the following with an example, Causal system, Memoryless system, Linear system, Time invariant system, Stable system. **(10 Marks)**

b. Find the convolution of the signal x(t) and h(t) sketch the following signals :

$x(t) = u(t) - u(t-2) \qquad h(t) = t[u(t) - u(t-4)]$. **(10 Marks)**

OR

4 a. The input and impulse response of a linear time invariant system is shown in Fig.Q4(a). Find the output of the system using graphical convolution.

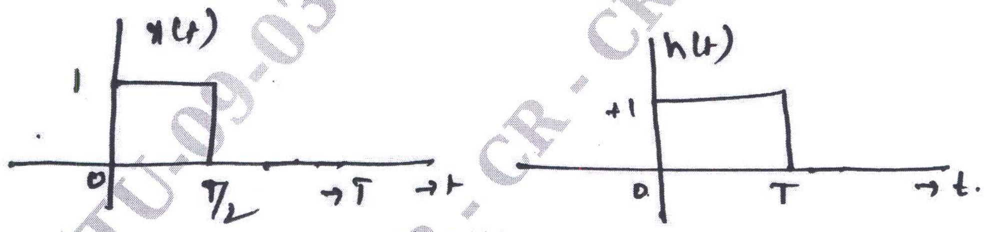

Fig.Q4(a) **(12 Marks)**

b. Find and sketch the convolution Sum of the signals

$x(n) = 2\partial(n) + 3\partial(n-1) + 4\partial(n-2)$

$h(n) = 2u(n) + 3u(n-1)$. **(08 Marks)**

Module-3

5 a. The impulse response of a system is :

$h(n) = \partial(n) + 4\partial(n-2) + 3\partial(n-3)$

i) Find the output y(n) of the system for the input $x(n) = u(n) - 2u(n-2) + u(n-4)$ sketch x(n), h(n) and y(n)

ii) Verify whether the system in causal memory less and stable. **(12 Marks)**

b. State and prove convolution property of discrete time periodic signals. **(08 Marks)**

OR

6 a. Find the Fourier series representation for the continuous time periodic signal x(t) shown in the Fig.Q6(a). Sketch the amplitude spectrum.

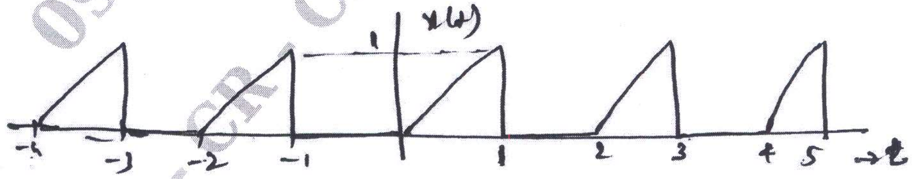

Fig.Q6(a) **(10 Marks)**

b. If x(t) is a real time periodic signal then show that :

$X^k(k) = X(-k)$ where X(k) is the complex Fourier series coefficient. **(04 Marks)**

c. Find the Fourier series representation for the discrete time signal.

$x(n) = 1 + \sin(0.25\pi n) + 3\cos(0.25\pi n) + \cos(0.5\pi n + 0.5\pi)$. **(06 Marks)**

Module-4

7 a. State and move the following properties of DTFT :
i) Time Shifting
ii) Parseval theorem. (08 Marks)

b. Find the inverse DTFT of $X(e^{j\Omega}) = (1 + \cos\Omega)e^{-j2n}$. (04 Marks)

c. Find the inverse Fourier transform of the following :

i) $X(jw) = \dfrac{5(1+jw)}{6+5jw-w^2}$

ii) $X(jw) = \dfrac{5+jw}{6+jw}$. (08 Marks)

OR

8 a. Find the Fourier transform for :
i) $g(t) = e^{-a|t|}$
ii) $x(t) = 1 - |t|$ for $-1 < t < +1$. (10 Marks)

b. The output of a continuous time system is $y(t) = 2e^{-3t}u(t)$ for the input system $x(t) = e^{-2t}u(t)$. Find the frequency response and impulse response of the system. Find the energy for both input and output signals. (10 Marks)

Module-5

9 a. Explain briefly the ROC and its important properties. (06 Marks)

b. State and prove shifting and scaling properties of Z transform. (06 Marks)

c. Find the Z transform of the following signals and indicate their ROC,

i) $x(n) = -a^n u(-n-1)$

ii) $x(n) = \left(\frac{1}{3}\right)^n \sin\left(\frac{\pi}{4}n\right)u(n)$. (08 Marks)

OR

10 a. Find the inverse Z transform for x(z) defined below :

$$X(z) = \frac{4+2z^{-1}}{(4-z^{-1})(2-z^{-1})(1-z^{-1})}$$

for ROC $|z| > 1$
$|z| < 0.25 \quad 0.5 < |z| < 1$. (10 Marks)

b. A causal discrete time system is defined by the difference equation :
$y(n) + 3y(n-1) + 2y(n-2) = 6x(n)$.
Find the transform function
Find the impulse response and step response for the system. (10 Marks)

* * * * *