College of Engineering, Pune

END SEMESTER EXAM

Year (S.Y. B.Tech, 2011)

(ET-203)- (Signals and Systems)

Day & Date- Max. Marks-50

Timing- Duration – 3 Hrs

Instructions:

1. Figures to the right indicate full marks.
2. All questions are compulsory.
3. Draw neat figures wherever needed.
4. Assume Suitable data wherever necessary.
5. Strictly follow the sequence of questions for the answers.

Q. 1 A A system is shown in Figure 1 determine is system is memoryless, causal, linear, time invariant. **(4)**

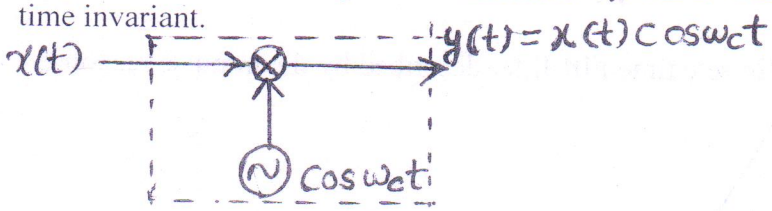


Figure 1

B The impulse response of the system is $h(t) = e^{-at}u(t)$. Find the step response of the system. **(3)**

C A continuous time signal is shown in figure 2. Sketch & label each of following signals (a) $x(t)u(1-t)$ (b) $x(t)[u(t)-u(t-1)]$ (c) $x(t)\delta(t-\frac{3}{2})$ **(3)**

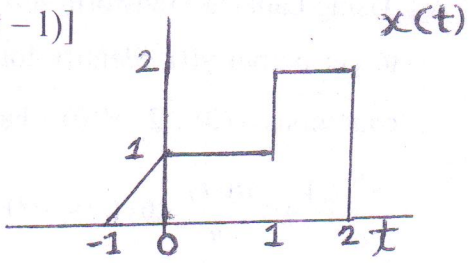


Figure 2

OR

Consider a continuous time LTI system whose step response is given by, **(3)**

$s(t) = e^{-t}u(t)$. Determine & sketch the o/p of the system to the input x(t) shown in figure 3.

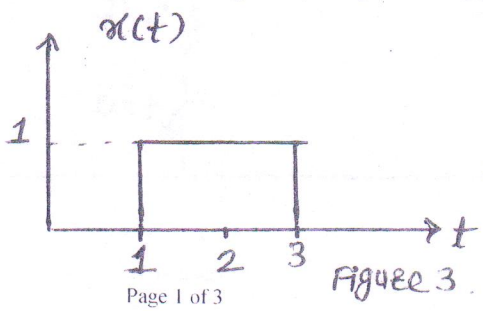
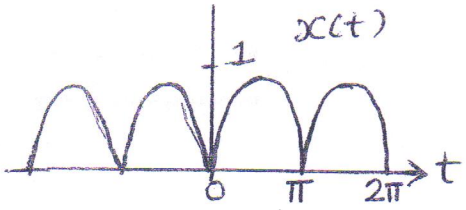


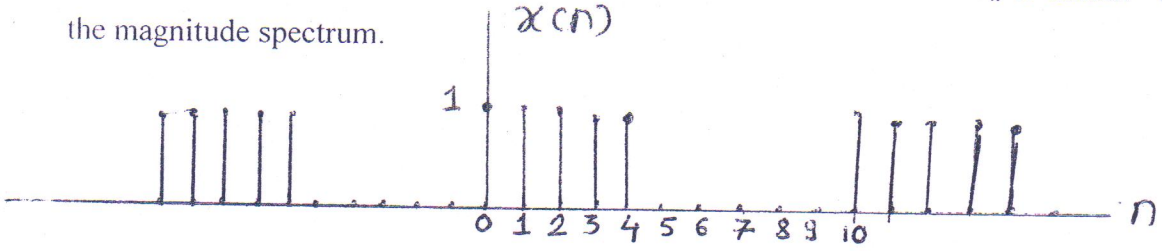
Figure 3

Q2 A Determine Fourier series representation of the full wave rectifier (5)

$x(t) = \sin t \quad 0 \le t < \pi$



B Consider a periodic sequence x(n) . Determine Fourier coefficients C_k & sketch the magnitude spectrum. (5)



OR

Consider a causal discrete time FIR filter described by the impulse response h(n)={ 2 2 -2 -2} (5)

a)Sketch the impulse response h(n) of the filter.

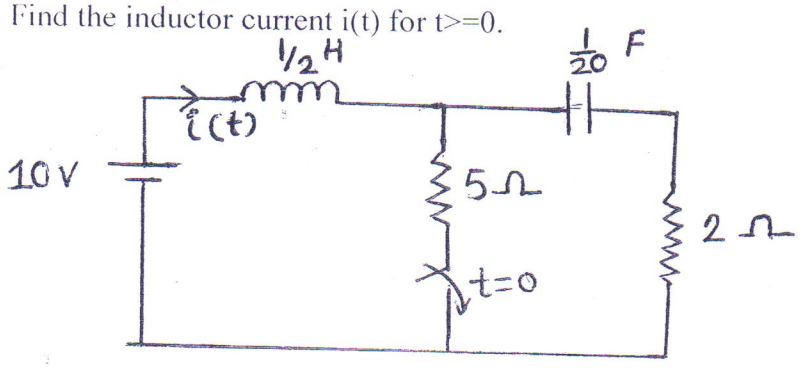
b)Find the frequency response of the filter $H(e^{jw})$

c) Sketch the magnitude response $|H(e^{jw})|$

Q3 A Using Laplace Transform solve the second order linear differential equation to get output y(t), identify forced & natural response of the system with initial conditions $y(0) = 2$, $y'(0) = 1$ and $x(t) = e^{-t}u(t)$ (5)

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = x(t)$$

B In the circuit the switch is in closed position for a long time, before it is opened at t=0. Find the inductor current i(t) for t>=0. (5)



C Using Laplace transform find the output of the system using convolution property. Given $x(t) = \cos(2t)u(t)$ and $h(t) = u(t-4)$ (5)

OR

Find the inverse Laplace Transform of the following signal $X(s) = \dfrac{2s+4}{s^2+4s+3}$ (5)

For ROC (i) $\mathrm{Re}(s) > -1$ (ii) $\mathrm{Re}(s < -3)$ (iii) $-3 < \mathrm{Re}(s) < -1$

Q.4 A Find Z-transform of $x(n) = -na^n u(-n-1)$. State its ROC. (5)

B Find inverse Z-T of the given function using long division method, for (5)

ROC i) $|z| > 1$ ii) $|z| < 1$ $\quad x(z) = \dfrac{1}{1-1.5z^{-1}+0.5z^{-2}}$

C A causal system is represented by the difference equation (5)

$$y(n)+\frac{1}{4}y(n-1)=x(n)+\frac{1}{2}x(n-1)$$

i) Find the system function H(Z) and give corresponding ROC

ii) Find unit sample response of the system

iii) Find the frequency response $H(e^{jw})$

OR

Draw block diagram implementation of the following systems as a parallel combination of second order sections using direct form-II with real valued coefficients. (5)

$$h(n) = 2\left(\frac{1}{2}\right)^n u(n)+\left(\frac{j}{2}\right)^n u(n)+\left(\frac{-j}{2}\right)^n u(n)+\left(\frac{-1}{2}\right)^n u(n)$$