

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020

Subject Code:2150307

Date:05/02/2021

Subject Name:Digital Signal Processing

Time:10:30 AM TO 12:30 PM

Total Marks: 56

Instructions:

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- (a) Define Systems. Briefly classify various types of Systems. **03**
 - (b) Define Sampling Process and state sampling theorem and also explain briefly various errors occurred during sampling process. **04**
 - (c) For given discrete time signal **07**
 $x(n) = \{1, 1, 1, 1, 2\}$
 sketch & compute(if applicable) the following output signals
 (i) $x(n)$
 (ii) $y(n) = x(3-n)$
 (iii) $z(n) = x(n) \cdot u(n-1)$
 (iv) Even Samples of $x(n)$
- Q.2**
- (a) Define Region of Convergence (ROC) and state the difference between single sided and double Z – Transform along with the equation. **03**
 - (b) Briefly classify and explain the term Time Domain Analysis and Frequency Domain Analysis. **04**
 - (c) Determine the Z – transform of signal given by: **07**
 $x(n) = n \cdot a^n u(n)$
- Q.3**
- (a) Explain briefly Goertzel Algorithm and state application of it. **03**
 - (b) Compute Linear convolution of following given sequence using mathematical method **04**
 $x(n) = \{1, -2, 1, 2\}$ & $h(n) = \{2, 2, 1, 1\}$
 - (c) Using DFT and IDFT method compute the linear convolution of two sequences **07**
 $x(n) = \{2, 3, 5\}$ & $h(n) = \{1, 3\}$
- Q.4**
- (a) Differentiate between Discrete Fourier Transform & Fast Fourier Transform. **03**
 - (b) Determine r_{xx} & r_{xy} for following sequences: **04**
 $x(n) = \{1, -2, 1, 2\}$ & $y(n) = \{2, 2, 1, 1\}$
 - (c) Explain in detail Radix – 2 DIT – FFT Algorithm. **07**

- Q.5** (a) Explain in brief the Transpose representation of Digital system giving one example. **03**
 (b) Draw Direct form – II structure for following given system **04**
- $$H(Z) = \frac{1 + \frac{1}{5}Z^{-1}}{(1 - 0.5Z^{-1} + \frac{1}{3}Z^{-2})(1 + 0.25Z^{-1})}$$
- (c) The transfer function of analog filter is **07**
- $$H(s) = \frac{2}{(s + 2)(s + 3)}$$
- Given $T_s = 0.1$ second.
 Design the digital IIR filter using Bilinear Transformation Method
- Q.6** (a) Explain Lattice realization of digital system giving suitable example. **03**
 (b) Obtain Direct form – I realization of following system **04**
- $$y(n) - \frac{1}{6}y(n - 1) + \frac{1}{3}y(n - 2) = x(n) + 2x(n - 2)$$
- (c) Design a linear phase FIR low pass filter of length seven with cutoff frequency 1 rad/sec using rectangular window. **07**
- Q.7** (a) Give the brief comparison between Butterworth and Chebyshev filter. **03**
 (b) Explain briefly the removal of noise in periodic events or waveform using IIR or FIR filtering approach. **04**
 (c) Explain in detail Impulse Invariance Technique for design of IIR filters. **07**
- Q.8** (a) Differentiate between IIR filters and FIR filters. **03**
 (b) Explain briefly the arrhythmias detection from ECG waveform using signal processing approach. **04**
 (c) Explain in detail design of IIR filter using approximation of derivatives. **07**
