Date: 29/05/2015

T.E Sem V - OLD - Extc - SS

(OLD COURSE)

(3 Hours)   [Total Marks : 100]

N.B. : (1) Questions **No.1** is **compulsory**.
  (2) Attempt any **five** questions in **all**.
  (3) Assume **suitable** data, if **required** & **state** them clearly.

1. Answer any four of the following: 20
  (a) A linear time invariant (LTI) system is characterized by the following difference equation.
     $y(n) = ay(n-1) + bx(n)$ for $0 < a < 1$.
     Find the magnitude & phase of the frequency response $H(e^{j\omega})$ of the system.
  (b) Determine the z transform of the signal
     $x(n) = n\,a^n u(n)$. Draw pole-zero plot & show ROC.
  (c) Let $x(n) = u(n) - u(n-5)$.
     Find & sketch even & odd parts of $x(n)$.
  (d) Determine the signal energy & signal power for the following signals:
     (i) $x(t) = e^{-3|t|}$
     (ii) $x(t) = e^{-3t}$
  (e) State & explain convolution property of z transform.

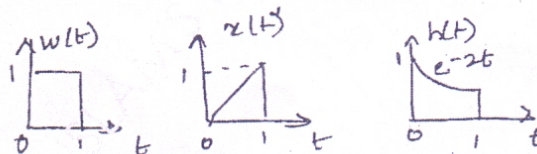2. (a) Find the Fourier series for the function $x(t)$ defined   10

$$x(t) = \begin{cases} 0 & -T/2 < t < 0 \\ A\sin\omega_0 t & 0 < t < T/2 \end{cases}$$

    and $x(t+T) = x(t)$, $\omega_0 = 2\pi/T$
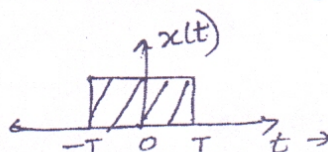
  (b) Find the Laplace transform of the signals shown below.   10

3. (a) Obtain the Fourier transform of a rectangular pulse shown.   6

  (b) Determine the O/P response of the system $h(t) = u(t)$ to an input   8
     $x(t) = e^{-at} u(t)$, $a>0$.
  (c) Explain & prove time shifting & frequency shifting property of Fourier transform. 6

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4. (a) Solve the following difference equation using z transform method.   10

$$x[n+2] + 3x[n+1] + 2x[n] = 0$$

Where the initial conditions are x [0] = 0 & x [1] = 1.

(b) A system is defined by the following difference equation   10

$$y(n) - \frac{1}{6} y(n-1) - \frac{1}{6} y(n-2) = x(n).$$

    (i)   Realize the system using direct form II & Parallel realisation.

    (ii)   Comment on the stability of the system.

5. (a) Obtain inverse z transform of the following X (z)   8

$$X(z) = \frac{1}{(1+z^{-1})(1-z^{-1})} \quad , \quad ROC|z|>1$$

(b) Prove that LTI system is stable if its impulse response is absolutely summable.   8

(c) Compare discrete time Fourier transform & continuous time Fourier.   4

6. (a) Determine the system function & unit sample response of the system describe   6
by the difference equation.

$$y[n] - \frac{1}{2} y[n-1] = 2x[n], \quad y[-1] = 0.$$

(b) Explain the relationship between Laplace transform & Fourier transform.   7

(c) The impulse response of LTI system is h [n] = {1, 2, 1, -1}   7
Find out the response of the system to the input signal x [n] = {1, 2, 3, 1}

7. (a) The transfer function of the system is given as   8

$$H(s) = \frac{s^2 + s + 5}{s^3 + 5s^2 + 8s + 4}$$

Obtain the sate variable model.

(b) Using a suitable method obtain the state transition matrix e^{At} for the following   8

system $A = \begin{bmatrix} 0 & -3 \\ 1 & -4 \end{bmatrix}$.

(c) State properties of state transition matrix.   4