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Question Paper Code : 11244

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

Fourth Semester

Electronics and Communication Engineering

EC3492 — DIGITAL SIGNAL PROCESSING

(Common to : Electronics Engineering (VLSI Design and Technology)/ Electronics and Telecommunication Engineering/Medical Electronics)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Fourier transform of a sequence.
2. Distinguish between DFT and FFT.
3. What are the different types of structures for realization of IIR systems?
4. What is the importance of poles in filter design?
5. What is the necessary condition for the linear phase characteristics of FIR filter?
6. Why rectangular window is not a good choice for designing FIR filter?
7. List some of the finite word length effects in filters.
8. Why rounding is preferred to truncation in realizing digital filter?
9. What is meant by down sampling and up sampling?
10. Write any two applications of multirate signal processing.

PART B — (5 × 13 = 65 marks)

11. (a) Compute the circular convolution of the following sequences using DFT.
 $x_1(n) = \{-1, 2, -2, -1\}$ and $x_2(n) = \{1, -2, -1, -2\}$.

Or

- (b) Using radix-2 DIT algorithm, find 8-point DFT of the sequence.

$$x(n) = \{1, -1, 1, -1, 0, 0, 0, 0\}$$

12. (a) For the given analog transfer function, determine $H(z)$ using impulse invariance and bilinear transformation method.

$$H(S) = \frac{2}{(S^2 + 2S + 1)}$$

Or

- (b) Realize the following IIR system with difference equation in direct form-I and direct form-II.

$$y(n) = 3/4 y(n-1) - 1/8 y(n-2) + x(n) + 1/3 x(n-1)$$

13. (a) Design an ideal high pass filter using hamming window with a frequency response,

$$H_d(e^{j\omega}) = 1; \pi/4 \leq |\omega| \leq \pi$$
$$= 0; |\omega| \leq \pi/4$$

Or

- (b) Obtain direct form-I and direct form-II structures for the following system.

$$y(n) = \frac{1}{2} y(n-1) + \frac{1}{4} y(n-2) + x(n) + x(n-1)$$

14. (a) Discuss the effects of quantization of filter coefficients with few examples.

Or

- (b) Multiply $+5_{10}$ and $+0.25_{10}$ by floating point multiplication. Choose 10-bit floating point format for mantisaa and 3 bits for exponent.

15. (a) Consider following discrete time signal and find the up-sampled version of the signal for the sampling rate multiplication factor of 2.

$$x(n) = \{1, 2, 3, 4\}$$

Or

- (b) Discuss the multistage implementation of sampling rate conversion.

PART C — (1 × 15 = 15 marks)

16. (a) Design a digital Butterworth filter satisfying the constraints with $T = 1$ sec using Bilinear Transformation method.

$$0.707 \leq |H(e^{j\omega})| \leq 1; 0 \leq \omega \leq \frac{\pi}{2}$$

$$|H(e^{j\omega})| \leq 0.2; \frac{3\pi}{4} \leq \omega \leq \pi$$

Or

- (b) Analyze the limit cycle behavior of the following system.

$$Y(n) = 0.65y(n-2) + 0.52y(n-1) + x(n)$$

15. (a) Consider following three time series and find the appropriate model for each series. (10 marks)

$$Y_t = 1 + 0.5Y_{t-1} + 0.25Y_{t-2}$$

(b)

Consider the following two series and find the appropriate model for each series. (10 marks)

$$Y_t = 1 + 0.5Y_{t-1} + 0.25Y_{t-2}$$

16. (a) Consider a linear regression model with the following data. (10 marks)

$$Y_t = 1 + 0.5Y_{t-1} + 0.25Y_{t-2}$$

$$Y_t = 1 + 0.5Y_{t-1} + 0.25Y_{t-2}$$

(b)

Consider the following two series and find the appropriate model for each series. (10 marks)

$$Y_t = 1 + 0.5Y_{t-1} + 0.25Y_{t-2}$$