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Assignment NO.1

1) classify various continuous time signal & describe in detail
2) Determine the initial & final value of a current where, $I(s) = \dfrac{0.52}{s(s^2+0.455+0.818)}$
3) classify various continuous time systems and describe in detail
4) If $x_1(t)$ and $x_2(t)$ are periodic signals with fundamental periods T_1 and T_2 respectively under what conditions $x(t) = x_1(t) + x_2(t)$ is periodic. what is the fundamental period of $x(t)$
5) Determine whether or not each of the following signals are periodic. If periodic determine its fundamental period, of each signal given as (a), (b), (c) and (d)

(a) $x(t) = \cos(t + \pi/4)$

(b) $x(t) = \sin \frac{2\pi}{3} t$

(c) $x(t) = \cos \frac{\pi}{3} t + \sin \frac{\pi}{4} t$

(d) $x(t) = \cos t + \sin \sqrt{2} t$

(e) $x(t) = \sin^2 t$

6) Explain the following operations of CT signals
Time shifting, Amplitude scaling, time scaling, time inversion / time folding

Assignment No.2

1) Describe the relationship between laplace transform & Fourier transform
2) Satate & derive the time scaling property of Laplace T. Transform

3) Find Inverse laplace transform $h(t)$ given

$$H(s) = \frac{(s-1)}{(s+1)(s-2)}$$

and comment on stability & causality of the system for various ROC's

4) Initial & final value theorem

5) Determine the laplace transforms of the functions :

(a) $x(t) = \delta(t)$

(b) $x(t) = u(t-t_0)$

(c) $x(t) = e^{-2t}[u(t)-u(t-5)]$

(d) $x(t) = \sum_{k=0}^{\infty} \delta(t-kT)$

6) Find laplace transforms for

(a) $x(t) = \delta(at+b)$ (b) $x(t) = 1$ (c) $x(t) = \text{sgn}\, t$

7) The waveform shown is a sweep voltage used to deflect the beam on a cathode ray oscilloscope shown that the transform of the function is

$$F(s) = \frac{1}{as^2} - \frac{e^{-as}}{s(1-e^{-as})}$$

Assignment NO. 3

1) Solve the second-order linear differential equation: $y''(t) + 5y'(t) + 6y(t) = x(t)$ with initial conditions $y(0) = 2$, $y'(0) = 1$. Take $x(t) = e^{-t}u(t)$

2) Describe Sampling Theorem

3) Find the Nyquist rate & Nyquist interval for the signals

(a) $x_1(t) = 1 + \cos(2000\pi t) + \sin(4000\pi t)$

(b) $x_2(t) = \frac{1}{\pi t}\sin(4000\pi t)$

(c) $x_3(t) = \text{sinc}(1000\pi t)$

(d) $x_4(t) = \text{sinc}(100\pi t) + \text{sinc}(50\pi t)$

(e) $x_5(t) = \left[\frac{\sin(200\pi t)}{\pi t}\right]^2$

(f) $x_6(t) = \cos 2\pi t \frac{\sin \pi t}{\pi t} + 3\sin 6\pi t \cdot \frac{\sin 2\pi t}{\pi t}$

4) The output $y(t)$ for a continuous-time LTI systems is found to be $2e^{-3t}u(t)$ when the input $x(t)$ is $u(t)$

a) Find the impulse response $h(t)$ of the system

b) Find the output $y(t)$ when the input $x(t)$ is $e^{-t}u(t)$

5) a) what are the properties of convolution integral

b) Define & calculate step response

6) Verify that $x(t) * h(t) = h(t) * x(t)$

Notebook :-

1) Find the partial fraction of the following function

$$X(s) = \frac{5s^2 - 17s - 4}{(s+2)(s-3)^2}$$

2) An LTI causal system is described by the differentiated equation

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

i) Find system function $H(s)$, and output $y(t)$ for input $x(t) = au(t)$. Answer the condition of initial rest

ii) Also find $y(t)$ for $x(t) = 2u(t)$, $y(0^-) = 3$, $y^-(0^-) = -5$ i.e. non-relaxed conditions

3) Find the inverse laplace transform of the following $X(s)$

(a) $X(s) = \dfrac{2s+4}{s^2+4s+3}$, $Re(s) > -1$ (b) $X(s) = \dfrac{2s+4}{s^2+4s+3}$, $Re(s) < -3$

(c) $X(s) = \dfrac{2s+4}{s^2+4s+3}$, $-3 < Re(s) < -1$

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4) check if the analog systems characterized by the the equations given below, are for linear or non-linear systems

(a) $y(t) = x(t-3)$ (b) $y(t) = x^2(t-2)$

(c) $y(t) = 3|x(t)|$

5) consider the continuous-time LTI system for which the input $x(t)$ & output $y(t)$ are related by the differential equation

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

(a) Find the system function $H(s)$

(b) Find the impulse response $h(t)$ for the cases:

i) The system is causal ii) The system is neigthe causal nor stable

iii) The system is stable

6) system function for a continuous time system given as, $H(s) = \frac{1}{(s+2)(s+5)}$ write all possible ~~ROC col~~ ROC conditions & find $h(t)$ for all ROC conditions Draw ROC diagram in each case

Class notebook:

1. Define parallel realization. Explain.
2. —"— Serial —"—
3. Continuous time LTI S/m which is also stable and causal is described by the differential equation : $\frac{dy(t)}{dt} + 5y(t) = 24x(t)$ where $x(t)$ is i/p and $y(t)$ is output. What is the final value $s(\infty)$ of the step response $S(s)$ of the system.
4. Determine the impulse response of the system described by input-output relationship. $\frac{dy(t)}{dt} + 3y(t) = 2x(t)$ Assume relaxed initial condition.

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(5) For the given function $F(s) = \frac{s+8}{s^2+6s+13}$, find $f(0)$ & $f'(0)$

(6) Find inverse laplace transform

a) $X_1(s) = \frac{2s+1}{s+2}$, $Re(s) > -2$

b) $X_2(s) = \frac{s^2+6s+7}{s^2+3s+2}$, $Re(s) > -1$

c) $X_3(s) = \frac{s^3+2s^2+6}{s^2+3s}$, $Re(s) > 0$

(7) Determine inverse laplace

$$X(s) = \frac{2(1+se^{-2s}+2e^{-4s})}{s^2+4s+3}, \quad Re(s) > -1$$

(8) Using partial fraction expression, find the time signals if their unilateral laplace transforms are given by:-

a) $X_1(s) = \frac{s+3}{s^2+3s+2}$

b) $X_2(s) = \frac{2s-1}{s^2+2s+1}$

Teacher's Sign.: