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Question Paper Code : 10583

B.E/B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fifth/Eighth Semester

Electrical and Electronics Engineering

EE 8591 — DIGITAL SIGNAL PROCESSING

(Common to : Electronics and Instrumentation Engineering/
Instrumentation and Control Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define energy signals.
2. What is the aliasing effect?
3. What is the condition for an LTI system to be stable?
4. Write the pair equations of DTFT.
5. State any two properties of DFT.
6. Find the number of multiplications needed in the calculation of 32-point DFT using FFT algorithm.
7. What is the difference between symmetric and antisymmetric filters?
8. Define prewarping.
9. What are the factors that influence the selection of digital signal processors?
10. List any four commercial digital signal processors.

PART B — (5 × 13 = 65 marks)

11. (a) List and explain the properties of discrete-time systems with examples.

Or

- (b) Describe the process of sampling and quantization of signals with an example.

12. (a) Compute the z transform and ROC of the signal $x(n) = [5(2)^n - 4(3)^n]u(n)$.

Or

- (b) Convolve the following signals using the z -transform.

$$x_1(n) = \left(\frac{1}{2}\right)^n u(n)$$

$$x_2(n) = \cos \pi n u(n)$$

13. (a) Compute 8-point DFT of the sequence $x(n) = \{2, 1, 2, 1, 1, 2, 3, 2\}$ using decimation in time algorithm.

Or

- (b) Find the inverse DFT of the $X(k)$ given below using the DIF algorithm.

$$X(k) = \{36, -4 + j 9.656, -4 + j 4, -4 + j 1.656, -4, -4 - j 1.656, -4 - j 4, -4 - j 9.656\}$$

14. (a) Obtain $H(z)$ using impulse invariance method if $T=1$ sec and $H(s) = \frac{1}{s^2 + 2s + 1}$.

Or

- (b) Obtain the direct form I, direct form II, cascade and parallel form structures of the system: $y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$.

15. (a) (i) Explain the features of Harvard architecture with a diagram. (7)
(ii) Compare and contrast RISC and CISC architectures. (6)

Or

- (b) Discuss the addressing formats and functional modes of digital signal processors.

PART C — (1 × 15 = 15 marks)

16. (a) Determine the coefficients $\{h(n)\}$ of a linear-phase FIR of length $M = 15$ which has a symmetric unit sample response and a frequency response that satisfies the condition.

$$H_r\left(\frac{2\pi k}{15}\right) = \begin{cases} 1, & k = 0, 1, 2, 3 \\ 0, & k = 4, 5, 6, 7 \end{cases}$$

Or

- (b) Design an ideal high pass filter with a frequency response

$$H_d(e^{j\omega}) = \begin{cases} 1 & \text{for } -\frac{\pi}{4} \leq \omega \leq \pi \\ 0 & \text{for } |\omega| \leq \frac{\pi}{4} \end{cases}$$

Find the value of $h(n)$ for $N = 11$ using hamming window. Find $H(z)$ and compute magnitude response.

