Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 70519

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Electronics and Communication Engineering

EC 8553 – DISCRETE-TIME SIGNAL PROCESSING

(Common to Biomedical Engineering / Computer and Communication Engineering / Electronics and Telecommunication Engineering / Medical Electronics)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   What is deterministic signal? Give an example.

2.   What are the properties of twiddle factor?

3.   Give any two properties of Butterworth Low Pass Filter.

4.   Distinguish between Butterworth and Chebyshev Type-I filter.

5.   What are the conditions for impulse response of the FIR filter to have linear phase?

6.   What are the desirable characteristics of the window to design FIR filter?

7.   What are the three quantization errors due to finite word length effects in digital filter?

8.   What is meant by rounding and truncation?

9.   What are the classification of digital signal processors?

10. What is pipelining?

PART B — (5 × 13 = 65 marks)

11. (a) State and prove any three properties of Discrete Fourier Transform (DFT).

Or

(b) Find the DFT of the sequence $x(n) = \{1, 1, 1, 1, 1, 1, 1\}$ using FFT algorithm.

12. (a) (i) Write the magnitude response of Butterworth Low Pass Filter and plot it. (4)

(ii) Write the properties of Butterworth Low Pass Filter. (4)

(iii) Give the procedure to design digital filters from analog filters. (5)

Or

(b) (i) Explain the procedure for digitizing analog filter transfer function using impulse Invariant and Bilinear Transformation methods. (8)

(ii) Give the different types of structures to realize IIR filter. (5)

13. (a) Derive the frequency response for linear phase FIR filter for the below two cases

(i) Symmetric Impulse Response when N odd (7)

(ii) Symmetric Impulse Response when N even. (6)

Or

(b) What are the different types of window functions available to design FIR filter? And give their properties.

14. (a) Explain limit cycle behaviour of a system with one example and find the Dead band of that system.

Or

(b) Explain different quantization methods in finite word length effects and the errors arising due to quantization process.

15. (a) Explain the functions of TMS320C50 processor with neat diagram.

Or

(b) Explain briefly about the instruction sets of TMS320C50 processor.

PART C — (1 × 15 = 15 marks)

16. (a) An FIR digital filter has the unit impulse response sequence $h(n) = \{2, 1, -1\}$. Determine the output sequence $y(n)$ in response to the input sequence $x(n) = \{1, 2, 3, -1, -2, -3, 4, 5, 6\}$ using the Overlap add method.

Or

(b) Design a third order Butterworth digital filter using impulse invariant method and realize it using Direct form - II structure. (Assume sampling period T = 1 sec)

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