



B.E DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2014)

Fifth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U14ECT503: Digital Signal Processing

COURSE OUTCOMES

- CO1:** Explain Properties and algorithms for implementation of DFT
CO2: Describe Filters and their structures
CO3: Illustrate the design of FIR and IIR filters
CO4: Discuss finite word length effects.
CO5: Relate the architectures and instruction set of a Digital Signal Processor

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Matching type item with multiple choice code

CO3 [K₂]

List I		List II	
A. Bilinear Transformation		i. $\Omega = \omega/T$	
B. Impulse Invariance Method		ii. Poles lying on Circle	
C. Butterworth filter		iii. Poles lying on Ellipse	
D. Chebyshev filter		iv. $\Omega = (2/T)\tan(\omega/2)$	

- | | A | B | C | D |
|----|-----|----|-----|-----|
| a) | ii | i | iii | iv |
| b) | iv | i | ii | iii |
| c) | ii | iv | iii | i |
| d) | iii | i | ii | iv |
2. The DFT of Unit impulse function is -----

CO1 [K₂]

- | | |
|------|------------------------|
| a) 1 | b) $1+a+a^2+a^3+\dots$ |
| c) 0 | d) -1 |

3. Which of the following statements are correct? CO2 [K₂]
1. IIR filter are always stable.
 2. Butterworth filters have no ripples in passband as well as in stopband.
 3. Type I Chebyshev filter has ripples in the passband.
 4. Type II Chebyshev filter has ripples in the passband.
- a) 1,3 b) 1,4
c) 1,2 d) 2,3
4. The no. of additions to be performed in the computation of 16-Point DFT using FFT is ----- CO1 [K₂]
- a) 32 b) 64
c) 128 d) 256
5. Assertion (A) : FIR filters have finite impulse response. CO2 [K₂]
Reason (R) : FIR filter are always stable.
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
6. Two's complement of -0.75 is ----- CO4 [K₂]
- a) 0.1100 b) 1.0100
c) 0.0011 d) 0.0100
7. Steps in designing of FIR filter using Frequency sampling Method CO4 [K₂]
1. Find Inverse DFT to get the filter co-efficients.
 2. Sample the desired frequency response at $2\pi k / 7$.
 3. Identify the length of the filter and obtain desired frequency response.
 4. Compute Magnitude response and phase response for all values of $k=0, 1, \dots, N-1$.
- a) 1-3-4-2 b) 3-4-2-1
c) 3-2-4-1 d) 3-4-1-2
8. The sampling rate of a discrete time signal $x(n) = \{-1, 2, -3, 4\}$ is increased by 3. The resultant sequence is ----- CO4 [K₁]
- a) $\{-1, 0, 2, 0, -3, 0, 4\}$ b) $\{0, -1, 0, 2, 0, -3, 0, 4\}$
c) $\{-1, 0, 0, 2, 0, 0, -3, 0, 0, 4\}$ d) $\{-1, -3\}$
9. TMS320C6713 has ----- bit data bus. CO5 [K₁]
- a) 16 b) 64
c) 32 d) 12

10. ----- Functional units are present in TMS320C67XX. CO5 [K₁]
- a) 2 b) 6
- c) 4 d) 8

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Define DFT Pair. CO1 [K₁]
12. Compute the DFT of the sequence, $x(n)=\{1,0,2,-1\}$. CO1 [K₂]
13. Compare Butterworth and Chebyshev filters. CO2 [K₂]
14. Obtain the direct form realization of FIR filter described by, CO2 [K₂]

$$H(z) = 1 + 2Z^{-1} + 3Z^{-2} + 2Z^{-3} + Z^{-4}$$
15. FIR filters are always stable. Justify your answer. CO3 [K₂]
16. Determine the order of a low pass Butterworth filter that has 3dB attenuation at 500 Hz and an attenuation of 40 dB at 1000Hz. CO3 [K₂]
17. Express $(-15)_{10}$ in sign magnitude and one's complement form. CO4 [K₂]
18. Distinguish between fixed point and floating point arithmetic. CO4 [K₂]
19. Compare Harvard and modified Harvard architectures. CO5 [K₂]
20. List the interrupts of TMS320C6713. CO5 [K₁]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. Compute the 8 point DFT using DIT – FFT algorithm for the sequence, CO1 [K₃]
 $x(n) = \{1,2,-1,3,0,4,0,3\}$
22. Design a symmetric FIR lowpass filter with the desired frequency response of CO3 [K₃]

$$H_d(e^{j\omega}) = \begin{cases} e^{-j5\omega} & -\pi/2 \leq \omega \leq \pi/2 \\ 0 & -\pi/2 \leq \omega \leq \pi \end{cases}$$
 CO2
 Use Hamming window. Realize the system using Direct form structure.
23. i) State and prove any three properties of the DFT. CO1 [K₃]

ii) Compute the circular convolution of $x_1(n) = [1, 3, 0, 1]$ and $x_2(n) = [5, 0, 4, 2]$

24. For a given specifications of the desired low pass filter is CO3 [K₃]

$$0.707 \leq |H(\omega)| \leq 1.0, \quad 0 \leq \omega \leq \pi/2$$

$$|H(\omega)| \leq 0.2, \quad 3\pi/4 \leq \omega \leq \pi$$

Design a digital butterworth filter using bilinear transformation. Assume $T = 1$ sec.

25. i) Realize the system described by difference equation, (7) CO2 [K₂]

$$y(n) = 3y(n-1) + 4y(n-2) + x(n) - 2x(n-1) + 3x(n-2) \text{ using Direct form I and II.} \quad (7) \text{ CO3}$$

ii) Apply Bilinear Transformation to $H(s) = 3/(S+4)(S+2)$ to find $H(z)$. Assume $T=1$ sec

26. i) Discuss the various methods of quantization. (7) CO4 [K₂]

ii) Derive the Signal to Noise Ratio (SNR) at the input of a quantizer. (7)

27. With neat block diagram, explain the various functional blocks of TMS320C67XX processor. CO5 [K₂]
