B **B4B082** **Pages: 4**

Reg. No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2017

Course Code: EC202

Course Name: SIGNALS & SYSTEMS

Max. Marks: 100 Duration: 3 Hours

PART A

Question No. 3 is compulsory.

1. a) Plot the signal $x(t) = u(t+1) + 2u(t) - u(t-3) - 2u(t-5)$ **(4)**

   b) Check the periodicity of given signals. Find the fundamental period if periodic

   i) $x(t) = 10 \sin 25\pi t + \cos 10\pi t$

   ii) $x(n) = \cos \frac{\pi n}{2} - \sin \frac{\pi n}{8} + 3\cos\left(\frac{\pi n}{4} + \frac{\pi}{3}\right)$ **(4)**

   c) Determine whether the following system is time invarient, linear and causal.

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

   d) Evaluate the following integral $\int_{-10}^{10} \cos(\pi t)\,\delta(2t-10)dt$ **(2)**

OR

2. a) What is the output sequence of a LTI system with impulse response h(n)=[3 , 2] to the input x(n)=[1, 2,3, 3]? **(5)**

   b) Compute the auto correlation of the signal $x(n) = a^n u(n)$ for $0 < a < 1$ **(6)**

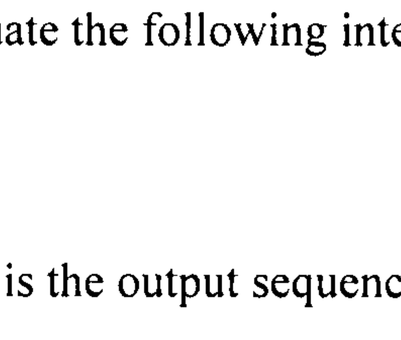
   c) Check the causality and stability of the systems whose impulse responses are given

   i) $h(t) = e^{at}u(t)$ ii) $h(n) = 2^n u(-n)$ $(a < 0)$ **(4)**

3. a) Find the output of an LTI system whose impulse response is **h(t)** to the input **x(t).**

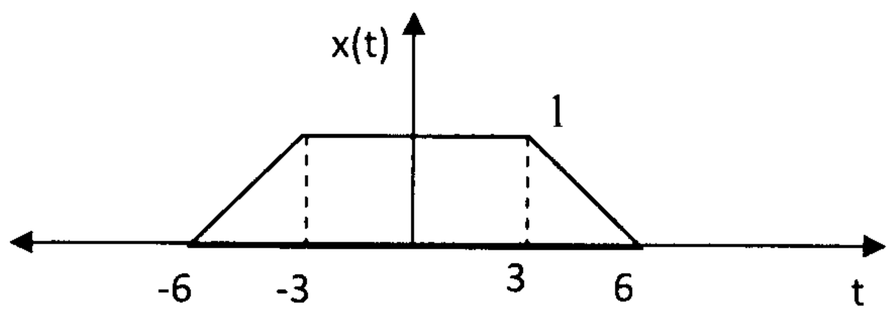
   $h(t) = u(t) - u(t-1)$

   x(t)=



(8)

b) For the given signal, plot *x(3-3t)*



(3)

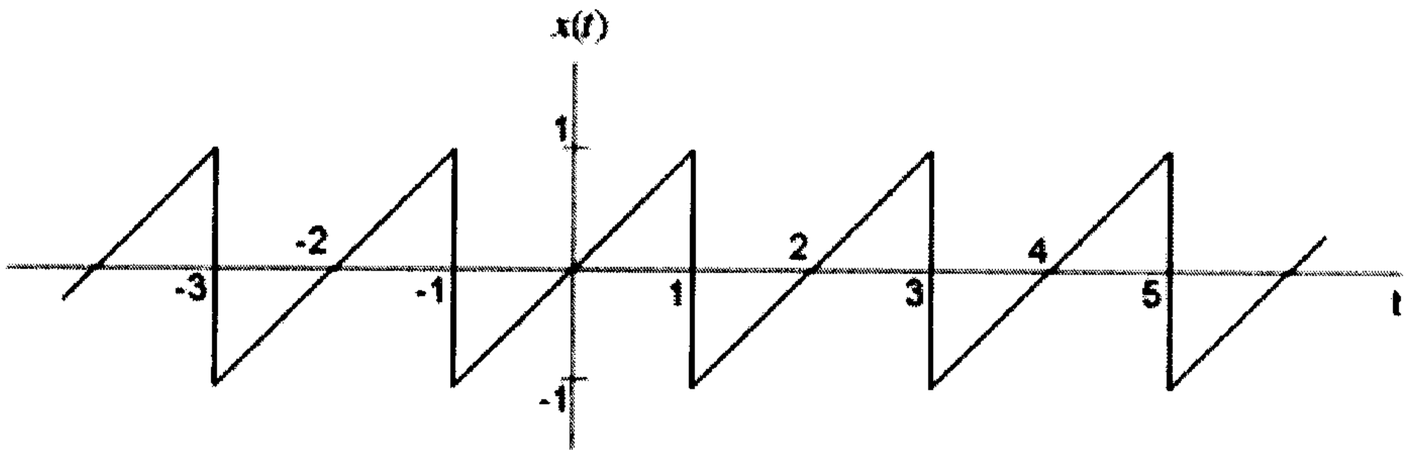
c) Classify the following signals into energy, power or neither. Determine energy and power.

i) $e^{2t}u(-t)$ ii) $e^{-3|t|}$ (4)

PART B

Question No. 6 is compulsory.

4. a) Determine the Fourier series representation of the signal shown in figure.



(8)

b) Compute and sketch the magnitude and phase spectrum of the signals

i) $x(t) = Ae^{-a|t|}$ (a>0) (4)

ii) $x(t) = \cos^2(2\pi t + 5) + 2\sin(5\pi t)$ (3)

OR

5. a) The step response of an LTI system is by $(1 - e^{-t} - te^{-t})u(t)$. For an input $x(t)$, the output is observed to be $(2 - 3e^{-t} + e^{-3t})u(t)$. For this observed measurement, determine the input to the system using laplace transform. **(6)**

b) State the sampling theorem for low pass signals **(2)**

c) Determine the Nyquist rate of sampling for the signals

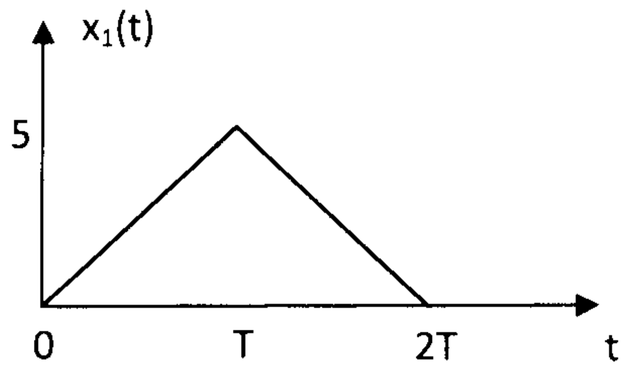
i) $x(t) = 2\sin 250\pi t + 3\cos^2 500t$ **(2)**

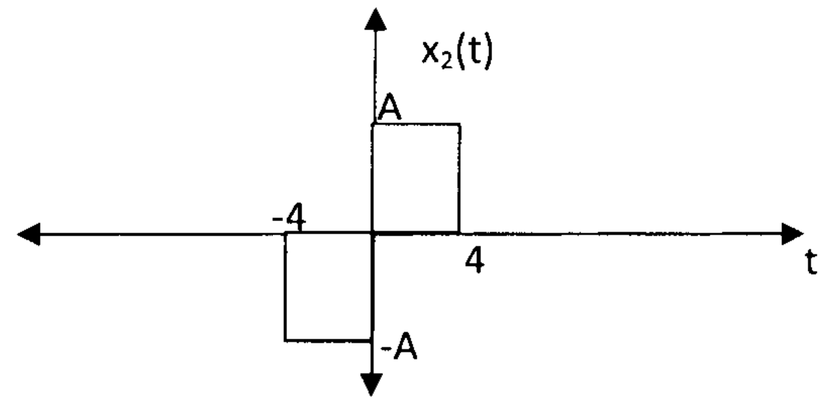
ii) $x(t) = 10\ \text{sinc}\ 500t$ **(3)**

d) A signal $x(t) = 2\cos 400\pi t + 6\cos 600\pi t$ is sampled with a sampling frequency 800Hz. Write the resultant discrete time signal. **(2)**

6. a) Find the Fourier Transform of following signals $x_1(t)$ and $x_2(t)$

(Any relevant property can be applied) **(10)**





b) A continuous time LTI system is described by the differential equation

$$\frac{d}{dt}y(t) + 5y(t) = x(t)$$

Determine the response of the system to the input $x(t) = e^{-2t}u(t)$ using Fourier Transform. **(5)**

PART C

Question 9 is compulsory.

7. a) Evaluate the inverse Z-transform of

$$X(z) = \log \frac{1}{1-az^{-1}} \qquad |a|<|z| \quad \textbf{(4)}$$

b) Evaluate the DTFT of following signals

i) $x(n) = a^n \sin \Omega_0 n\, u(n)$ **(4)**

ii) $x(n) = 0.25^n\, u(n+2)$ **(4)**

c) Give the Parseval's theorem for DTFT. Prove it. **(4)**

d) Compute the energy of the sequence $x(n) = \frac{\sin \Omega_c n}{\pi n}$ **(4)**

OR

8. a) A system is described by the difference equation

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

Determine the impulse response of the system using fourier transform. Also find the step response of the system. **(8)**

b) An LTI system is characterized by the system function given as

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$

Under what conditions the system will be obey causality and stability? **(4)**

Determine the impulse response of the system such that

i) The system is causal ii) The system is stable

Justify the answers. **(8)**

9. a) The frequency response of a three point moving average system is given as $H(e^{j\Omega}) = \frac{1}{4}(1 + \cos \Omega)\, e^{-j\Omega}$. Determine the difference equation representation of the system. **(5)**

b) Determine the response of the system with impulse response $h(n) = (0.5)^n\, u(n)$ to the input signal $x(n) = 10 - 5 \sin \frac{\pi}{2} n$ **(5)**

c) Find the z-transform and specify ROC

i) $x(n) = u(n-2) * (\frac{2}{3})^n u(n)$ *(* stands for convolution)* **(5)**

ii) $x(n) = -n(\frac{1}{3})^n u(-n-1)$ **(5)**

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