06EE52

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Signals & Systems

3 hrs. Max. Marks:100

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

PART – A

a. Define following terms: (05 Marks)
   (i) Signal & system
   (ii) Continuous and discrete time signals
   (iii) Even and odd signals.

b. Determine whether the following signals are periodic. (05 Marks)
   (i) $x(t) = \sin^2 t$ (ii) $x(t) = \cos t + \sin \sqrt{2}\, t$

c. Check whether the signal shown in Fig.1(c) is power or energy and find the corresponding value. (10 Marks)

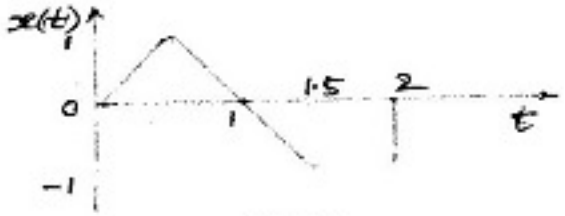

Fig.1(c)

a. A continuous time signal x(t) is shown in Fig.2(a). Sketch & label each of following signals. (06 Marks)
   (i) $x(-t+3)$ (ii) $x(t/2-2)$ (iii) $x(-2t-1)$

Fig.2(a)

b. A system was the input – output relation given by $y(n) = T\{ x(n) \} = x(n^2)$. Determine whether the system is (i) Linear (ii) Time invariant (iii) causal (iv) Memory less (v) Stable. (06 Marks)

c. Consider a continuous time LTI system with unit impulse response $h(t) = e^{-t}\, u(t)$ and input $x(t) = e^{-3t}\, [u(t) - u(t-2)]$. Find the output y(t) of the system. (08 Marks)

a. Find the response of the system described by the difference equation.
   $y(n) - y(n-1) - 2y(n-2) = x(n)$ with $y(-1) = -1$ & $y(-2) = 4$ and input $x(n) = 12u(n)$ (08 Marks)

b. Draw the direct form – I and II implementation of the system represented by the differential equation $\dddot{y} + 2\ddot{y} + 3y = x + 3\ddot{x}$. (06 Marks)

c. Response of discrete time – LTI system is given by
   $Y(n) = 2x(n+1) + 3x(n) - 4x(n-1)$
   Determine whether it is stable, causal and memory less system. (06 Marks)

d. State and prove frequency and time shift properties of Fourier series. (08 Marks)

b. Determine the discrete time Fourier series (DTFS) coefficients to evaluate DTFS representation of following sequences: **(12 Marks)**

(i) $x(n) = \cos\left(\frac{6\pi}{13}n + \frac{\pi}{6}\right)$ (ii) $x(n) = (-1)^n$; $-\infty \le n \le \infty$

PART – B

5 a. State and prove convolution property of discrete time Fourier transform. **(06 Marks)**

b. Obtain Fourier transform of following signals. **(06 Marks)**

(i) $x(t) = e^{at}\, u(-t)$ (ii) $x(t) = e^{-a|t|}$.

c. Obtain the Fourier transform of following sequences: **(08 Marks)**

(i) $x(n) = -a^n\, u(-n-1)$ (ii) $x(n) = \delta(n)$ (iii) $x(n) = a^n\, u(n)$

6 a. State and prove low pass sampling theorem. **(10 Marks)**

b. The system produces the output of $y(t) = e^{-1}\, u(t)$ for an input of $x(t) = e^{-2t}\, u(t)$. Determine the impulse response and frequency response of the system. **(10 Marks)**

7 a. What is Region of convergence (ROC)? List the properties of ROC. **(06 Marks)**

b. Find the Z-transform X(Z) and sketch the pole-zero plot with the ROC for each of the following sequences. **(08 Marks)**

(i) $x(n) = (1/2)^n\, u(n) + (1/3)^n\, u(n)$

(ii) $x(n) = (1/3)^{-n}\, u(n) + (1/2)^n\, u(-n-1)$

c. Find the Z-Transform of the signal $x(n) = n \sin(\pi/2)n\, u(-n)$ **(06 Marks)**

8 a. Find the time domain signals corresponding to the following Z-transforms. **(08 Marks)**

(i) $X(z) = \frac{1}{1-z^{-2}}$; $|z| > 1$

(ii) $X(z) = \cos(2z)$; $|z| < \infty$

b. Consider a causal discrete time sequence whose output y(n) and input x(n) are related by

$$y(n) - \frac{5}{6}y(n-1) + \frac{1}{6}y(n-2) = x(n)$$

(i) Find its system function.

(ii)Find its impulse response. **(08 Marks)**

c. By using uni-lateral Z-transform, solve the following difference equation.

$$y(n) + 3y(n-1) = x(n)$$

with $x(n) = u(n)$ and the initial condition $y(-1) = 1$. **(04 Marks)**

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