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10EE52

Fifth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define signals and systems with examples. **(06 Marks)**

b. Given $x[n] = [3 \quad 2 \quad 1 \quad \underset{\uparrow}{0} \quad 1 \quad 2 \quad 3]$ and $y[n] = [-1 \quad -1 \quad -1 \quad -1 \quad \underset{\uparrow}{0} \quad 1 \quad 1 \quad 1 \quad 1]$ plot $x[n-2] + y[n+2]$. **(08 Marks)**

c. For the triangular wave shown in Fig.Q.1(c) find the average power. **(06 Marks)**

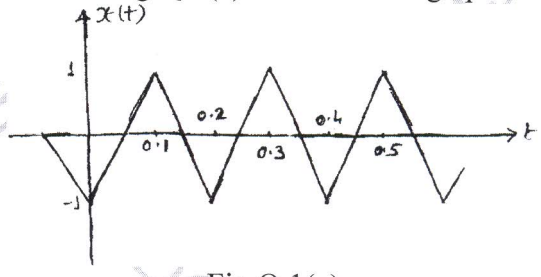


Fig.Q.1(c)

2 a. Determine the output of an LTI system for an input x(t) = u(t) and impulse response $h(t) = e^{-t}.u(t)$. **(06 Marks)**

b. Given $x[n] = 1$; $0 \le n \le 4$ and
$= 0$; otherwise
and $h[n] = \alpha^n$; $0 \le n \le 6$ where $\alpha > 1$
$= 0$; otherwise
find the output of LTI system using convolution sum. **(08 Marks)**

c. The input and output relationship of a discrete time LTI system is
$y[n] = x[n+1] + 5x[n] - 7x[n-1] + 4z[n-2]$.
Find: i) The impulse response of the system and
ii) Whether the system is stable and causal. **(06 Marks)**

3 a. Find the step response of a LTI system if impulse response $h(t) = t^2.u(t)$. **(04 Marks)**

b. Obtain the response of the system given by $\frac{d^2}{dt^2}y(t) + y(t) = 3\frac{d}{dt}x(t)$ with $y(0) = -1$; $\frac{d}{dt}y(t)\Big/_{t=0} = y'(0) = 1$ and $x(t) = 2e^{-t}.u(t)$. **(08 Marks)**

c. Find the difference equation for the system shown in Fig.Q.3(c). **(08 Marks)**

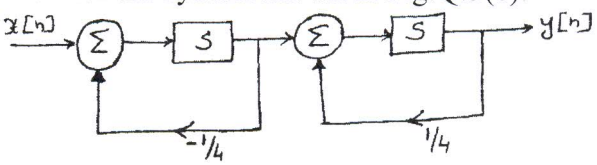
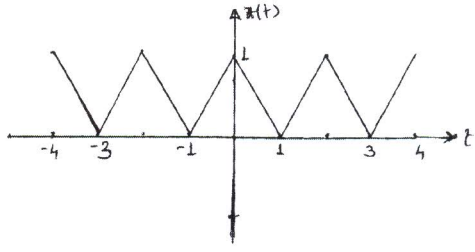


Fig.Q.3(c)

4 a. State and prof following properties of DTFs:
i) Convolution; ii) Periodicity; iii) Frequency shift. **(10 Marks)**

b. Find the Fourier series coefficient of the signal in Fig.Q.4(b) and draw the spectrum. **(10 Marks)**

Fig.Q.4(b)



PART – B

5 a. State and explain Parseval's theorem. **(06 Marks)**

b. Find the Fourier transform of $x(t) = e^{-a|t|}$; $a > 0$ and draw its spectrum. **(06 Marks)**

c. Find the Fourier transform of the signal using appropriate properties $x(t) = \sin(\pi t)\, e^{-2t}.u(t)$. **(08 Marks)**

6 a. Determine the Fourier transform of the signal

i) $x[n] = a^{|n|}; |a| < 1$

ii) $x[n] = [\alpha^n \sin(\Omega_0 n)]u[n]; \alpha < 1$. **(06 Marks)**

b. Determine the time domain signal corresponding to $x(e^{j\Omega}) = \cos^2\Omega$. **(04 Marks)**

c. Find the frequency response and impulse response of the system described by the equation

$$\frac{d^2}{dt^2}y(t) + 5\frac{d}{dt}y(t) + 6y(t) = -\frac{d}{dt}y(t).$$ **(10 Marks)**

7 a. What is region of convergence (ROC)? List any five properties of ROC. **(06 Marks)**

b. Find the inverse Z-transform of

$$x(z) = \frac{2 + z^{-1}}{1 - \frac{1}{2}z^{-1}} \quad \text{with} \quad \text{ROC}|z| > \frac{1}{2}.$$ **(06 Marks)**

c. State and explain time reversal and final value theorem. **(08 Marks)**

8 a. For the system having transfer function

$$H(z) = \frac{1 - 4z^{-1} + 4z^{-2}}{1 - \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2}}$$ find the transfer function of the inverse system and check whether the system is both stable and causal. **(06 Marks)**

b. Find the unilateral Z-transform of signals

$$x[n] = 7\left(\frac{1}{3}\right)^n \cos\left[\frac{2\pi n}{6} + \pi/4\right].$$ **(06 Marks)**

c. A causal system has input x(n) and output y(n). Find the impulse response of the system if

$$x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$$

$$y(n) = \delta(n) - \frac{3}{4}\delta(n-1).$$ **(08 Marks)**

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