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10EC44

Fourth 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. If x(t) and y(t) are as shown Fig.Q1(a), sketch x (1 – t) · y(t/2). **(06 Marks)**

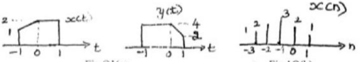


Fig.Q1(a) Fig.1Q(b)

b. If x(n) is as shown Fig.1(b), find the energy of the signal x(2n – 1). **(04 Marks)**

c. Find whether the system represented by y(t) = x(t/2) is linear, TI, causal substantiate your answers. **(05 Marks)**

d. Express x(t) in terms of g(t) if x(t) and g(t) are as shown in FigQ1(d): **(05 Marks)**

Fig.Q1(d)

2 a. Perform the convolution of the two signals.

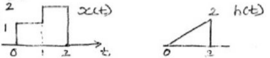


Fig.Q2(a)

Using the formula : $y(t) = \int_{-\infty}^{\infty} h(\tau)x(t-\tau)d\tau$. **(10 Marks)**

b. Perform the convolution of two finite sequences using graphical method only :

$x(n) = \left\{-1, 1, \underset{\uparrow}{0}, 1, -1\right\}$ $h(n) = \left\{1, \underset{\uparrow}{2}, 3\right\}$. **(10 Marks)**

3 a. Find natural, forced and total responses for the differential equation :
$y''(t) + 4y'(t) + 4y(t) = e^{-2t}u(t)$, assume $y(0) = 1$, $y'(0) = 0$. **(09 Marks)**

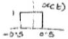
b. Find whether LTI system given by : $y(n) = 2x(n+2) + 3x(n) + x(n-1)$ is causal. Justify your answer. **(04 Marks)**

c. Draw DF – I and DF – II implementations for the differential equation :

$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 4y(t) = x(t) + \frac{dx(t)}{dt}$. **(07 Marks)**

4 a. Consider the periodic waveform $x(t) = 4 + 2\cos 3t + 3\sin 4t$
   i) Find period 'T'
   ii) What is the total average power
   iii) Find the complex Fourier coefficients
   iv) Using Parseval's theorem, find the power spectrum
   v) Show that total average power using Parseval's theorem is same as obtained in part (2) of the question. **(12 Marks)**

b. Find FT of the following :

i) 

ii) $x(t) = \delta(t-2)$ iii) $x(t) = e^{-at}u(t)$. **(08 Marks)**

PART – B

5 a. Find inverse FT of $x(\omega) = \frac{j\omega}{(j\omega+2)^2}$ **(06 Marks)**

b. Find the DTFT of the rectangular pulse sequence shown in Fig .Q5(b).

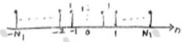


Fig Q5(b)

Also Plot $X(\Omega)$. **(10 Marks)**

c. Find DTFT of $x(n) = \delta(4-2n)$. **(04 Marks)**

6 a. State sampling theorem. What s aliasing explain? **(04 Marks)**

b. Specify the Nyquist rate and Nyquist intervals for each of the following signals :
   i) $g(t) = \text{sinc}^2(200t)$ ii) $g(t) = \text{sinc}(200t) - \text{sinc}^2(200t)$. **(06 Marks)**

c. Find the FT of the signum function, $x(t) = \text{sgn}(t)$. Also draw the amplitude and phase spectra. **(10 Marks)**

7 a. Sate and prove the following properties of Z – transform :
   i) Multiplication by a R amp ii) Convolution in time domain. **(06 Marks)**

b. Find Z – transform of the following and specify its RoC.

$$x(n) = \sin\left(\frac{\pi}{4}n - \frac{-\pi}{2}\right)u(n-2) \quad ; \qquad x(n) = \left(\frac{2}{3}\right)^n u(n) * 2^n u(-n-3).$$ **(08 Marks)**

c. Find IZT, if $x(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}$ for all possible RoC's. **(06 Marks)**

8 a. Solve the difference equation using Z – transform, $y(n) = y(n-1) - y(n-2) + 2$; $n \geq 0$ with initial conditions : $y(-2) = 1$, $y(-1) = 2$. **(08 Marks)**

b. Consider the system described by difference equation,
   $y(n) - 2y(n-1) + 2y(n-2) = x(n) + \frac{1}{2}x(n-1)$
   i) find system function H(z)
   ii) find the stability of the system
   iii) find h(n) of the system. **(08 Marks)**

c. Perform IZT using long division method : $x(z) = \frac{z}{z-a}$ RoC $|z| > |a|$. **(04 Marks)**

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