

## Department of Electronics &amp; Communication Engineering

Faculty of Engineering, Integral University, Lucknow

## Assignment Sheet 3

Signals &amp; Systems (IEC-402)

Faculty : Shrish Bajpai

Problems : 09

Section : Unit III &amp; IV

Due Date : March 13, 2015.

1. The impulse response of an RC high pass circuit is given by  $h(t) = \left[ \delta(t) - \left\{ \frac{1}{\tau} e^{-\left(\frac{t}{\tau}\right)} U(t) \right\} \right]$  where  $x(t)$  is the voltage source which is given as  $5\{U(t) - U(t-T)\}$ , find the output  $y(t)$  is the voltage across the resistor where  $\tau = RC$  is the time constant of the network.
2. The impulse response  $h(t)$  and input  $x(t)$  for an LTI system is given as  $[U(t-1) - U(t-6)]$ . Draw its output response.
3. A unit step input is applied to an LTI system at rest result in the response

$$y_s(t) = \left[ \frac{1}{2} tU(t) - \frac{1}{20} (1 - e^{-10t})U(t) \right]$$

What is the impulse response from the step response?

4. The current in an RLC circuit  $y(t)$  is related to its input voltage  $x(t)$  by

$$6y(t) + 9 \frac{dy}{dt} + 3 \frac{d^2y}{dt^2} = 3x(t) + \frac{dx}{dt}$$

With the initial condition given by  $y(0) = 6$  &  $y'(0) = \left. \frac{dy}{dt} \right|_{t=0} = -5$  with  $x'(0) = \left. \frac{dx}{dt} \right|_{t=0} = 0$ .

Determine the complementary function, particular solution and total response of the circuit for  $x(t) = 4$ .

5. The impulse response of an LTI system is given as  $h(t) = 3\delta(t - 1)$ .
  - (a). Determine  $H(s)$ .
  - (b). If the system is modified such that the function  $H(s)$  becomes as given by

$$H(s)|_{s=\sigma+j\omega} = H(j\omega) = \begin{cases} 3e^{-j\omega} & ; |\omega| < 100 \text{ rad/s} \\ 0 & ; |\omega| \geq 100 \text{ rad/s} \end{cases}$$

Determine the steady state response of the modified system to each input (I).  $x(t) = 5e^{j70t}$  (II).  $x(t) = 7e^{-j120t}$

6. The impulse response of an RC high pass circuit  $h(t) = \left[ \delta(t) - \left\{ \frac{1}{\tau} e^{-\left(\frac{t}{\tau}\right)} U(t) \right\} \right]$  where  $\tau = 0.1$ .

(a) What is the system function  $H(j\omega)$ .

(b) What is the steady state response of the circuit to the

(I).  $x(t) = 5$

(II).  $x(t) = 5e^{j100t}$

(III).  $x(t) = 5e^{-j100t}$

(IV).  $x(t) = 10 \cos 100t$

7. A DT LTI system with the unit samples response of  $h[n] = a^n U(n)$  is excited by the input  $x[n] = U(n)$ . What is the response of the system?

8. From the model of a 3 point moving average given by

$$y[n] = \frac{1}{3} \{x[n] + x[n-1] + x[n-2]\}$$

Determine the impulse response of the averager.

9. Let the impulse response of an interpolator describe by

$$y[n] = x[n] + 0.5\{x[n-1] + x[n+1]\}$$

Determine that system is causal or not.

Do the assignment on A-4 sheets only. Use both side of the page.

After the date of submission, assignment will not be accepted and zero marks will be allotted to the student who fail to submit the assignment on due date.