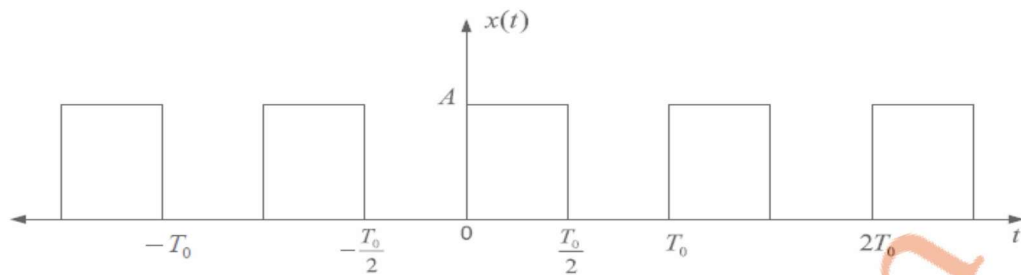


GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2021****Subject Code:3141005****Date:04/09/2021****Subject Name:Signal & Systems****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

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) Find whether the given signals are periodic or not? If yes, give its fundamental period. (i) $x(t) = 4 \cos (3\pi t + \pi/2) + 2 \cos (8\pi t + \pi/2)$ (ii) $x[n] = 10 \sin (20n)$ | 03 |
| | (b) Find the even and odd components of the following signals. (i) $x(t) = \cos t + \sin t + \cos t \sin t$ (ii) $x(n) = \{1, 1, 1\}$ | 04 |
| | (c) Explain following property for the system $y(t) = 10 x(t) + 5$. (i) Linearity (ii) Time-invariance (iii) Causality (iv) Dynamicity | 07 |
| Q.2 | (a) Determine the energy and power of a signal $x(n) = e^{-3t} u(t)$. | 03 |
| | (b) Find the natural response of the system described by difference equation $y(n) - 1.5 y(n-1) + 0.5 y(n-2) = x(n)$; $y(-1) = 1$; $y(-2) = 0$. | 04 |
| | (c) Sketch signal $x(t) = u(t+2) - u(t-2) + u(t+1) - u(t-1)$. Also sketch (i) $x(2t)$ (ii) $x(1-t)$ (iii) $x(t) u(t)$. | 07 |
| OR | | |
| | (c) Determine the convolution sum of two sequences using graphical method $x(n) = \{1, 4, 3, 2\}$; $h(n) = \{1, 3, 2, 1\}$ | 07 |
| Q.3 | (a) State and prove a condition for a discrete time LTI system to be stable. | 03 |
| | (b) Determine whether the following system with impulse response $h(n) = 2^n u(-n)$ is stable or not. | 04 |
| | (c) Find the Fourier series coefficients for the continuous time periodic signal $x(t) = 1.5$ for $0 \leq t < 1$ $= -1.5$ for $1 \leq t < 2$ with fundamental frequency $W_0 = \pi$. | 07 |
| OR | | |
| Q.3 | (a) Prove that DT LTI system is causal if and only if $h(n) = 0$ for $n < 0$. | 03 |
| | (b) Prove Commutative property of Convolution. | 04 |

- (c) Consider the periodic signal $x(t)$ shown below, determine its complex exponential Fourier series representation. 07



- Q.4** (a) Determine the Z – Transform & ROC of the following sequence 03
 $x(n) = (3)^n u(n) - (4)^n u(n)$
- (b) Explain the Differentiation property of Z-Transform. 04
- (c) By using partial fraction method, determine the inverse z-transform of 07

$$X(Z) = \frac{\frac{1}{4} z^{-1}}{\left(1 - \frac{1}{2} z^{-1}\right)\left(1 - \frac{1}{4} z^{-1}\right)} \quad \text{ROC : } |Z| > \frac{1}{2}$$

OR

- Q.4** (a) Find the Fourier transform of the signal 03
 $x(t) = e^{-at} u(t)$.
- (b) Explain the time shifting property of Fourier Transform. 04
- (c) Define ROC and explain the property of ROC. 07
- Q.5** (a) Find DTFT of the sequence $x(n) = \{1, 0, 4, 2\}$ 03
- (b) State Dirichlet condition for Fourier Series Representation. 04
- (c) Determine the impulse response $h(n)$ for the system described by the difference equation $y(n) - 3/4 y(n - 1) + 1/8 y(n - 2) = x(n)$. 07

OR

- Q.5** (a) Find the DFT of the sequence $x(n) = \{1, 1, -2, -2\}$ 03
- (b) Determine the Z – Transform & ROC of the following sequence 04
 $x(n) = (3)^n u(n) - (2)^n u(-n-1)$
- (c) State & Prove Sampling Theorem. 07
