USN | | | | | | | | | | **06EC44**

Fourth Semester B.E. Degree Examination, June-July 2009
Signals and Systems

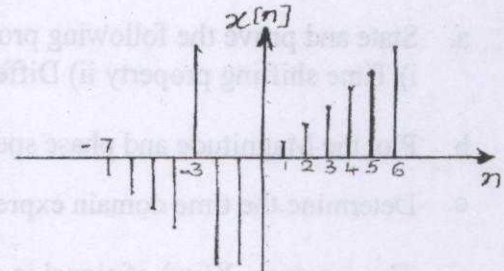
Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. A function x[n] is defined by

$$x[n]=\begin{cases}-(n+8) & \text{for } -8<n<-3\\ 6 & \text{for } n=-3\\ -6 & \text{for } -3<n<0\\ n & \text{for } -1<n<7\\ 0 & \text{otherwise}\end{cases}$$



Sketch $y[n] = 3.x[n/2 + 1]$ **(04 Marks)**

b. Perform the following operations (addition & multiplication) on given signals. Fig.1(b).

(i) $y_1(t) = x_1(t) + x_2(t)$ (ii) $y_2(t) = x_1(t) . x_2(t)$

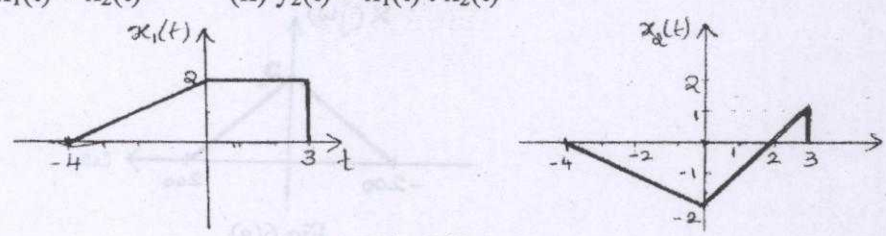


Fig.1(b) **(04 Marks)**

c. Distinguish between i) Energy signal & power signal ii) Even & odd signal. **(06 Marks)**

d. Explain the following properties of systems with suitable example:
i) Time invariance ii) Stability iii) Linearity. **(06 Marks)**

2 a. Find the convolution integral of x(t) & h(t) and sketch the convolved signal:
$x(t) = \delta(t) + 2\delta(t-1) + \delta(t-2)$, $h(t) = 3$, $-3 \le t \le 2$. **(08 Marks)**

b. Determine the convolution sum of the given sequence
$x(n) = \{3, 5, \underset{\uparrow}{-2}, 4\}$ and $h(n) = \{3, 1, 3\}$ **(06 Marks)**

c. Show that i) $x(t) * \delta(t-t_0) = x(t-t_0)$

ii) $x(n) = \sum_{k=-\infty}^{\infty} x(k).\delta(n-k)$ **(06 Marks)**

3 a. The impulse response of the system is $h(t) = e^{-4t}u(t-2)$. Check whether the system is stable, causal and memoryless. **(06 Marks)**

b. Draw the direct form-I & direct form-II implementation of the following difference equation. $y(n) - \frac{1}{4}y(n-1) + y(n-2) = 5x(n) - 5x(n-2)$ **(06 Marks)**

c. Find the forced response of the system shown in Fig.3(c), where x(t) = const. **(08 Marks)**

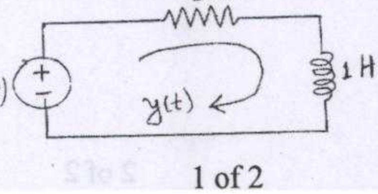


Fig.3(c)

4 a. State the condition for the Fourier series to exist. Also prove the convergence condition [Absolute integrability]. **(06 Marks)**

b. Prove the following properties of Fourier series. i) Convolution property ii) Parsevals relationship. **(06 Marks)**

c. Find the DTFS harmonic function of $x(n) = A\cos(2\pi n/N_o)$. Plot the magnitude and phase spectra. **(08 Marks)**

PART – B

5 a. State and prove the following properties of Fourier transform.
i) Time shifting property ii) Differentiation in time property iii) Frequency shifting property. **(09 Marks)**

b. Plot the Magnitude and phase spectrum of $x(t) = e^{-|t|}$ **(06 Marks)**

c. Determine the time domain expression of $X(jw) = \dfrac{2jw+1}{(jw+2)^2}$ **(05 Marks)**

6 a. The spectrum X(jw) of signal is shown in Fig.6(a). Draw the spectrum of the sampled signal at i) half the Nyquist rate ii) Nyquist rate and iii) Twice the Nyquist rate. Mark the frequency values clearly in the figure. **(12 Marks)**

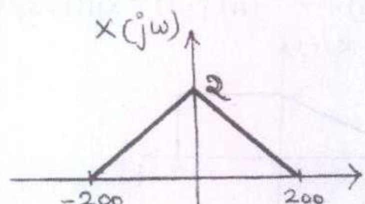


Fig.6(a)

b. Define and explain Nyquist sampling theorem with relevant figures. Give significance of this theorem. **(08 Marks)**

7 a. Describe the properties of Region of convergence and sketch the ROC of two sided sequences, right sided sequence and left sided sequence. **(10 Marks)**

b. Find the inverse Z-transform of

$$X(z) = \frac{1}{(z^2 - 2z + 1)(z^2 - z + \frac{1}{2})}$$ using partial fraction method. **(10 Marks)**

8 a. Solve the difference equation $y(n+2) - \frac{3}{2}y(n+1) + \frac{1}{2}y(n) = \left(\frac{1}{4}\right)^n$ for $n \geq 0$ with initial conditions y(0) = 10 and y(1) = 4. Use z-transform. **(12 Marks)**

b. Explain how causality and stability is determined in terms of z-transform. Explain the procedure to evaluate Fourier transform from pole zero plot of z-transform. **(08 Marks)**

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