SE MTRX / SEM-IV / CBSGS / DATE:13/6/2017

T2224 / T1104 SIGNALS AND SYSTEMS

Q. P. Code: 16126

(03 Hours) [Total Marks: 80]

N.B. (1) Question No. 1 is compulsory.
(2) Solve any three questions from remaining five questions.
(3) Draw neat diagrams and assume suitable data wherever necessary. Justify your assumptions.

Q-1 [20]

a) Classify different types of systems.

b) State initial & final value theorem.

c) Determine whether each of the following signal is periodic. If yes, find its fundamental period.
   i) $x(t) = 3\cos\sqrt{2}\,.t + 4\cos 5\pi t$
   ii) $x(t) = 3\tan 4t$

d) Find Fourier transform of x(t) where,
$x(t) = \sin w_c t\,.u(t)$

Q-2 a) Classify whether the given signals [10]
   i) $y(t) = x(t+10) + x^2(t)$
   ii) $y(t) = 10x(t) + 5$
   are: stable/unstable, causal/non causal/, Linear/Non-linear & Time variant/ Time invariant.

b) Determine the unit step response of the system whose impulse response is given as $h(t) = 3tu(t)$ [5]

c) Give Dirichlet's conditions for existence of a Fourier series. [5]

Q-3 a) Obtain the Inverse Laplace transform of [10]

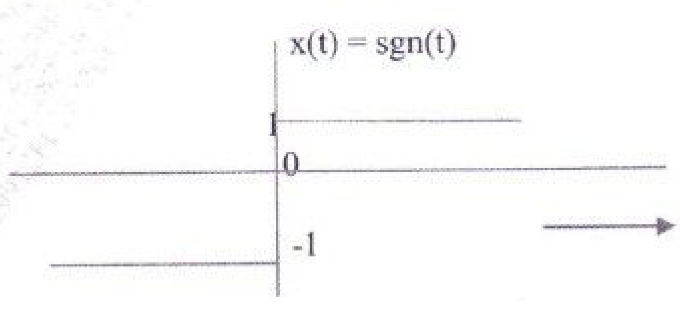
$$X(S) = \frac{S - 1/2}{S^2 + \frac{3}{4}S + 1/8} \quad ; \text{ROC: } \sigma > -1/4$$

and also plot the poles and zeros for the given function.

b) Determine the initial and final value for the following signals using initial and final value theorem respectively. [10]
   i) $X(S) = \dfrac{S+1}{S^2+2S+2}$
   ii) $X(S) = \dfrac{S+5}{S^2(S+9)}$

Q-4 a) Prove that if Fourier transform of a function f(t) is F(w), then fourier transform of $-jt\,f(t)$ is d/dw F(w). [5]

b) Find the Fourier transform of the signum function as shown : [5]



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c) Solve the differential equation using Laplace transform: [10]

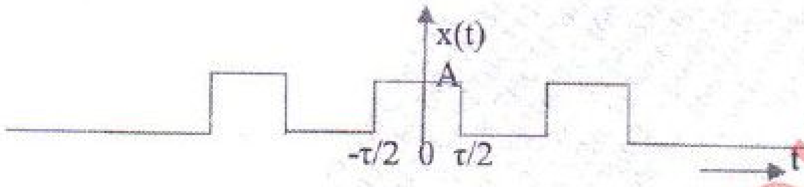
$$dy/dt + 2y(t) = x(t)$$

For the input $x(t) = e^{-2t} u(t)$. Assume zero initial conditions.

Q-5) a) Obtain the inverse Z of the following [10]

$$X(Z) = \frac{1 - \frac{1}{2} Z^{-1}}{1 - \frac{1}{4} Z^{-2}} \quad ; \quad |Z| > \frac{1}{2}$$

b) Obtain the exponential fourier series for the rectangular pulse train as shown below and sketch the spectrum [10]



Q-6) a) Determine the system function, unit sample response and pole zero plot of the system described by the difference equation : [10]

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

b) Determine the energy & power of signal given by [5]

$$x(n) = (\tfrac{1}{2})^n \quad ; n \geq 0$$
$$= (3)^n \quad ; n < 0$$

c) List the properties of Laplace Transform. [5]

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