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10EE52

Fifth Semester B.E. Degree Examination, June/July 2015
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Distinguish between the following:
i) Even and odd signals
ii) Periodic and non-periodic signals
iii) Energy and power signals. **(06 Marks)**

b. Determine whether the signal is periodic or non-periodic. If periodic find the fundamental period:

i) $x(n) = \cos\left(\frac{n\pi}{8}\right).\cos\left(\frac{3n\pi}{7}\right)$

ii) $x(t) = e^{j\frac{2\pi}{3}t}$

iii) $x(t) = \sin^2 t$ **(08 Marks)**

c. For given x(t) in Fig.Q.1(c). Sketch the following signals:

i) $x(4-t)$ ii) $x\left(\frac{2}{3}t-1\right)$ iii) $x(-t+1)$. **(06 Marks)**

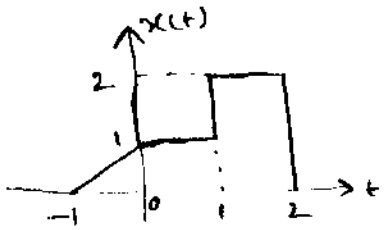

Fig.Q.1(c)

2 a. Find the convolution sum of
$x(n) = \{2\delta(n+1), -\delta(n), \delta(n-2)$
$h(n) = \{u(n) - u(n-3)\}$. **(06 Marks)**

b. Evaluate the step response for the LTI system having following responses:
i) $h(t) = e^{-2|t|}$ ii) $h(n) = (-a)^n u(n)$. **(08 Marks)**

c. Draw the direct form I and direct form II implementation of the following system:
$2\dot{y}(t) - 3\ddot{y}(t) = 4x(t) - 3\dot{x}(t) + \ddot{x}(t)$. **(06 Marks)**

3 a. Evaluate $y(t) = e^{-3t}u(t) * u(t-2)$. **(06 Marks)**

b. Solve the differential equation $y''(t) + 3y'(t) + 2y(t) = 2x(t)$ with initial conditions $y(0) = 0$, $y'(0) = 1$, for the i/p $x(t) = \cos t$ for $t \geq 0$. **(08 Marks)**

c. Check whether the following impulse response are memory less, causal and stable:
i) $h(t) = e^{-2t}u(t-2)$ ii) $h(n) = e^{3n}u(-n)$. **(06 Marks)**

4 a. State and prove the convolution property of Fourier series. **(06 Marks)**

b. Evaluate the DTFS representation for the signal

$x(n) = \sin\left(\frac{2\pi}{21}n\right) + \cos\left(\frac{10\pi}{21}n\right) + 1$ sketch the magnitude and phase spectra. **(08 Marks)**

c. Determine the Fourier series for the signal $x(t) = \cos 4t + \sin 8t$. **(06 Marks)**

PART – B

5 a. State and explain Parseval's theorem of discrete time Fourier transform. **(06 Marks)**

b. Find the Fourier transform of the signal

i) $x(t) = te^{-2t}u(t)$

ii) $x(t) = \begin{cases} 1; & -T < t < T \\ 0; & \text{otherwise} \end{cases}$ **(08 Marks)**

c. Find the Fourier series coefficients for the periodic signal x(t) with period is given by $x(t) = e^{-t}$; $-1 < t < 1$. **(06 Marks)**

6 a. Compute DTFT of the signal $x(n) = 2^n u(-n)$. **(06 Marks)**

b. I. A discrete-time LTI system described by $y(n) - \frac{1}{2}y(n-1) = x(n) + \frac{1}{2}x(n-1)$.

i) Determine the frequency response $H(\Omega)$

ii) Find the impulse response h(n) of the system.

II. Find inverse IDFT of $x(\Omega) = 1 + 2\cos\Omega + 3\cos 2\Omega$. **(08 Marks)**

c. Find the differential equation that represents the frequency response:

$H(JW) = \frac{2 + 3(JW) - 3(JW)^2}{1 + 2(JW)}$. **(06 Marks)**

7 a. Determine the Z-transform, ROC and pole zero locating of X(2) for

$x(n) = \left(\frac{2}{3}\right)^2 u(n) + \left(\frac{-1}{2}\right)^n u(n)$. **(06 Marks)**

b. Determine Z-transformation of the following signal

$x(n) = \frac{1}{2}(n^2 + n)\left(\frac{1}{3}\right)^{n-1} u(n)$. **(08 Marks)**

c. State and prove the differentiation in 2-domain. **(06 Marks)**

8 a. Find the inverse of 2-transform of

$x(z) = \frac{\frac{1}{4}z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)} \qquad |z| > \frac{1}{2}$. **(06 Marks)**

b. Solve the following difference equation using unilateral z-transform:

$y(n) = \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = x(n)$ for $n \geq 0$ with initial conditions $y(-1) = 4$, $y(-2) = 10$ and input $x(n) = \left(\frac{1}{4}\right)^n u(n)$. **(08 Marks)**

c. If $H(z) = \frac{z+1}{z^2 - 2z + 3}$ represents a causal system. Find the differential equation and frequency response of the system. **(06 Marks)**

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