Printed Pages : 8

328415 (28)

BE (4th Semester)

Examination, April-May, 2013

Branch : AEI, EI, Et & T

SIGNALS AND SYSTEMS

Time Allowed : Three Hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Part (a) of each question is compulsory [illegible] carries 2 marks. Part (b), (c) & (d) carry [illegible] marks. Attempt any two parts from (b), (c) and (d).

Q. 1. (a) Find the even and odd components of the signal x(t) = cos t + 2 sin t + 3 cos [illegible]

www.csvtuonline.com

(b) Determine whether the given signals are energy or power signals or neither of the two.

(i) x(t) = [illegible]

(ii) x(n) = [illegible]

(c) Determine whether the given signals are periodic or not. Find their fundamental period if periodic.

(i) x(t) = sin(t) + cos([illegible])

(ii) x(n) = [illegible]

(d) Determine whether the system described by the following input output relationship is :

(i) static or dynamic

(ii) causal or non-causal

www.csvtuonline.com

(iii) linear or non-linear

(iv) time invariant or time-variant

$d^2y(t)/dt^2 + 4\,dy(t)/dt + y(t) - 4 = x(t)$

2. (a) State the Dirichlet conditions for the existence of Fourier series of a periodic signal.

(b) Consider the Fourier transform pair

$$e^{-|t|} \xleftrightarrow{FT} \frac{2}{1+w^2}$$

(i) Use appropriate Fourier transform properties to find the Fourier transform of $X(t) = te^{-|t|}$

(ii) Use the above result along with the duality property, to determine the Fourier transform of

(iii) $$\frac{4t}{(1+t^2)^2}$$

(c) The complex exponential Fourier representation of a signal x(t) over the interval (0, T) is

$$x(t) = \sum_{n=-\infty}^{\infty} \frac{3}{4+(n\pi)^2} e^{jn\pi t}$$

(i) What is the numerical value of T?

(ii) One of the components of x(t) is A cos(3πt). Determine the value of A.

(iii) Determine the minimum number of terms which must be retained in the representation of x(t) in order to include 99.9% of the energy in the given interval. Given that total power E_x = 0.665 watts.

(d) [illegible] conductor [illegible] and [illegible]

Q. 5. (a) What is [illegible] response of an LTI system?

(b) Realize the system having following transfer function using [illegible] form:

H(s) = [illegible]

(c) Obtain the state space representation of the system whose differential equation is given by

$d^3y(t)/dt^3 + 2d^2y(t)/dt^2 + 5dy(t)/dt + 3y(t) = d^2x(t)/dt^2 + 3dx(t)/dt + 6x(t)$

(d) Consider an LTI system S and a signal $x(t) = 2e^{-3t}u(t-1)$. If $x(t) \to y(t)$ and $\frac{dx(t)}{dt} \to -3y(t) + e^{-2t}u(t)$, determine the impulse response h(t) of S.

www.csvtuonline.com

Q. 4. (a) Explain the time shifting and differencing property of Z-transform.

(b) A linear time invariant (LTI) system is characterized by the system function

H(z) = [illegible]

Specify the ROC of H(z) and determine h(n) for the following conditions:

(i) System is stable

(ii) System is causal

(iii) System is anticausal

(c) (i) Determine the N-point DFT of the sequence

x(n) = [illegible], [illegible]; 0, otherwise

(ii) Find DTFT of the sequence

x(n) = [illegible]

www.csvtuonline.com

www.csvtuonline.com

www.csvtuonline.com

www.csvtuonline.com

(d) Find linear convolution of the given sequences using circular convolution

$x_1(n) = \{1, 3\}$

$x_2(n) = \{1, 2, 3\}$

Q. 5. (a) What are the conditions for causality and stability of a discrete time LTI system ?

(b) Realize the following system using Direct form I and Direct form II

$$H(z) = \frac{0.28z^2 + 0.319z - 0.04}{0.5z^3 - 0.3z^2 + 0.17z - 0.2}$$

(c) Consider a system whose input x[n] and output y[n] are related by, y[n − 1] + 2y[n] = x[n]

(i) Determine the zero-input response of this system if y[−1] = 2

 P.T.O.

www.csvtuonline.com

www.csvtuonline.com

www.csvtuonline.com

(ii) Determine the zero-state response of the system to the input $x[n] = (1/4)^n u[n]$

(iii) Determine the output of the system for $n \geq 0$ when $x[n] = (1/4)^n u[n]$ and $y[-1] = 2$.

(d) Consider a system consisting of the cascade of two LTI systems with frequency responses, $H_1(e^{j\omega}) = \frac{2 - e^{-j\omega}}{1 + 0.5e^{-j\omega}}$ and $H_2(e^{j\omega}) = \frac{1}{1 - 0.5e^{-j\omega} + 0.25e^{-j2\omega}}$

(i) Find the difference equation describing the overall system.

(ii) Determine the impulse response of the overall system.

 5,370

www.csvtuonline.com