USN

**10EE52**

# Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
# Signals and Systems

Time: 3 hrs. Max. Marks: 100

**Note:** ***Answer FIVE full questions, selecting at least TWO questions from each part.***





## PART – A

1 a. Define a signal and a system. Briefly explain the properties of Discrete time LTI system. **(10 Marks)**

b. Sketch the following signal. Hence find even and odd components of signal. Draw even and odd parts of x(t).

$$x(t) = u(t) - r(t-1) + 2r(t-2) - r(t-3)$$ **(10 Marks)**

2 a. Differentiate between power and energy signal. Check whether the signal shown in Fig.Q2(a) is power or energy signal. Hence find the corresponding value. **(10 Marks)**

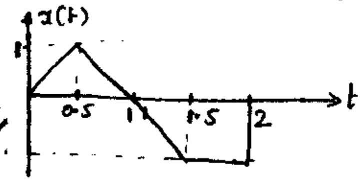


Fig.Q2(a)

b. Obtain the convolution of the given two signals. Also sketch the output signal, y(t).

Given: $h(t) = \begin{cases} 1 & \text{for } 1 \le t \le 3 \\ 0 & \text{otherwise} \end{cases}$ $x(t) = \begin{cases} 1-t & \text{for } 0 \le t \le 1 \\ 0 & \text{otherwise} \end{cases}$ **(10 Marks)**

3 a. The impulse response of a continuous time LTI system is given by, $h(t) = e^{2t} u(t-1)$. Check, whether the system is stable, causal and memoryless. **(06 Marks)**

b. Find the response of the system described by the difference equation :

$$y(n) - \frac{1}{4}y(n-2) = x(n-1) \quad \text{with } y(-1) = 1,\ y(-2) = 0 \text{ and } x(n) = u(n).$$ **(08 Marks)**

c. Find the difference equation representation, for the block diagram representation, for the continuous time LTI system shown in Fig.Q3(c). **(06 Marks)**

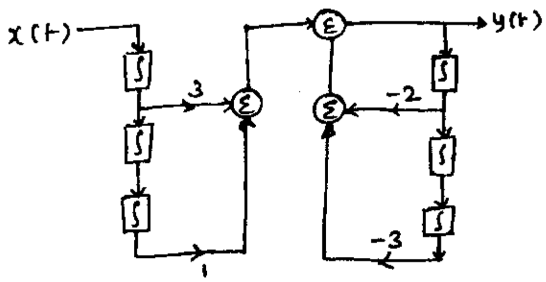


Fig.Q3(c)

4 a. Prove the following properties:

i) Convolution property of periodic discrete time sequences

ii) Parseval relationship for the FS. **(10 Marks)**

b. Determine the FS representation for the signal x(t) of fundamental period T given by $x(t) = 3\cos\left[\frac{\pi}{2}t + \frac{\pi}{4}\right]$. Sketch the magnitude and phase of X(k). **(10 Marks)**

## PART – B

5 a. State and prove the following of fourier transform:
i) Time shifting property ii) Time differentiation property iii) Parseval's theorem **(12 Marks)**

b. Using convolution theorem, find inverse fourier transform of:
$$X(\omega) = \frac{1}{(4 + j\omega)^2}$$ **(08 Marks)**

6 a. Determine the time domain expression for the following:
i) $X(e^{j\Omega}) = \dfrac{6 - \frac{2}{3}e^{j\Omega} - \frac{1}{6}e^{-j2\Omega}}{-\frac{1}{6}e^{-j2\Omega} + \frac{1}{6}e^{j\Omega} + 1}$ ii) $X(j\omega) = \dfrac{2j\omega + 1}{(j\omega + 2)^2}$ **(10 Marks)**

b. State and prove sampling theorem for low pass signals. **(10 Marks)**

7 a. List the properties of ROC. **(05 Marks)**

b. Find the z-transform of the following:
i) $x(n) = n\sin\left(\frac{\pi}{2}n\right)u(-n)$ ii) $x(n) = \left(\frac{1}{2}\right)^n u(n) * \left(\frac{1}{3}\right)^n u(n)$ **(06 Marks)**

c. Prove the following properties of z-transform:
i) Differentiation ii) Convolution iii) Linearity. **(09 Marks)**

8 a. Use unilateral z-transform to determine the forced response, the natural response and the complete response of the system described by the difference equation:
$y(n) - \frac{1}{2}y(n-1) = 2x(n)$ with the input, $x(n) = 2\left(\frac{-1}{2}\right)^n u(n)$ and initial condition $y(-1) = 3$. **(12 Marks)**

b. A causal system has $4H(z) = \dfrac{8}{z^{-2} - 6z^{-1} + 8}$. Determine the pole locations. Is the system stable? Obtain the Impulse Response h(n). **(08 Marks)**

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