# N 1162

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Sixth Semester

Electrical and Electronics Engineering

EE 337 — DIGITAL SIGNAL PROCESSING

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Distinguish between deterministic and random signals.

2. What is a multichannel signal?

3. Examine the system $y(n) = \sum_k x(k), n_0 \le k \le n$ for shift invariance / shift variance.

4. State the initial value theorem of the $z$-transform.

5. Compute DFT of the sequence $x(n) = e^{-n}$ $0 \le n \le 4$.

6. Calculate the number of complex multiplications for direct evaluation of 8-point DFT.

7. Define conversion time of an A/D converter.

8. State Sampling theorem.

9. Find the number of delays required in a Direct Form I structure that realizes a second order transfer function.

10. Mention two characteristics of Butterworth approximation.

PART B — (5 × 16 = 80 marks)

11. (i) Realize a cascade structure for $y(n) = (3/4)\, y(n-1) - (1/8) y(n-2) + x(n) + (1/3) x(n-1)$ using first order sections only. (8)

(ii) Convert the analog filter $H(s) = \dfrac{(s+2)}{(s+1)(s+3)}$ into the digital IIR filter using impulse invariant method. (8)

12. (a) Discuss properties of discrete time signals. Give the proof of each property.

Or

(b) (i) Prove the sampling theorem. (8)

(ii) What is meant by aliasing? Explain with example. (8)

13. (a) Determine the inverse $z$-transform of causal $X(z) = \dfrac{4 - 8z^{-1} + 6z^{-2}}{(1 - 2z^{-1})^2 (1 + z^{-1})}$ using partial fraction expansion.

Or

(b) Determine one-sided $z$-transform of $y(n) + 0.5\, y(n-1) - 0.25 y(n-2) = 0$ given that $y(-1) = y(-2) = 1$.

14. (a) (i) Consider two sequences $x_1(n)$ and $x_2(n)$ with DFTs $X_1(k)$ and $X_2(k)$ respectively. Obtain the sequence $x_3(n)$ for which the DFT is $X_1(k)\, X_2(k)$. (10)

(ii) Give the properties of DFT, FFT. (6)

Or

(b) (i) Draw the signal flow graph of 8-point decimation - in - time algorithm. (12)

(ii) Compare decimation-in-time algorithm and decimation-in-frequency algorithm. (4)

(a) Explain using a block diagram the basic elements of an A/D converter and the conversion technique.

Or

(b) Calculate the mean and variance of the error in A/D conversion assuming uniform distribution for error.

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