



B.E. DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Fourth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U18ECI4201: Digital Signal Processing

COURSE OUTCOMES

- CO1:** Apply DFT algorithm for signal analysis.
CO2: Design, implement and analyze IIR filter for the given specification.
CO3: Design, implement and analyze FIR filter for the given specification.
CO4: Compare different structures for filter implementations.
CO5: Analyze the effect of finite word length.
CO6: Compare DSP Processor Architectures.

Time: Three Hours

Maximum Marks: 100

**Answer all the Questions:-
 PART A (10 x 2 = 20 Marks)
 (Answer not more than 40 words)**

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|------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|
| 1. Find DFT of $x(n) = \{1, -1, 0, 1\}$. | CO1 | [K ₂] |
| 2. Compare DTFT and DFT. | CO1 | [K ₁] |
| 3. Convert the given analog transfer function $H(S) = 1 / (s+a)$ into digital transfer function by Impulse Invariant Method. | CO2 | [K ₂] |
| 4. What is Warping effect? | CO2 | [K ₁] |
| 5. What is Gibb's phenomenon? | CO3 | [K ₁] |
| 6. Draw the direct form realization for the following linear phase filter $h(n) = \{1, 2, 3, 4, 3, 2, 1\}$ | CO4 | [K ₂] |
| 7. Compare fixed point and floating point arithmetic. | CO5 | [K ₂] |
| 8. What is meant by (Zero-input) limit cycle oscillations? | CO5 | [K ₁] |
| 9. Define pipelining. | CO6 | [K ₁] |
| 10. Compare Von-Neumann and Harvard architecture. | CO6 | [K ₂] |

**Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)**

11. a) Apply radix-2 DIF-FFT algorithm to find DFT of the sequence 8 CO1 [K3]
 $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2, 1\}$.
- b) Construct the output sequence $y(n)$ sequence in response to input sequence 8 CO1 [K3]
 $x(n) = \{1, 2, 3, -1, -2, -3, 4, 5, 6\}$ with impulse response $h(n) = \{2, 1, -1\}$ using overlap-add method.
12. a) Apply Bilinear transformation to determine $H(z)$ for Butterworth filter satisfying 8 CO2 [K3]
the following specifications.
- $$0.6 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq 0.35\pi$$
- $$|H(e^{j\omega})| \leq 0.1 \quad 0.7\pi \leq \omega \leq \pi$$
- b) Analyze and design an ideal filter with the frequency response 8 CO3 [K4]
 $H_d(e^{j\omega}) = e^{-j3\omega}$ for $-\pi/4 \leq \omega \leq \pi/4$
0 for otherwise
Determine $h(n)$ & $H(z)$ for $N=7$ using hamming window
13. a) Examine a linear phase FIR low pass filter using rectangular window by taking 7 8 CO3 [K4]
samples of window sequence and with cutoff frequency $\omega_c = 0.2\pi$ rad/sample.
- b) Apply frequency sampling technique to determine the coefficients $h(n)$ of length 8 CO3 [K3]
 $N=15$ and its frequency response as
- $$H(2\pi k/15) = 1, \quad k = 0, 1, 2, 3$$
- $$0.4, \quad k = 4$$
- $$0 \quad k = 5, 6, 7.$$
14. a) Compare the direct form I, direct form II, cascade and parallel form realization of 10 CO4 [K4]
LTI System governed by the equation:
- $$y(n) = -3/8 y(n-1) + 3/32 y(n-2) + 1/64 y(n-3) + x(n) + 3x(n-1) + 2x(n-2).$$
- b) Realize the following system with minimum number of multipliers, 6 CO4 [K4]
 $H(z) = 1/3 + 1/4 Z^{-1} + 3/2 Z^{-2} + 3/2 Z^{-3} + 1/4 Z^{-4} + 1/3 Z^{-5}$
15. a) Assume sign magnitude is 4 bits and characterize limit cycle oscillation with 8 CO5 [K2]
respect to the system described by the equation $y(n) = 0.95y(n-1) + x(n)$ and

estimate the dead band of the filter, when $x(n) = 7/8, n=0$

0, otherwise

- b) Evaluate the steady state output noise power and the steady state variance of the noise in the output due to quantization of input for the first order filter $y(n) = ay(n-1) + x(n)$. 8 CO5 [K3]
16. a) Explain the various types of addressing modes in DSP Processor with suitable examples. 6 CO6 [K2]
- b) Explain in detail about the architecture of TMS320C67XX digital signal processors with neat sketches 10 CO6 [K2]
