**Course Code:** 1960420 **Roll No:** **MLRS-R19**

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**INSTITUTE OF TECHNOLOGY AND MANAGEMENT**
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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III B.Tech II Sem Regular End Examination, June 2022

## Digital Signal Processing

## (Electronics and Communication Engineering)

**Time: 3 Hours.** **Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.
2. In Part – A, answer all questions which carries 20 marks.
3. In Part – B, answer any one question from each unit.
Each question carries 10 marks and may have a, b as sub questions.

### PART- A

**(10*2 Marks = 20 Marks)**

| | | | | | |
|---|---|---|---|---|---|
| 1. | a) | Draw the block diagram of digital signal processing. | 2M | CO1 | BL1 |
| | b) | Discuss the need for multi-rate signal processing. | 2M | CO1 | BL2 |
| | c) | Give the relation between DTFT, DFS and DFT. | 2M | CO2 | BL2 |
| | d) | Find the 2-point DFT of the following sequence. $x(n)=\{1, 1\}$ | 2M | CO2 | BL1 |
| | e) | Discuss the necessity of analog filter approximations to design a digital filter. | 2M | CO3 | BL2 |
| | f) | List the types of methods to convert analog to digital IIR filters. | 2M | CO3 | BL1 |
| | g) | Compare the features of IIR and FIR filters. | 2M | CO4 | BL2 |
| | h) | Give the condition that need to be satisfied for an FIR filter to exhibit a linear phase characteristics. | 2M | CO4 | BL2 |
| | i) | Discuss the stability of a digital system in both time and z-domains. | 2M | CO5 | BL2 |
| | j) | Explain the effect of round-off noise in IIR digital filters. | 2M | CO5 | BL2 |

### PART- B

**(10*5 Marks = 50 Marks)**

| | | | | | |
|---|---|---|---|---|---|
| 2 | a) | Check the causality and stability of following discrete time systems. (i) $y(n)=(0.9)^n u(n)$ (ii) $y(n)=(2)^n u(n+1)$ | 5M | CO1 | BL1 |
| | b) | Define down sampling, up sampling, decimation and interpolation with corresponding mathematical equations. | 5M | CO1 | BL2 |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 3 | | Find the frequency response $H(e^{jw})$ of the linear time invariant (*LTI*) whose input and output satisfy the following difference equation. $y[n]-\frac{1}{3}y[n-1]=x[n]+4x[n-1]+2x[n-2]$ | 10M | CO1 | BL2 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | a) | State and prove the time circular convolution property of DFT. | 5M | CO2 | BL1 |
| | b) | Find the convolution of the following two causal sequences using overlap add method. $h(n)=\{\underset{\uparrow}{-3},2,-1\}$ $x(n)=\{\underset{\uparrow}{2},4,-4,-2,2,-1,1,0,1,-5,-7,1,2,4,-1\}$ | 5M | CO2 | BL2 |
| | | **OR** | | | |
| 5 | | Compute *8-point IDFT* of the following sequence using *radix-2 DIT-FFT* algorithm. $X(k)=\{5,-j2.414,1,-j0.414,1,j0.414,1,j2.414\}$ | 10M | CO2 | BL2 |
| 6 | a) | Consider an analog first order passive *low pass filter (LPF)* with *R=1 kΩ, C=0.1μF.* Convert this analog filter into a digital one using a Bilinear transformation method for a sampling frequency of *8 kHz.* | 5M | CO3 | BL2 |
| | b) | Write the steps to design IIR digital filters using bilinear transformation method. | 5M | CO3 | BL1 |
| | | **OR** | | | |
| 7 | | Design *a digital IIR Butterworth filter* for the following specifications using impulse invariance method. Sampling frequency is *10 kHz.* $0.7943 \le \lvert H(j\Omega)\rvert \le 1 \quad 0 \le \Omega \le 1\,kHz$ $\lvert H(j\Omega)\rvert \le 0.3159 \quad 2.5\,kHz \le \Omega \le 5\,kHz$ | 10M | CO3 | BL3 |
| 8 | a) | Explain the need for windowing in design of FIR filters. Compare the features of different windows that will reduce the effect of Gibbs phenomenon. | 5M | CO4 | BL1 |
| | b) | Give the design steps of an FIR filter using frequency sampling method with considering an example. | 5M | CO4 | BL2 |
| | | **OR** | | | |
| 9 | | Design a digital FIR low pass filter using Hamming window for the following specifications. $H(e^{jw}) = e^{-j7w}$ ; $-\pi/4 \le w \le \pi/4$ $0$ ; $\pi/4 \le w \le \pi$ | 10M | CO4 | BL2 |
| 10 | a) | Write short notes on limit cycle oscillations and overflow oscillations. | 5M | CO5 | BL1 |
| | b) | Illustrate the measurement methodology of coefficient quantization effects through pole-zero movement. | 5M | CO5 | BL2 |
| | | **OR** | | | |
| 11 | | Draw the direct form-I structure of the following discrete time system. $y(n)=0.2y(n-2)+0.4y(n-1)+5x(n)+7.1x(n-1)+0.9x(n-3)$ | 10M | CO5 | BL2 |

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