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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: EC202

Course Name: SIGNALS & SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Question No. 3 is compulsory. Answer question 1 or 2

1 a) Distinguish between energy and power signals. Give an example for each category. (4)

b) A system has input - output relation given by $y[n] = nx[n]$. Determine whether the system is memoryless, causal, linear, time invariant or stable. (5)

c) A signal is given by $x(t) = \begin{cases} 1 & -1 \le t \le 1 \\ 0 & otherwise \end{cases}$ (6)

Sketch $x(3t+2), x(2(t-2))$ and $x(-2t-1)$.

OR

2 a) Derive the condition for stability of a discrete time LTI system in terms of its impulse response. (4)

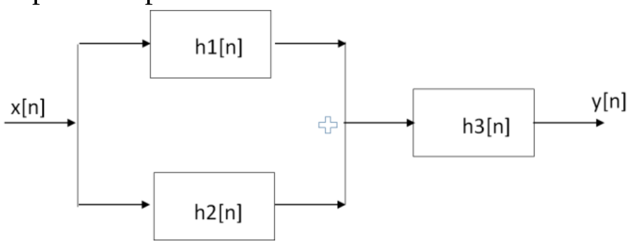
b) Given $x_1[n] = \{1,1,1\}$ and $x_2[n] = \{1,2\}$. Find convolution of the sequences graphically. (5)

c) For an LTI system, unit impulse response is given by $h(t) = e^{-at}u(t),\ a > 0$. Obtain step response of the system. (6)

3 a) What are the three differences between discrete time sinusoids and continuous time sinusoids? Find the fundamental period of $x[n] = \cos \Pi n$, if periodic. (4)

b) An LTI system is described by $y[n] - \frac{1}{2}y[n-1] = x[n]$. Assuming initial conditions as zero, find its impulse response (5)

c) (6)



Given $h1[n] = u[n],\ \ h2[n] = u[n+2] - u[n]$ and $h3[n] = \delta[n-2]$. Find the overall impulse response of the given system.

PART B

Question No. 6 is compulsory. Answer question 4 or 5

4 a) Explain Dirichlets conditions for the existence of Fourier Transform of a continuous time signal. (4)

b) Determine the complex exponential Fourier Series representation of the signal, $x(t) = \cos 4t + \sin 6t$. (5)

c) Find Fourier Transform of signal $x(t) = te^{at}u(t)$. (6)

OR

5 a) State and prove sampling theorem for low pass signals. (4)

b) A continuous time LTI system is described by $\frac{dy(t)}{dt} + 2y(t) = x(t)$. Using Fourier transform, find the output y(t) given $x(t) = e^{-t}u(t)$. (5)

c) A signal is given by $x(t) = 2Cos(400\pi t) + 6Cos(640\pi t)$ What is the minimum sampling frequency required to avoid aliasing? If the signal is ideally sampled with sampling frequency of 500 Hz, what are the frequency components present at the output? (6)

6 a) State and prove time-shifting property of Laplace transform. (4)

b) Find inverse Laplace transform of $X(s) = \frac{-5s-7}{(s+1)(s-1)(s+2)}$, with ROC $-1 < \text{Re}(s) < 1$ (5)

c) For a continuous time LTI system, input $x(t)$ and $y(t)$ are related by $\frac{d^2y(t)}{dt^2} + \frac{dy(t)}{dt} - 2y(t) = x(t)$. Find system function *H(s)*. Determine *h(t)* given that the system is causal. (6)

PART C

Question 9 is compulsory. Answer question 7 or 8

7 a) Write down properties of ROC for Z transform (6)

b) x[n] is a discrete time periodic square wave with period N and amplitude 1. Non-zero samples extends from $-N_1$ to $+N_1$. Find the Fourier coefficients. (7)

c) Find inverse z-transform of X(z) using power series expansion technique. (7)

$$X(z) = \frac{z}{2z^2 - 3z + 1} \quad |z| > 1$$

OR

8 a) Determine the discrete Fourier series representation for the sequence $x[n] = \cos\frac{\pi}{4}n$ and pot the magnitude and phase response. (6)

b) A discrete time LTI system is given by $y[n] - \frac{1}{2}y[n-1] = x[n] + x[n-1]$. Determine frequency response and impulse response of the system. (7)

c) Explain the relation between DTFT and z-transform. Explain whether DTFT can be obtained from z-transform for (i) $x[n] = a^n u[n]$ (ii) $x[n] = u[n]$ (7)

9 a) State and prove convolution property of DTFT. (6)

b) Given $x[n] = \begin{cases} 1, & |n| \le N_1 \\ 0, & |n| > N_1 \end{cases}$ Find Fourier Transform (7)

c) The step response of a discrete time LTI system is given by $s[n] = a^n u[n]$; $0 < a < 1$, Find impulse response *h[n]* of the system using z-transform. (7)

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