Subject Code: XXXXX

Roll No:

BTECH

(SEM-5) DIGITAL SIGNAL PROCESSING 2021-22

TIME:3 HOUR ***Total Marks: 100***

Instruction: Attempt the questions as per the given instructions. Assume missing data suitably.

SECTION - A

Attempt *All Parts* in Brief **2*10 = 20**

Q1	Questions	Marks
(a)	Define the recursive and non-recursive systems.	2
(b)	Enlist the condition for Linear Phase FIR digital with 5 number of samples.	2
(c)	Differentiate Butterworth Low Pass Filter with Chebyshev in terms of Filter Order.	2
(d)	Evaluate the value of $C_3(x)$, Chebyshev Polynomial.	2
(e)	Demonstrate the term Gibb's phenomenon with schematic diagram.	2
(f)	Explain the terms Truncation error and Round off error with suitable examples.	2
(g)	Evaluate the DFT for the sequence [1,2, 7,3].	2
(h)	Find out the total no of Complex additions and Complex multiplications required for calculating 8-point Conventional DFT and by using butterfly structure DIT-FFT.	2
(i)	Explain the term Decimation with suitable example.	2
(j)	Find the output of the sequence [1 2 3] after up sampling by a factor N = 3.	2

SECTION - B

Attempt *Any Three* of the following **3*10 = 30**

Q2	Questions	Marks
(a)	Realize the given H(z) for using ladder structure. $$H(z) = \frac{2 + 8z^{-1} + 6z^{-2}}{1 + 8z^{-1} + 12z^{-2}}$$	10
(b)	Design Digital Butterworth filter to satisfy the following constraints using bilinear transformation method, the sampling interval is 2 second: assume missing data if required: $$0.52 \le |H(e^{jw})| \le 1 \quad , \quad 0 \le w \le \pi/2$$ $$|H(e^{jw})| \le 0.1 \quad , \quad 3\pi/4 \le w \le \pi$$	10
(c)	Explain the concept of the Limit Cycle Oscillations and dead band effect with suitable example.	10
(d)	Calculate the circular convolution using graphical method for x(n) = [1,2, 3, 4] and h(n) = [4,3,2, 1]	10
(e)	Summarize QMF and Explain analytical and synthesis filter bank with aliasing free filter bank.	10

SECTION - C

Attempt *Any One* of the following **5*10 = 50**

Q3	Questions	Marks
(a)	Describe the linear phase FIR system and for h(n) = [1/2, 1/3, 1/5, 1/3, 1/2]. Realize H(a) of the Linear phase FIR system for the given impulse response.	10
(b)	Find out the direct form-I and direct form-II realization of a discrete-time system represented by the transfer function $$y(n) = \frac{13}{12}y(n-1) - \frac{9}{24}y(n-2) - \frac{1}{24}y(n-3) + x(n) + 4x(n-1) + 3x(n-2)$$	10
Q4	**Questions**	**Marks**
(a)	Design Chebyshev Digital LPF filter to satisfy the following constraints using Impulse Invariant method. $$0.9 \le |H(e^{jw})| \le 1 \quad , \quad 0 \le w \le 0.25\pi$$ $$|H(e^{jw})| \le 0.24 \quad , \quad 5\pi \le w \le \pi$$	10
(b)	Design Chebyshev Digital LPF filter to satisfy the following constraints using Bilinear Transformation	10

	method, assume that the sampling time is one second. $0.707 \leq \lvert H(e^{jw}) \rvert \leq 1 \quad , \quad 0 \leq w \leq 0.2\,\pi$ $\lvert H(e^{jw}) \rvert \leq 0.1 \quad , \quad 0.5\pi \leq w \leq \pi$	
Q5	**Questions**	**Marks**
(a)	A low Pass filter is to be designed with the following specifications: $H_d(e^{jw}) = \begin{cases} e^{-2jw} & , \; -\pi/4 \leq w \leq \pi/4 \\ 0 & , \; \text{otherwise} \end{cases}$ Using Rectangular window function, find the Filter coefficients and Frequency spectrum of the designed filter.	10
(b)	Design a filter with $H_d(e^{jw}) = \begin{cases} e^{-3jw} & , \; -\pi/4 \leq w \leq \pi/4 \\ 0 & , \; -\pi/4 \leq w \leq \pi \end{cases}$ Using Hamming window with M = 7.	10
Q6	**Questions**	**Marks**
(a)	Using DIF FFT find X (k) for x (n) = 2^{k+1} for N= 8	10
(b)	Derive and solve the DIT FET algorithm for 8 numbers of samples.	10
Q7	**Questions**	**Marks**
(a)	Explain the block diagrammatic presentation of DSP processor, with its architecture, addressing formats and its commercial usages.	10
(b)	Write a short note on LMS algorithm.	10