Total No. of printed pages = 2

EC 131505 (NR)

Roll No. of candidate

4/3/22   2021

B.Tech. 5th Semester End-Term Examination

ECE + AEI + EEE

DIGITAL SIGNAL PROCESSING

(New Regulation)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions : $(10 \times 1 = 10)$

    (i)   List the basic elements of digital signal processing.

    (ii)   What is the difference between convolution and correlation?

    (iii) What do you mean by circular shift of a sequence?

    (iv)   Give the significance of ROC in Z-transform.

    (v)   List limitations of analog signal processing.

    (vi)   Give the various steps involved in the design of IIR filter.

    (vii) Appending zeros to a sequence in order to increase its length is called _____

    (viii) Give two advantages of digital signal processing over analog signal processing.

    (ix)   Give the computational efficiency of FFT over DFT.

    (x)   What is the function of accumulator unit in DSP processor?

2. (a) Compute the convolution $y(n) = h(n) * x(n)$ for the values of $x(n)$ and $h(n)$ as given below $(9+6=15)$

        $x(n) = (1/2)^n \cdot u(n)$ and $h(n) = (1/4)^n \cdot u(n)$

    (b) Explain the direct form realization of FIR filter.

[Turn over

3. (a) Obtain the direct form I, direct form II, cascade and parallel structure for the following system: (10+5=15)

$$y(n) = -0.1\,y(n-1) + 0.2y(n-1) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$$

(b) The transfer function of analog filter is :

$$H_a(s) = 3/(s+2)(s+3)$$

With T = 0.1sec. Design the digital filter using Bilinear Transformation Technique.

4. (a) Define Fourier transform and Z-transform of discrete time signal and obtain the relationship between them. What do you understand by ROC of Z-transform? (8+7=15)

(b) Determine the Z-transform and sketch the ROC of :

$$x(n) = -a^n u(-n-1)$$

5. (a) What is filtering? Why it is not feasible to design an ideal filter? What are the characteristics of practical frequency selective filters? (9+6=15)

(b) What do you mean by 'in-place computing' in FFT algorithm? What are 'twiddle factors' of the DFT computation?

6. (a) Compute the 8-point DFT of the sequence

$$x(n) = (0, 1, -1, 0, 0, 2, -2, 0)$$

using the radix-2 decimation-in-time algorithm. (10+5=15)

(b) Explain the different types of structures for the realization of IIR filter.

7. (a) What is the reason that FIR filters are always stable? What is the need for employing window technique for FIR filter design? (5+5+5=15)

(b) What are the desirable characteristics of the window?

(c) Explain different types of discrete time systems with examples.