USN

10EC44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Signals and Systems

Time: 3 hrs. Max. Marks:100

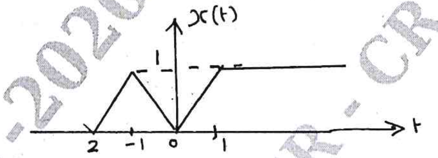
Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART - A

1 a. Sketch the even and odd part of the signal shown in Fig. Q1(a). **(06 Marks)**

Fig.Q1(a)



b. Find the energy of the signal

$$x(n) = \begin{cases} n, & 0 \le n \le 5 \\ 10 - n, & 6 \le n \le 10 \\ 0, & \text{otherwise} \end{cases}$$ **(06 Marks)**

c. Let x(t) and y(t) are given in fig.Q1(c) respectively. Sketch the following signals
i) x(t) y(t – 1) ii) x(t – 1) y(-t). **(08 Marks)**

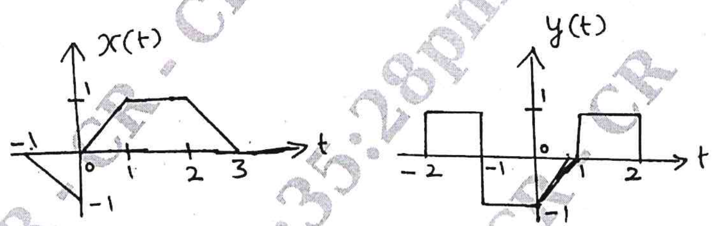


Fig.Q1(c)

2 a. An LT1 system has impulse response
h(n) = u(n+2) – u(n-2) and input
x(n) = u(n+5) – u(n-5), find the ouput of the system and sketch the output. **(10 Marks)**

b. Use the definition of the convolution integral to derive the following properties :
i) x(t) * h(t) = h(t) * x(t) ii) $[x(t) * h1(t)] * h_2(t) = x(t) * [h_1(t) * h_2(t)]$. **(10 Marks)**

3 a. Find the output of the system described by the differential equation with input and initial conditions are specified.

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = \frac{dx(t)}{dt} \text{ with } y(0) = 0\ ,\ \left.\frac{dy(t)}{dt}\right/_{t=0} = 1 \text{ and } x(t) = \sin t\ u(t).$$ **(08 Marks)**

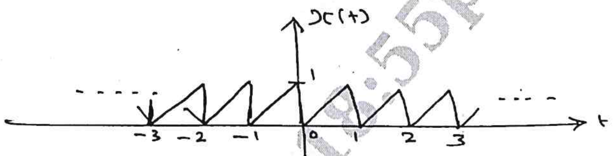
b. Find the natural response of the system described by difference equation
y(n) – 4 y(n-2) = x(n-1) with y(-1) = 1 and y(-2) = -1. **(06 Marks)**

c. Draw the Direct form – 1 and direct form – 11 implementation for the difference equation
$y(n) + \frac{1}{2}\ y(n-1) - y(n-3) = 3x(n-1) + 2x(n-2)$. **(06 Marks)**

4 a. Prove the following properties of Continuous time Fourier series :
i) Time shift ii) Frequency shift iii) Modulation. **(12 Marks)**

b. Find the Complex Fourier Coefficient for the periodic waveform x(t) shown in fig.Q4(b). **(08 Marks)**

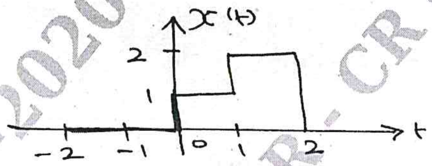
Fig.Q4(b)



PART - B

5 a. Find the Fourier Transform of the pulse x(t) shown in fig. Q5(a). **(06 Marks)**

Fig.Q5(a)



b. Find the Fourier Transform of the signal $x(t) = e^{-a(t)}$, $a > 0$.
Also sketch the magnitude and phase spectra. **(08 Marks)**

c. Find the Inverse Fourier Transform of

$$X(W) = \frac{jW}{(jW+2)^2}.$$ **(06 Marks)**

6 a. Obtain the Frequency response and impulse response of the system having output y(n) for the input x(h)

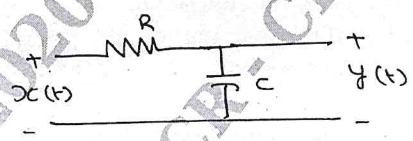
$$x(n) = \left(\frac{1}{2}\right)^n u(n)$$

$$y(n) = \frac{1}{4}\left(\frac{1}{2}\right)^n u(n) + \left(\frac{1}{4}\right)^n u(n).$$ **(08 Marks)**

b. A signle $x(t) = \cos(5\pi t) + 0.5\cos(10\pi t)$ is ideally sampled with sampling period T_s. Find the Minimum Sampling frequency in H_z. **(04 Marks)**

c. Find the Frequency response of the network shown in fig.Q6(c). Also find the impulse response of the network. **(08 Marks)**

Fig.Q6(c)



7 a. What is ROC? Mention its properties. **(06 Marks)**

b. Determine the Z – transform and ROC of the sequence

$$x(n) = 7\left(\frac{1}{3}\right)^n u(n) - 6\left(\frac{1}{2}\right)^n u(n).$$ **(06 Marks)**

c. Determine Inverse Z – transform of the function

$$X(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - 2z^{-1}\right)\left(1 - z^{-1}\right)},$$

With i) ROC : $|z| > 2$ ii) ROC : $|z| < \frac{1}{2}$.

Use Partial Fraction Expansion Method. **(08 Marks)**

8 a. An LT1 system described by a system Transfer function

$H(z) = \dfrac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$. Specify the ROC of H(z) and determine h(n) for the following condition : i) The system is stable ii) The system is causal. **(08 Marks)**

b. Determine h(n) of the system described by $y(n) + \frac{1}{2}y(n-1) = x(n) - 2x(n-1)$. **(06 Marks)**

c. Solve the following difference equation with x(n) = u(n) and initial condition is y(-1) = 1.
$Y(n) + 3y(n-1) = x(n)$. **(06 Marks)**

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