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Question Paper Code : 60578

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Fifth/Eighth Semester

Electrical and Electronics Engineering

EE8591 — 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 × 2 = 20 marks)

1. State sampling theorem.
2. Is DFT of a finite duration sequence is periodic? If so, state the theorem.
3. Find the convolution of $x(n) = \{1, 2, 3, 1, 2, 1, 1\}$ and $h(n) = \{1, 2, 1\}$ by matrix method.
4. State convolution theorem with respect to Z transform.
5. Calculate % saving in computing through radix - 2 DFT algorithm of DFT coefficients. Assume $N = 512$.
6. What does "frequency warping" mean? What is the effect on magnitude and phase response?
7. Mention two advantages and disadvantages of IIR filters.
8. Define Gibbs phenomenon.
9. Differentiate Von Numann and Harvard architecture.
10. Mention the three ways of representing negative numbers.

PART B — (5 × 13 = 65 marks)

11. (a) Find the impulse response of a discrete time invariant system whose difference equation is given by

$$y(n) = y(n-1) + 0.5y(n-1) + x(n) + x(n-1) \quad (13)$$

Or

- (b) A discrete time systems can be

- (i) Static or dynamic
- (ii) Linear or non linear
- (iii) Time invariant or time varying
- (iv) Stable or unstable.

Examine the following system with respect to the above properties
 $y(n) = x(n) + nx(n+1)$. (13)

12. (a) State and prove any four properties of z transform. (13)

Or

- (b) Find the inverse z-transform of $X(Z) = 4Z(z+1)2(z+3)$ for all possible ROCs also analyze about the relationship between ROC and Z-transform. (13)

13. (a) With suitable example, derive the butterfly structure for a radix-2 DIF algorithm that is used to compute FFT. (13)

Or

- (b) Compute $X(k)$ of $x(n) = \{1, -1, -1, 1, 1, 1, -1\}$ using radix-2 DIT FFT. Also find the amplitude and frequency spectra. (6+7)

14. (a) Design a second order digital low pass Butter Worth filter with a cut-off frequency 3.4 kHz at a sampling frequency of 8 kHz using bilinear transformation. (Assume necessary data). (13)

Or

- (b) A low pass filter is to be designed with the following desired frequency response (13)

$$H(e^{j\omega}) = \begin{cases} e^{-j^2\omega}, & -\pi/4 \leq \omega \leq \pi/4 \\ 0, & \pi/4 < |\omega| \leq \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ if the window function is defined as

$$w(n) = \begin{cases} 1, & 0 \leq n \leq 4 \\ 0, & \text{otherwise} \end{cases}$$

15. (a) With a neat diagram, explain in detail the architecture of any one of the latest digital signal processor. (Assume necessary data). (13)

Or

- (b) Discuss the addressing modes supported by a DSP processor and also explain how each mode can be used for various DSP operations. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Determine the response of the system defined by the equation

$$y(n) = \frac{5}{6} y(n-1) - \frac{1}{6} y(n-2) + x(n)$$

to the input signal $x(n) = \delta(n) - \frac{1}{3} \delta(n-1)$ assuming zero initial conditions. (10)

- (ii) Justify with suitable illustrations, the necessity for quantization and nyquist criterions influence on the quantization function. (5)

Or

- (b) Elucidate the characteristics of limit cycle oscillation represented to the system described by $y(n) = 0.96y(n-1) + x(n)$. Deduce the dead band of the filter. (15)

