L 1286

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Sixth Semester

Electrical and Electronics Engineering

EE 337 — DIGITAL SIGNAL PROCESSING

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between one–dimensional signal and two–dimensional signal and give an example for each signal.

2. What are the most basic time–domain signal operations?

3. What do you mean by BIBO stable?

4. Give the z – transform of the signal $\alpha^n u(n)$ and what is its ROC?

5. Define Discrete time Fourier Transform of a sequence $x(n)$ and Find DTFT of a causal sequence $x(n) = (0.5)^n \, u(n)$.

6. Draw the flow–graph of the radix – 2 DIT algorithm for $N = 4$.

7. State sampling theorem and what is Nyquist frequency?

8. What is anti–aliasing filter?

9. Draw a causal FIR filter structure for length M = 5.

10. What is Bilinear transformation? What are its advantages?

PART B — (5 × 16 = 80 marks)

11. (a) (i) What are the advantages and disadvantages of digital signal processing compared with analog processing? (6)

    (ii) Explain the following signal processing Applications

        (1) Sound Recording (5)

        (2) Equalizers and filters. (5)

Or

    (b) (i) Explain the concept of signal processing. (5)

    (ii) Explain the following signal processing Applications

        (1) Noise reduction system (5)

        (2) Echo cancellation in Telephone Networks. (6)

12. (a) (i) Explain the various types of sequences. (6)

    (ii) A causal LTI IIR digital filter is characterized by a constant Co–efficient difference equation given by $y(n) = x(n-1) - 1.2x(n-2) + x(n-3) + 1.3y(n-1) - 1.04y(n-2) + 0.222y(n-3)$, Obtain its transfer function. (5)

    (iii) What is ROC? and explain with an example. (2 + 3 = 5)

Or

    (b) (i) Explain the basic operations of the sequences. (5)

    (ii) Explain the following properties of discrete – time systems with examples.

        (1) Linearity

        (2) Stability. (3 + 3 = 6)

    (iii) Find the inverse z – transform of the transfer function

    $$H(z) = \frac{1}{1 - z^{-1} + 0.5z^{-2}} \quad |z| > 1.$$ (5)

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13. (a) (i) Define DFT and explain its properties. (10)

     (ii) Find the DFT of the sequence $x(n) = \{1\ 0\ 0\ 1\}$. (6)

Or

     (b) (i) Explain the Fourier series and Fourier transform with an example. (6)

     (ii) Find the DFT of the sequence $x(n) = \{2, 2, 2, 2, 1, 1, 1, 1\}$ using radix – 2 DIT algorithm. (10)

14. (a) (i) Explain the effect of time–domain sampling on the frequency response with illustrations. (10)

     (ii) State sampling theorem. What is Nyquist frequency if the maximum frequency present in the signal is 1 KHz. (6)

Or

     (b) (i) Determine the lowest order of a lowpass Butterworth filter with a 0.5 dB cutoff frequency at 1.5 kHz and a minimum attenuation of 60 dB at 6.1 kHz. (6)

     (ii) Draw a basic sample and Hold circuit and explain its operation with Input/Output waveforms. (10)

15. (a) (i) Draw a Cascade form FIR structure for a sixth–order FIR filter and explain. (6)

     (ii) Explain the Impulse Invariance Method of IIR Filtter Design. (10)

Or

     (b) (i) Draw the structure for IIR Filter in direct form – II for the following transfer function

$$H(z) = \frac{\left(2 + 3z^{-1}\right)\left(4 + 2z^{-1} + 3z^{-2}\right)}{\left(1 + 0.6z^{-1}\right)\left(1 + z^{-1} + 0.5z^{-2}\right)}.$$ (6)

     (ii) Derive an expression between s – domain and z – domain in Bilinear transformation. Explain frequency warping. (10)

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