R22 Regulation *Subject code: 4E6DB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech VI Semester Supplementary Examinations, November 2025

DIGITAL SIGNAL PROCESSING

(ECE)

Maximum Marks: 60 Date: 21.11.2025 Duration: 3 hours

Note:
1. **This question paper contains two parts A and B.**
2. **Part A is compulsory which carries 10 marks. Answer all questions in Part A.**
3. **Part B consists of 5 Units. Answer any one full question from each unit.**
4. **Each question carries 10 marks and may have a, b, c, d as sub questions.**

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	Bloom Tx
1.a)	Classify the discrete-time systems.	1M	CO1	BT1
b)	Calculate the z-transform and ROC for the signal $x(n)= \delta(n-k)+ \delta(n+k)$.	1M	CO1	BT2
c)	The first five DFT coefficients of a sequence x(n) are X(0) = 20, X(1)=5+j2, X(2) = 0, X(3) = 0.2+j0.4 , X(4) = 0 . Discover the remaining DFT coefficients for an 8 point.	1M	CO2	BT3
d)	Draw the basic butterfly diagram of radix -2 FFT.	1M	CO2	BT3
e)	Write the relationship between S & Z in bilinear transformation.	1M	CO3	BT2
f)	Enlist the disadvantages of impulse invariant method.	1M	CO3	BT1
g)	Write the condition for the system to have linear phase.	1M	CO4	BT2
h)	Mention the advantages of FIR filter over IIR filter.	1M	CO4	BT1
i)	Give two applications of Multi Rate Signal Processing.	1M	CO5	BT2
j)	What is decimation?	1M	CO5	BT1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	Determine whether the following discrete time system is static, causal, linear, shift invariant and stable $y(n) = x\left(\frac{n}{2}+1\right) + x(n-1)$.	10M	CO1	BT4
	OR			
3	a) Determine the pole-zero plot for the system described by the difference equation $y(n) - \left(\frac{3}{4}\right)y(n-1) + \left(\frac{1}{8}\right)y(n-2) = x(n) - x(n-1)$.	5M	CO1	BT5
	b) Evaluate the Inverse z-transform of $X(z) = \frac{z}{[3z^2 - 4z + 1]}, ROC\|z\| > 1$	5M		
4	a) Discuss in detail the important properties of the DFT.	3M	CO2	BT4
	b) Determine IFFT using DIT method for X(k) = {4, -6, 8, -10, 12, -3, 2, -1}	7M		
	OR			

5	a) Find the 4-point DFT of the sequence x(n) = [1,0,1,0] b) Compute an 8-point DFT using DIF FFT radix -2 algorithm. x(n) = { 1,2,3,4,4,3,2,1}	4M 6M	CO2	BT4
6	Design a Butterworth IIR low pass filter with the following specifications: Pass band ripple $\alpha_p = 1$dB, stop band attenuation $\alpha_S = 40$dB, pass band edge frequency is 2000 Hz, stop band edge frequency is 10000 Hz and sampling frequency is 25000 Hz, using bilinear transformation technique.	10M	CO3	BT4
	OR			
7	Design an analog low pass IIR Chebyshev filter for pass band cut off frequency of 1500 Hz, stop band cut off frequency of 7500 Hz, Attenuation in pass band 3 dB and attenuation in stop band 15dB. Assume suitable sampling frequency?	10M	CO3	BT4
8	Describe the design of FIR filter using frequency sampling technique.	10M	CO4	BT3
	OR			
9	The desired frequency response of a low pass filter is given by $H_d(\omega) = \{e^{-j2\omega}; -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4}; 0$ otherwise$\}$. Obtain the filter coefficient, h(n) using rectangular window.	10M	CO4	BT4
10	a) Explain the interpolation process. How it is different from Decimation? b) How do you change the sampling rate by Rational factor I/D?	5M 5M	CO5	BT2
	OR			
11	a) Illustrate the circular mode of addressing in DSP with example. b) Explain pipeline operation of TMS320C54XX processor.	5M 5M	CO5	BT2