Code No: 153BT

R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, February - 2024
SIGNALS AND SYSTEMS
(Common to ECE, EIE)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Plot the signal x(n) = u(n)-u(n-1). [2]
b) Verify the signal is energy or power signal $x(t) = 2\cos 4t$. [3]
c) Power signals will have Fourier transforms and energy signals will have Fourier series in the frequency domain. Justify the statement. [2]
d) State and Prove the Parseval's Theorem in Continuous Time Fourier Transform. [3]
e) Determine whether $y(n) = x(n^2)$ discrete time system is linear or non-linear. [2]
f) What is Paley-Winer criterion? What is its significance? [3]
g) Find the Laplace Transform of x(t) = tu(t) [2]
h) State and prove initial value theorem of z-transform. [3]
i) Define and draw aliasing phenomenon in frequency domain. [2]
j) Compare the merits and demerits of performing sampling using impulse, natural and flat top sampling techniques. [3]

PART – B

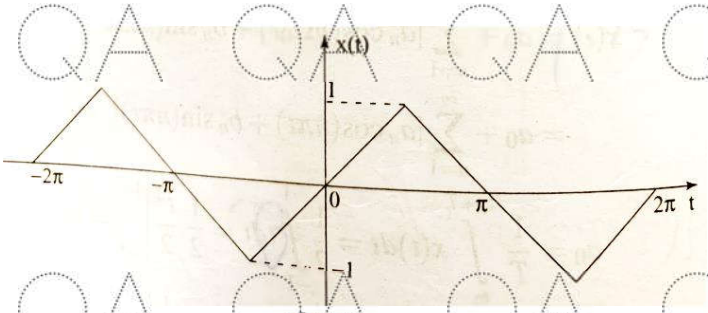
(50 Marks)

2.a) Verify the following signal is periodic or aperiodic, if periodic find fundamental time period.
i) $x(t) = 4\sin 10t \cos 4t$ ii) $x(n)=\sin(\frac{6\pi n}{7}+1)$
b) Find and sketch the derivatives of the following signals.
i) x(t) = u(t)-u(t-a), a>0 ii) x(t) = t[u(t)-u(t-a)], a>0 [5+5]

OR

3. Obtain the condition under which two signals $f_1(t)$ and $f_2(t)$ are said to be orthogonal to each other. Hence prove that sin $n\omega_0 t$ and cos $n\omega_0 t$ are orthogonal to each other for all integer values of m, n. [10]

4. Find trigonometric Fourier series representation of the triangular wave shown in Figure. [10]



OR

5.a) State and prove time shifting and frequency shifting properties of Fourier transform.

b) Find the Fourier transform of the signal $x(t)= e^{-t} \sin 5t\, u(t)$. [5+5]

6. The impulse response of the continuous time system is given as, $h(t)=(1/RC)\, e^{-t/RC}\, u(t)$. Determine the frequency response and plot the magnitude phase plots. [10]

OR

7.a) Describe the ideal characteristics of LPF.

b) Perform the convolution between the following signals graphically and plot the convoluted output. [3+7]

$$x(t)=\begin{cases}1, & for\ -3\le t\le 3\\ 0, & elsewhere\end{cases} \quad h(t)=\begin{cases}2, & for\ \ 0\le t\le 3\\ 0, & elsewhere\end{cases}$$

8.a) Find the Laplace transform of the signal $x(t)= 3e^{-2t}u(t)-2e^{-t}u(t)$ and find their ROC.

b) State and prove any two properties of z-transform. [6+4]

OR

9.a) State and prove time scaling and Convolution in time domain properties of Laplace Transform.

b) Find the inverse Z-transform of $X(z)= 1/(1+z^{-1})(1-z^{-1})^2$, ROC:$|z|>1$ [5+5]

10. Discuss the way of performing natural and flat top sampling techniques. [10]

OR

11. Write short notes on the following:

a) Parsevals Theorem

b) Energy density spectrum. [5+5]

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