

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV(NEW) EXAMINATION – WINTER 2022****Subject Code:3141005****Date:14-12-2022****Subject Name:Signal & Systems****Time:10:30 AM TO 01:00 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. **03**
- (b) If the given signal $x(t) = e^{-at}u(t)$. Draw the signals: $x(-t + 2)$ and $x(-t - 3)$. **04**
- (c) Determine whether the following systems are : (1) Memoryless (2) Causal (3) Stable (4)Time Invariant (5) Linear. **07**
- (I) $y(t) = x(0.5t)$ (II) $y[n] = x[n - 1] + x[n]$.

- Q.2**
- (a) State and prove a condition for a discrete time LTI system to be stable. **03**
- (b) Find the step response of the system whose impulse response is : **04**
- (1) $\delta[n + 2] + \delta[n - 3]$ (2) $u[n]$
- (c) Obtain convolution integral of : $x(t) = 1$ for $-1 \leq t \leq 1$ and $h(t) = 1$ for $0 \leq t \leq 2$ **07**

OR

- (c) Obtain linear convolution of two discrete time signals given as : **07**
- $x[n] = u[n]$ and $h[n] = a^n u[n], a < 1$.

- Q.3**
- (a) Give the difference between DFT and DTFT. **03**
- (b) Obtain Fourier Transform of a Unit Step Function. **04**
- (c) State convolution property of Fourier Transform and find Fourier Transform of the following signal : $y(t) = e^{-at}u(t) * u(t)$. **07**

OR

- Q.3**
- (a) Define DFT and IDFT. **03**
- (b) Determine complex exponential Fourier series of $\cos(\omega_0 t)$ **04**
- (c) Determine the trigonometric Fourier Series of : **07**

$$\delta_{T_0}(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT_0)$$

- Q.4**
- (a) Define Sampling Theorem. **03**
- (b) Find the Nyquist rate and interval of $x(t) = 5 \cos 1000\pi t \cos 4000\pi t$. **04**
- (c) State and Prove Time Shifting Property of Fourier transform. **07**

OR

- Q.4**
- (a) What is aliasing? How can we eliminate Aliasing? **03**
- (b) A bandpass signal has a spectral range that extends from 20 kHz to 82 kHz. Find the sampling frequency. **04**
- (c) Define the continuous time Fourier Transform. State and prove Duality property of Fourier Transform. **07**

- Q.5**
- (a) State and prove Time Shifting Property of z Transform. **03**
- (b) Determine z Transform of following sequences : **04**
- (1) $x[n] = \alpha^{-|n|}, 0 < \alpha < 1$ (2) $x[n] = 2^n u[n] + 3^n u[-n - 1]$

- (c) Find the convolution of the signal using z Transform. 07
 $x_1[n] = a^n u[n]$, $a < 1$ and $x_2[n] = u[n]$

OR

- Q.5** (a) State and prove Time Reversal Property of z Transform. 03
(b) Find z Transform of $x[n] = na^n u[n]$. 04
(c) Determine inverse z Transform of $X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$ 07
If (1) ROC : $|z| > 1$ (2) ROC : $|z| < 0.5$ (3) ROC: $0.5 < |z| < 1$
