EC-303

Roll No. | | | | | | | | | | |

B. Tech.
(SEM. III) ODD SEMESTER EXAMINATION 2014-15
SIGNALS AND SYSTEMS

Time: 3 Hours Maximum Marks: 100

Note: *Attempt all Questions. All Questions carry equal marks:-*

Q1.Attempt any ***four*** parts of the following:- (5x4=20)

(a) Determine whether the following signal is Energy signal or, Power signal and calculate their energy and power.
$x(t) = rect(t/T_0)\cos w_0 t$

(b) Establish the relationship among Unit step function, Unit ramp function and Unit impulse function.

(c) Find the even and parts of the signals
(i) $x[n]=u[n]$ (ii) $x[n]=a^n u[n]$

(d) Express the given waveform as shown in Fig. 1using ramp signals.

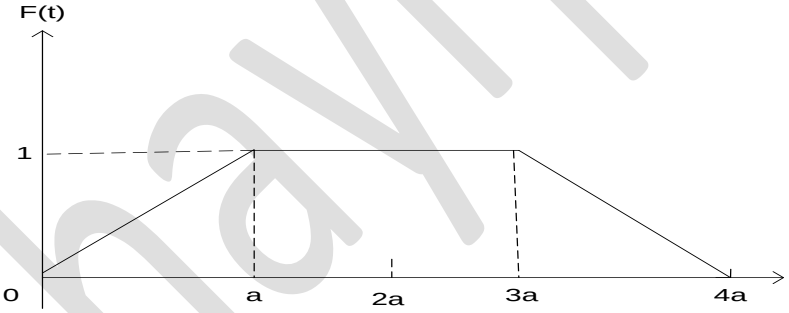

Fig. 1

(e) Determine the value of P∞ and E∞ of the followimg signals
(i) $x[n] = 2^n u[n]$ (ii) $e^{-(1/2)t}u(t)$

(f) Determine whether or not each of the following signals is periodic. If a signal is periodic specify its fundamental period **(i)** $x(t) = \sin^2 t$ **(ii)** $x[n] = \cos[(\pi/8)n^2]$

Q2. Attempt any ***four*** parts of the following:- (5x4=20)

(a) (i) Find the inverse Laplace transform of $F(s)=s-2/s(s+1)^3$, ROC: $Re(S)< -1$

(ii) Find the convolution integral of x (t) & h (t) and sketch the convolved signal.
$x(t) = \delta(t) + 2\delta(t-1) + \delta(t-2), \quad h(t) = 3 \quad -3 < t < 2$

(b) Determine Z- transform, sketch the pole zero plot and indicate the ROC of the signal given below:
$x[n]=[(1/2)^n + (3/4)^n]\, u[n-10]$

(d) Using the power series expansion technique, find the inverse z transform of the following X (z):

$X(z) = (z^2+z) / (z^3-3z+3z-1)$, ROC $|z|<1$

(e) Determine the initial and final values of x[n] for each of the following X(z):

$$X(z) = \frac{2z(z-\frac{5}{12})}{(z-\frac{1}{2})(z-\frac{1}{3})}, |z|>\frac{1}{2}$$

(f) A finite sequence x[n] is defined as

$$x[n] = \begin{cases} \neq 0 & N1 < n < N2 \\ = 0 & otherwise \end{cases}$$

Where N1 and N2 are finite. Show that the ROC of X(z) is the entire z-plane except possibly z=0 or z=∞

Q3.Attempt any ***two*** parts of the following:- (10x2=20)

(a) State and proof the following properties of fourier transform
(i)Parseval's theorem
(ii)Convolution theorem
(iii)differentiation in time domain
(iv) frequency shifting

(b) Find the magnitude and phase spectrum of the pulse shown in Fig 2

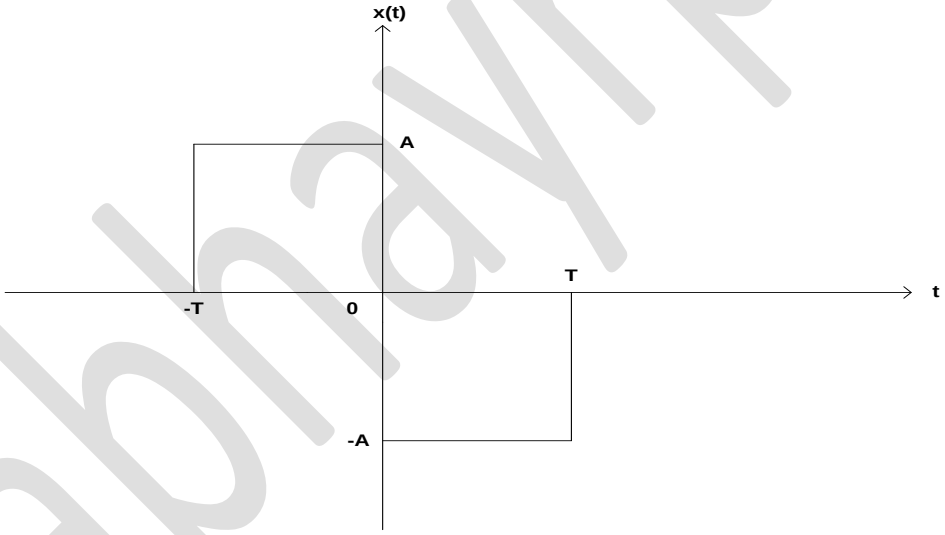

Fig 2.

(c) Find the DTFT of
(i) $x[n]=(1/2)^{n-1} u[n-1]$ (ii)$x[n]= \sin(\pi n/2) u[n]$

Q4. Attempt any ***two*** parts of the following:- (10x2=20)

(a) Determine whether the system shown below is stable , causal, linear and time invariant.
(i) $y(t)=x^2(t-t_0)+2$ (ii) $y(t) =d/dt[e^{-t} x(t)]$

(b) What is LTI System? Discuss the impulse response of LTI system and show that for LTI output Y(t)=h(t)*x(t) where x(t) is input and h(t) is the system response. If the system shown in Fig 5 (a) is formed by connecting two systems in cascade. The impulse response of the systems are given by $h_1(t)$ and $h_2(t)$, respectively, and $h_1(t)= e^{-2t} u(t)$ $h_2(t)=2 e^{-t} u(t)$

(i) Find the impulse response h (t) of the overall system shown in Fig 5 (b)

(ii) Determine if the overall system is BIBO stable.

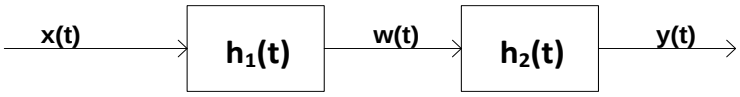

Fig 5 (a)

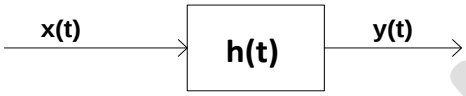

Fig 5 (b)

(c) The step response of an continuous-time LTI system is given by u(t-1). For a certain unknown input x(t), the output y(t) is observed to be $1/3[1-e^{-3(t-1)}]$. Find the input x (t)

Q5. Attempt any ***two*** parts of the following:- (10x2=20)

(a) Determine the transfer function by using canonical and parallel form realization of the system shown in Fig. 6 using block diagram reduction technique

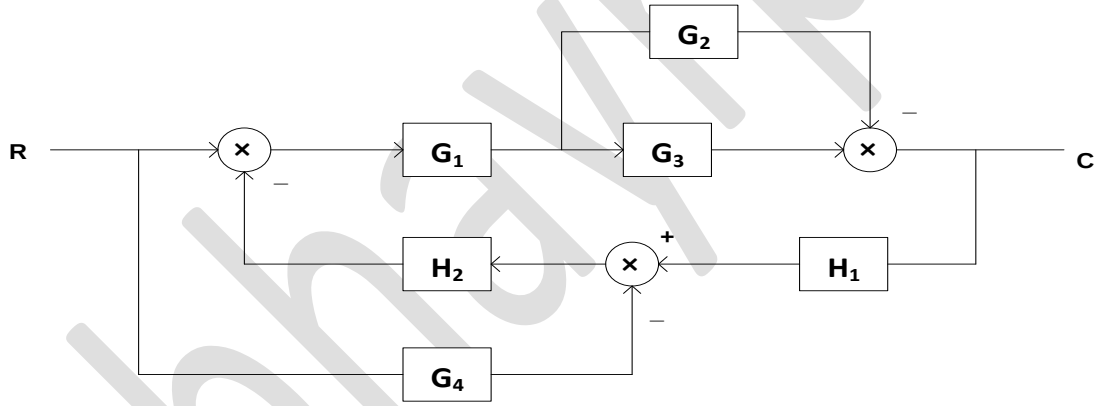

Fig. 6

(b) For the second-order differential equation for causal and stable LTI system, determine the impulse response of the system by showing underdamped, overdamped and critical damped conditions.

(c) Find the current i (t) for t > 0 for the circuit in Fig. 7 .Assume that the circuit has reached steady state at $t=0^-$

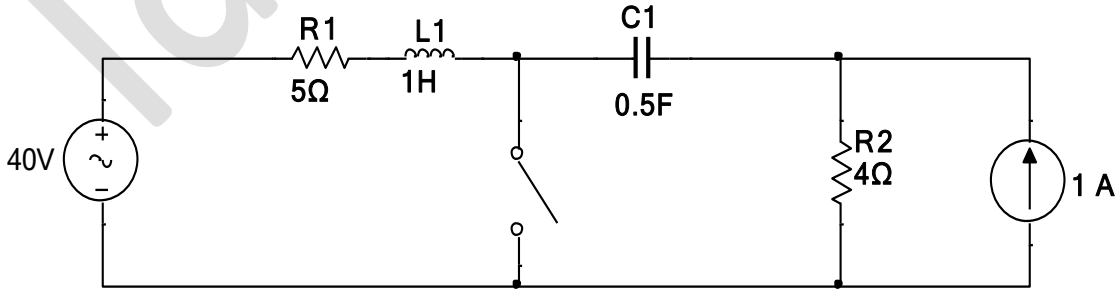

Fig. 7