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

T 3237

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

Sixth Semester

Electrical and Electronics Engineering

EC 1361 — DIGITAL SIGNAL PROCESSING

(Common to Instrumentation and Control Engineering and Electronics and Instrumentation Engineering)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is a linear time invariant system?

2. What is known as alaising?

3. Define ROC in Z-transform.

4. Determine the Z-transform of the sequence $x(n) = \{2, 1, -1, 0, 3\}$.
   ↑

5. Define DFT pair.

6. Draw the basic butterfly structure for DITFFT and DIF FFT Algorithms.

7. State the condition for linear phase in FIR filters for symmetric and antisymmetric response.

8. What is called prewarping?

9. What are the various interrupt types supported by TMS 320 C 54?

10. Mention the function of the program controller of the DSP processor TMS 320 C 54.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the concept of energy and power signals. Also check whether the following signals are energy or power signal.

(1) $x(n) = \left(\frac{1}{3}\right)^n u(n)$.

(2) $x(n) = \sin\left(\frac{\pi}{4}\right)^n$. (12)

(ii) Briefly explain Quantization. (4)

Or

(b) Check the following system for linearity, time invariance, causality and stability.

(i) $y(n) = e^{x(n)}$

(ii) $y(n) = x(-n + 2)$. (16)

12. (a) (i) Determine the Z-transform of $x(n) = \cos wn\, u(n)$. (6)

(ii) State and prove the following properties of Z-transforms :

(1) Time shifting

(2) Time reversal

(3) Differentiation

(4) Scaling in Z domain. (10)

Or

(b) (i) Determine the inverse Z transform of $X(z) = \frac{1 + 3z^{-1}}{1 + 3z^{-1} + 2z^{-2}}$ for $|z| > 2$. (8)

(ii) Compute the response of the system $y(n) = 0.7\, y(n-1) - 0.12\, y(n-2) + x(n-1) + x(n-2)$ to input $x(n) = n\, u(n)$. (8)

13. (a) (i) Derive and draw the flow graph of the Radix-2 DIFFFT algorithm for the computation of 8 point DFT. (10)

(ii) What are the differences and similarities between DIT and DIF FFT algorithms? (6)

Or

(b) (i) Compute the 8 point DFT of the sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$. (10)

(ii) Illustrate the concept of circular convolution property of DFT. (6)

14. (a) (i) Obtain the cascade and parallel realization of the system described by $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$. (10)

(ii) Discuss about any three window functions used in the design of FIR filters. (6)

Or

(b) (i) Design a digital Butterworth filter satisfying the following constraints with $T = 1$ sec. using Bilinear transformation. (12)

$$0.707 \leq \left|H(e^{jw})\right| \leq 1 \quad \text{for } 0 \leq w \leq \pi/2$$

$$\left|H(e^{jw})\right| \leq 0.2 \text{ for } \frac{3\pi}{4} \leq w \leq \pi$$

(ii) What are the different frequency transformations in analog domain? (4)

15. (a) (i) Describe the function of onchip peripherals of TMS 320 C 54 DSP processor. (12)

(ii) What are the different buses of TMS 320 C 54 and their functions? (4)

Or

(b) Discuss in detail the various quantization effects in the design of digital filters. (16)