R22 Regulation *Subject code:4E5BC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Supplementary Examinations, April 2026

DIGITAL SIGNAL PROCESSING

(EEE)

Maximum Marks: 60 Date:22.04.2026 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	BTL
1.a)	Define a Linear time invariant system	1M	1	L2
b)	Give the formula for Two-sided Z-transform	1M	1	L2
c)	Draw the butterfly diagram for Decimation-in-frequency FFT algorithm	1M	2	L3
d)	Mention any 2 properties of N-point DFT.	1M	2	L2
e)	List any one difference between Butterworth and Chebyshev approximations	1M	3	L2
f)	Draw the frequency response of the Chebyshev type-I approximation	1M	3	L3
g)	Give the formula for rectangular window function.	1M	4	L2
h)	List any one difference between IIR and FIR filters	1M	4	L2
i)	Define upsampling.	1M	5	L2
j)	Define down sampling.	1M	5	L2

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) Determine the frequency response, and time delay of the systems given by y(n)-1/2 y(n-1) = x(n). b) Discuss on stability criterion of a system using Z-transforms.	8M 2M	1	L3
	OR			
3	Determine whether the following system is: i) Linear ii) Causal iii) Stable, and iv) Time invariant. $y(n)=\log_{10} x(n)$ Justify your answer.	10M	1	L3
4	Determine the 8- point DFT for the sequence x(n) = {2,2,2,2,-2,-2,-2,-2}	10M	2	L3
	OR			
5	a) Give the illustration for 8-point DFT using decimation-in-time FFT algorithm. b) Determine the 8-point DFT using DIT-FFT for the sequence x(n) = {1,0,1,0,1,0,1,0}	5M 5M	2	L3
6	Determine the system function H(Z) of the lowest order Chebyshev digital filter that meets the following specifications.	10M	3	L3

	i) 3 db ripple in the passband $0 \leq \|\omega\| \leq 0.3\pi$ ii) At least 40 dB attenuation in the stopband $0.35\pi \leq \|\omega\| \leq \pi$. Determine filter order.			
	OR			
7	a) What are the analog to digital filter transformation techniques? Explain. b) Find $H(z)$ using the Bilinear transformation for the analog system function, Assume $T = 1\ s$. $$H(s) = \frac{1}{(s+0.5)(s^2+0.5\,s+2)}$$	4M 6M	3	L3
8	a) Distinguish between FIR and IIR filters. b) The desired frequency response of a low pass filter is $$H_d(e^{jw}) = \begin{cases} 1; \frac{-\pi}{2} \leq w \leq \frac{\pi}{2} \\ 0; \frac{\pi}{2} \leq w \leq \pi \end{cases}$$ Determine *hd (n) for N = 7* using a rectangular window.	5M 5M	4	L3
	OR			
9	Design a High Pass FIR filter whose cut-off frequency is 1.8 radians/sec and N = 7 using Hamming Window.	10M	4	L3
10	What do you mean by fractional sampling rate conversion? Explain with an example of converting 48 kHz signal to 44.1 kHz signal using multi-stage fractional sampling rate converter.	10M	5	L3
	OR			
11	Explain the decimation and interpolation process with an example. Also find the spectrum.	10M	5	L3