Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 23-05-2025 **Time:** 01:00 pm –04:00 pm

School: SOE	**Program:** B. Tech-ECE	
Course Code : ECE3161	**Course Name**: DIGITAL SIGNAL PROCESSING	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**
Marks	**14**	**14**	**41**	**31**

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.	Distinguish between linear convolution and circular convolution?	**2 Marks**	**L2**	**CO1**
2.	Define DFT and IDFT.	**2 Marks**	**L2**	**CO1**
3.	Define a twiddle factor and state its properties	**2 Marks**	**L2**	**CO2**
4.	Draw the signal flow graph of a 2-point Radix-2 Decimation-in-Frequency (DIF) FFT.	**2 Marks**	**L2**	**CO2**
5.	How does a Butterworth filter compare to a Chebyshev filter?	**2 Marks**	**L2**	**CO3**
6.	What are the available transformation techniques for converting an analog transfer function into a digital transfer function?	**2 Marks**	**L2**	**CO3**
7.	What is prewarping, and why is it used in digital filter design?	**2 Marks**	**L2**	**CO3**
8.	What is the equation for the rectangular window function?	**2 Marks**	**L2**	**CO4**
9.	Write the magnitude and phase function of FIR filter when impulse response is symmetric and N is Odd.	**2 Marks**	**L2**	**CO4**
10.	What are the well-known design techniques for linear-phase FIR filters?	**2 Marks**	**L2**	**CO4**

Part B

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

11.	**a.**	Find the linear convolution of the two sequences: x(n)={1,-1,2,3} and h(n)={2,3,-2,-3}	**10 Marks**	**L2**	**CO1**
		Or			
12.	**a.**	Find the circular convolution of the two sequences: x(n)={1,2,3,4} and h(n)={2,1,2,1}	**10 Marks**	**L2**	**CO1**

13.	**a.**	An 8-point sequence is given by x(n)={1,2,3,4,4,3,2,1}.Compute 8-point DFT of x(n) using radix-2 DIT-FFT.	**10 Marks**	**L3**	**CO2**
		Or			
14.	**a.**	An 8-point sequence is given by x(n)={1,1,1,1,1,1,1,1}.Compute 8-point DFT of x(n) using radix-2 DIF-FFT.	**10 Marks**	**L3**	**CO2**

15.	**a.**	For the given desired frequency response, $$H_d(e^{j\omega}) = \begin{cases} e^{-j4\omega} & \frac{\pi}{4} < \lvert\omega\rvert < \pi \\ 0 & otherwise \end{cases}$$ with length N= 9, Using rectangular window, Design FIR filter with frequency response:	**10 Marks**	**L3**	**CO4**
		Or			
16.	**a.**	For the given desired frequency response $$H_d(e^{j\omega}) = \begin{cases} e^{-j5\omega} & \lvert\omega\rvert \le \frac{\pi}{4} \\ 0 & otherwise \end{cases}$$ with length N=11, Using rectangular window, Design FIR filter and find frequency response?	**10 Marks**	**L3**	**CO4**

17.	**a.**	Design a linear phase FIR lowpass filter using hamming window by taking 5 samples of window sequence and with a cut-off frequency, $\mathbf{w_c = 0.35\pi}$ **rad/sample**.	**15 Marks**	**L3**	**CO4**
		Or			
18.	**a.**	Design a linear phase FIR highpass filter using rectangular window by taking 5 samples of window sequence and with a cut-off frequency, $w_c = 0.48\pi$ rad/sample	**15 Marks**	**L3**	**CO4**

19.	**a.**	Using Impulse Invariant transformation, find the transfer function of the digital filter for $\boldsymbol{H(s) = \frac{10}{(S+0.5)(S+0.25)}}$ for T=0.2Sec**.(**5 Marks**)**	**5 Marks**	**L3**	**CO3**
	b.	Realise the given difference equation $y(n) - \frac{3}{10}y(n-1) - \frac{4}{11}y(n-2) + \frac{3}{16}y(n-3) = x(n) - \frac{3}{7}x(n-1)) + \frac{5}{9}x(n-2)$ Using Direct form I and Direct form II methods.	**10 Marks**		
		Or			

20.	**a.**	Using Bilinear transformation, find the transfer function of the digital filter for $H(s) = \frac{0.5}{(S^2+0.5S+0.25)}$ for T=0.2Sec.	**5 Marks**	**L3**	**CO3**
	b.	Obtain direct form-I and Direct form II realizations for the transfer function of the system given by $H(z) = \frac{0.5 + 0.75z^{-1} + 0.5z^{-2}}{0.75 + 0.125z^{-1} - 0.25z^{-2}}$ **(10 Marks)**	**10 Marks**		

21.	**a.**	The specification of the desired low pass digital filter is $\boldsymbol{0.8 \leq |H(w)| \leq 1.0}$; $\boldsymbol{0 \leq w \leq 0.35\pi}$ $\boldsymbol{|H(w)| \leq 0.3}$; $\boldsymbol{0.6\pi \leq w \leq \pi}$ Design a Chebhshev Digital filter using impulse invariant transformation for T=1 sec.	**20 Marks**	**L3**	**CO3**
		Or			
22.	**a.**	Design a Digital Butterworth filter that satisfies the following constraints using Bilinear transformation for T=0.2 sec. $0.75 \leq |H(w)| \leq 1.0$; $0 \leq w \leq \frac{\pi}{4}$ $|H(w)| \leq 0.25$; $\frac{3\pi}{4} \leq w \leq \pi$	**20 Marks**	**L3**	**CO3**