# GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2024

Subject Code:3141005   **Date:21-11-2024**

Subject Name:Signal & Systems

Time:02:30 PM TO 05:00 PM   **Total Marks:70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

         MARKS

Q.1 **(a)** Compare Energy and power signals with example. **03**

      (b) Determine whether the following systems are linear or not **04**

         1) $\dfrac{dy(t)}{dt} + 5\,y(t) + 2 = x(t)$

         2) $5.\dfrac{dy(t)}{dt} + y(t) = 5.x(t)$

      (c) What ROC in z-transform, how ROC change with causality and stability of the system? Mention any four properties of the z-transform. **07**

Q.2 **(a)** Define DFT and IDFT. **03**

      (b) Prove the following: **04**

         1) $\delta(n) = u(n) - u(n-1)$

         2) $u(n) = \sum_{k=-\infty}^{\infty} \delta(k)$

      (c) Determine the following system described by $y(t) = \sin[x(t+2)]$ is memory less, causal, linear, time-invariance or stable? **07**

               OR

      (c) Find weather the following sequences are periodic?, if yes then find out its fundamental period. **07**

         1) $X1(n) = \sin\left(\dfrac{6\pi n}{7}\right)$

         2) $X2(n) = \sin\left(\dfrac{n}{8}\right)$

Q.3 **(a)** List out properties of convolution. **03**

      (b) State and prove time scaling and time shifting property of Fourier transform **04**

      (c) Figure shows the periodic rectangular waveform, obtain the Fourier series representation **07**
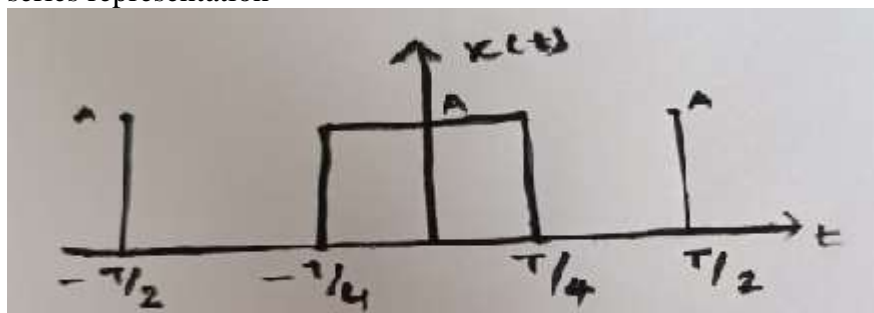
Q.3 **(a)** Check the BIBO stability for the impulse response of a discrete time system given by h (n) = $\alpha^n u(n)$ **03**

(b) Find the even and odd part of the signal: x(n) = $\alpha^n u(n)$ **04**

(c) Obtain the Fourier transform of the rectangular pulse of the duration 2 seconds and having amplitude of 10 volts.   **07**

Q.4 **(a)** Explain trigonometric Fourier series.   **03**

(b) Obtain the linear convolution of two sequences: x(n) = {1,2,1,2} and h(n) ={1,1,1}   **04**

(c) Find the Z -transform and sketch the ROC of: X(n) = $(-1)^n \, 2^{-n} \, u(n)$ **07**

OR

Q.4 **(a)** Define : Initial value theorem and final value theorem   **03**

(b) The impulse response of LTI system h(n)={1,2,1,-1}, determine the response of system to the input x(n) = {1,2,3,1}   **04**

(c) Determine Z- transform including ROC of the following: X(n)= $(\frac{1}{2})^n \{ u(n) - u(n-10)\}$ **07**

Q.5 **(a)** What is aliasing? How can we eliminate Aliasing?   **03**

(b) An analog signal is expressed by the equation x(t) = 3 cos50πt + 10 sin300 πt – cos100 πt. Calculate the Nyquist rate for the signal.   **04**

(c) Use partial fraction expansion method to find the inverse z - transform of the following transfer function   **07**

$$H(z) = \frac{-4+8z^{-1}}{1+ 6z^{-1}+8z^{-2}}$$

OR

Q.5 **(a)** Define Nyquist sampling theorem.   **03**

(b) Obtain relationship between Laplace and Fourier Transform.   **04**

(c) Find the Discrete Fourier transform of the sequence x(n)= {1,1,0,0} and find IDFT of Y(k) = {1,0,1,0}   **07**

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