Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 90524

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

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 × 2 = 20 marks)

1. Define energy and power signals.
2. State sampling theorem.
3. What is the region of convergence of z transform?
4. Write the equation of Discrete Time Fourier Transform pair.
5. What is zero padding? What are its uses?
6. How many multiplications and additions are required to compute N-point DFT using radix-2 FFT?
7. Give the equation of the Hamming window.
8. What is prewarping?
9. Mention the important features of Harvard architecture.
10. List any four commercial digital signal processors.

PART B — (5 × 13 = 65 marks)

11. (a) Determine whether or not the system $y(n)=x(-n+2)$ is

    (i) Linear
    (ii) Causal
    (iii) Stable
    (iv) Time invariant
    (v) Static. (13)

Or

(b) Describe the sampling and quantization process with an example, and explain aliasing effect. (5+5+3)

12. (a) (i) Find the z-transform with ROC of the signal $x(n)=\left[3(3)^n-4(2)^n\right]u(n)$. (6)

(ii) Determine the inverse z transform of the following expression using partial fraction expansion. (7)

$$X(z)=\frac{1}{\left(1-\frac{1}{3}z^{-1}\right)\left(1-\frac{1}{6}z^{-1}\right)}\ ROC|z|>\frac{1}{3}$$

Or

(b) (i) A linear time-invariant system is characterized by the system function (8)

$$H(z)=\frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}.$$

Specify the ROC of $H(z)$ and determine $h(n)$ for the following conditions:

(1) The system is stable

(2) The system is causal

(3) The system is anticausal

(ii) Find the linear convolution of

$x(n)=\{1,2,3,4,2,1,7\}$ with $h(n)=\{2,3,-1,6\}$. (5)

13. (a) List and explain the properties of Discrete Fourier Transform with equations. (13)

Or

(b) (i) Elaborate the steps of radix-2 Decimation in Time (DIT) FFT algorithm. (8)

(ii) Find circular convolution of the sequences using concentric circle method $x(n)=\{1,1,2,-1\}$ and $h(n)=\{1,2,3,4\}$. (5)

14. (a) Determine the coefficients of a linear-phase FIR filter of length M = 15 which has a symmetric unit sample response and a frequency response that satisfies the conditions (13)

$$H_r\left(\frac{2\pi k}{15}\right)=\begin{cases}1, & k=0,1,2,3\\ 0.4, & k=4\\ 0, & k=5,6,7\end{cases}$$

Or

(b) Determine the digital transfer function obtained by transforming the following analog transfer function using the impulse invariance method. Assume T = 1 sec. $H_a(S)=\frac{2}{(s+1)(s+4)}$. (13)

15. (a) (i) Explain the functions of the MAC unit. (4)

(ii) Elaborate the principle of pipelining with an example. (9)

Or

(b) Discuss various types of addressing modes of digital signal processors with suitable examples. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Compute 8 point DFT of the sequence $x(n)=\{1,2,3,\ 2,1,\ 2,3,\ 2\}$ using the Decimation in Time (DIT) algorithm.

Or

(b) Compute IDFT of the sequence $X(k)=\{8,1+2j,1-j,0,1,0,1+j,1-2j\}$ using the Decimation in Frequency (DIF) algorithm.

———————