Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 23- 05- 2026 **Time:**09:30am – 12:30pm

School: SOE	**Program:** B.Tech	
Course Code: ECE2520	**Course Name:** Digital Signal Processing	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	12	12	24	14	26	12

Instructions:

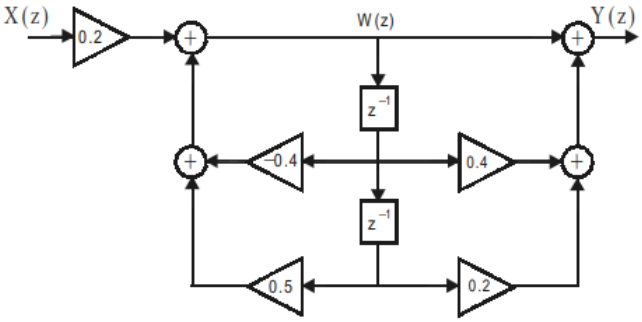
(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	An analog signal contains frequency components up to 5 kHz. What is the minimum sampling rate required to sample this signal without aliasing?	**2 Marks**	**L2**	**CO1**
2.	How many multiplications and additions are required to compute N-point DFT using radix-2 FFT algorithm?	**2 Marks**	**L2**	**CO2**
3.	How do you find the analog transfer function for Low pass filter using the Butterworth method for a filter of order (N) is 1 with a cutoff frequency (Ω_c) of 2 rad/sec?	**2 Marks**	**L2**	**CO3**
4.	What is the relationship between analog poles and digital poles in the impulse invariant transformation method?	**2 Marks**	**L2**	**CO3**
5.	Obtain the transfer function for the following structure.	**2 Marks**	**L2**	**CO4**

				
6.	The transfer function of an IIR system has 'Z' number of zeros and 'P' number of poles. How many number of additions, multiplications and memory locations are required to realize the system in direct form-I and direct form-II	**2 Marks**	**L2**	**CO4**
7.	Write the magnitude and phase function of FIR filter when impulse response is symmetric and N is Even.	**2 Marks**	**L2**	**CO5**
8.	What is the necessary and sufficient condition for linear phase characteristic of an FIR filter?	**2 Marks**	**L2**	**CO5**
9.	What is Gibbs Phenomenon?	**2 Marks**	**L2**	**CO5**
10.	Realize the following FIR system with minimum number of multipliers. h(n) = { −0.5, 0.8, −0.5 }	**2 Marks**	**L2**	**CO6**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Given the sequences: $\boldsymbol{x(n) = \{1, 2, 3, 4\}, h(n) = \{1, -1, 2\}}$ Tasks: 1. Compute the linear convolution of $\boldsymbol{x(n)}$and $\boldsymbol{h(n)}$. 2. Compute the circular convolution using length $\boldsymbol{N = 4}$. 3. Compare both results and explain the difference.	**10 Marks**	**L3**	**CO1**
		Or			
12.	**a.**	Given $x(n) = \{1,2,3,4,5,6\}, h(n) = \{1,1,1\}$ Perform convolution using the **Overlap-Add method**.	**10 Marks**	**L3**	**CO1**
13.	**a.**	Compute the 8-point DFT of the sequence $\boldsymbol{x(n) = \{1, 1, 1, 1, 0, 0, 0, 0\}}$ using the Radix-2 Decimation-In-Time (DIT) FFT algorithm.	**10 Marks**	**L3**	**CO2**

		Or			
14.	**a.**	Compute the 8-point DFT of the sequence $$x(n) = \{0,1,2,3,4,3,2,1\}$$ using the Radix-2 DIF FFT algorithm.	**10 Marks**	**L3**	**CO2**
15.	**a.**	An LTI system is governed by the following difference equation: $$\boldsymbol{y(n) = -\frac{3}{4}y(n-1) + \frac{1}{2}y(n-2) + \frac{1}{4}y(n-3) + x(n) + 4x(n-1) + 3x(n-2)}$$ Realize the system using the Direct Form-I and Direct form-II structure.	**10 Marks**	**L3**	**CO4**
		Or			
16.	**a.**	A discrete-time LTI system is described by the transfer function: $$H(z) = \frac{z+5}{(z+0.4)(z+0.5)(z+0.6)}$$ Realize the system using the Direct Form-I and Direct form-II structure.	**10 Marks**	**L3**	**CO4**
17.	**a.**	A discrete-time FIR system is described by the equation: $$\boldsymbol{y(n) = 0.2x(n) + 0.25x(n-1) + 0.3x(n-2) - 0.35x(n-3) - 0.4x(n-4) - 0.45x(n-5) - 0.5x(n-6)}$$ Draw the Direct Form realization of the FIR system.	**10 Marks**	**L3**	**CO6**
		Or			
18.	**a.**	Realize the following FIR systems using the minimum number of multipliers by exploiting symmetry, factorization, or other suitable techniques: $$y(n) = \frac{1}{8}x(n) + \frac{3}{4}x(n-1) + \frac{3}{2}x(n-2) + \frac{3}{4}x(n-3) + \frac{1}{8}x(n-4)$$	**10 Marks**	**L3**	**CO6**
19.	**a.**	The specification of the desired low pass digital filter is $$\boldsymbol{0.85 \leq |H(\omega)| \leq 1.0\ ;\ 0 \leq \omega \leq 0.3\pi}$$ $$\boldsymbol{|H(\omega)| \leq 0.25\ ;\ 0.55\pi \leq \omega \leq \pi}$$ Design a Butterworth Digital filter using Bilinear transformation for T=1 sec.	**20 Marks**	**L3**	**CO3**
		Or			
20.	**a.**	The specification of the desired low pass digital filter is	**20 Marks**	**L3**	**CO3**

		Design a **Chebyshev** Digital filter using **Bilinear** transformation for T=1 sec.			

21.	**a.**	Design a linear phase FIR bandpass filter to pass the frequencies in the range $0.35\,\boldsymbol{\pi}$ to $0.48\,\boldsymbol{\pi}$ rad/sample using rectangular window by taking 5 samples of rectangular window sequence	**20 Marks**	**L3**	**CO5**
		Or			
22.	**a.**	Design a linear phase FIR high pass filter using rectangular window by taking 5 samples of window sequence and with a cut-off frequency, $w_c = 0.48\pi$ rad/sample	**20 Marks**	**L3**	**CO5**