Seat No.: ________ Enrolment No.___________

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2021**

**Subject Code:2171708** **Date:04/08/2021**

**Subject Name:Digital Signal Processing**

**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.**

| | | | **MARKS** |
|---|---|---|---|
| **Q.1** | **(a)** | State merits and demerits of Analog signal processing v/s Digital Signal processing. | **03** |
| | **(b)** | State and prove the properties of discrete time sinusoids. | **04** |
| | **(c)** | Discuss from the location of poles, time domain behavior of causal signals. | **07** |
| **Q.2** | **(a)** | Derive the power of unit step signal in discrete time domain. | **03** |
| | **(b)** | Check whether the following system is<br>1) Linear/Non-linear<br>2) Static/Dynamic<br>3) Time variant/Time invariant<br>4) Causal/anti-causal<br>**y(n) = Ax(n) + B** | **04** |
| | **(c)** | Determine the total solution y(n), $n \geq 0$, to the difference equation<br>**y(n) – 3 y(n-1) – 4 y(n-2) = x(n) + 2 x(n-1)**<br>when the input sequence is $x(n) = 4^n u(n)$. | **07** |
| | | **OR** | |
| | **(c)** | Calculate the linear convolution for the LTI system<br>h(n) = {1, 2, $\underline{1}$, -1} and input signal x(n) ={ 1,$\underline{2}$ ,3 1} | **07** |
| **Q.3** | **(a)** | Prove the convolution property of Z transform. | **03** |
| | **(b)** | Derive the z transform for<br>1) $X(n) = a^n u(n) + b^n u(-n-1)$ | **04** |
| | **(c)** | Derive the closed form expression for the nth term of Fibonacci sequence. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Prove the multiplication of two sequence propertiy in Z domain. | **03** |
| | **(b)** | Derive the necessary and sufficient condition for a system to be stable in Z plane. | **04** |
| | **(c)** | Using partial fraction expansion, for the following system.<br>$$H(z) = \frac{(3 - 4z^{-1})}{(1 - 3.5z^{-1} + 1.5z^{-2})}$$<br>Specify the ROC of H(z) and determine h(n) for following system.<br>1) The system is stable.<br>2) The system is causal.<br>3) The system is anti-causal. | **07** |
| **Q.4** | **(a)** | Determine the signal having following Fourier transform<br>$X(w) = \cos^2 w$. | **03** |
| | **(b)** | Compute and plot energy density spectra for the signal<br>x(n) = u(n) – u(n-4). | **04** |

**(c)** Derive and explain symmetry properties for DTFT. **07**

**OR**

**Q.4** **(a)** Obtain circular convolution of two sequences $x_1(n) = \{ 1,2,3,4\}$ and $x_2(n) = \{0,1,0,-1\}$. **03**

**(b)** State and prove following properties of DTFT. **04**

1) Convolution
2) Time reversal

**(c)** Derive and explain symmetry properties for DFT. **07**

**Q.5** **(a)** Explain in brief about windowing method for FIR filter design. **03**

**(b)** Draw cascade and parallel FIR filter structure for the system described by difference equation, **04**

$$y(n) – 3\ y(n-1) – 4\ y(n-2) = x(n) + 2\ x(n-1)$$

**(c)** Using decimation in frequency (DIF) radix-2 algorithm, compute 8 point DFT for the sequence $x(n) = \cos^2 л\ n$ **07**

**OR**

**Q.5** **(a)** Explain in brief about impulse invariance method for IIR filter design. **03**

**(b)** Draw form-I and form-II FIR filter structure for the system described by difference equation, **04**

$$y(n) – 3\ y(n-1) – 4\ y(n-2) = x(n) + 2\ x(n-1)$$

**(c)** Using decimation in time (DIT) radix-2 algorithm, compute 8 point DFT for the sequence $x(n) = \cos^2 л\ n$ **07**

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