Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Question Paper Code : 33382

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Electronics and Communication Engineering

EC 1302/EC 1303 A — DIGITAL SIGNAL PROCESSING

(Regulation 2004/2007)

(Common to B.E. (Part-Time) Fourth Semester Electronics and Communication Engineering, Regulation 2005)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the percentage saving in calculation in a 512 point radix 2 FFT, as compared to Direct DFT.

2. How is the cross correlation between $x_1(n)$ and $x_2(n)$ computed?

3. High pass digital filters are not to be designed by impulse invariant transformation. Justify

4. Obtain linear phase realization for $H(z) = \left(1 + \frac{1}{2}z^{-1} + z^{-2}\right)$.

5. What is the relationship between truncation error e and the bits b for representing a decimal into binary?

6. Mention the need for signal scaling.

7. State the significance of power spectrum estimation.

8. Define bias and consistency of an estimate.

9. What is meant by instruction pipelining?

10. Write a note on NORM instruction in C5X.

PART B — (5 × 16 = 80 marks)

11. (a) (i) State and prove the circular time shift property of DFT. (6)

(ii) Determine the response of LTI system when the input sequence $x(n) = \{-1, 1, 2, 1, -1\}$ by radix 2 DIT FFT. The impulse response of the system is $h(n) = \{-1, 1, -1, 1\}$. (10)

Or

(b) (i) Compute the DFT of the sequence {1, 1, 2, 2, 3, 3}. Hence the corresponding amplitude and phase spectrum. (10)

(ii) Draw the butterfly flow graph for 16 point DIFFFT in radix 2 algorithm. (6)

12. (a) (i) Justify that bilinear transformation is a one to one mapping from analog to digital domain. (6)

(ii) Design a digital Butterworth filter for the following specifications using impulse invariant transformation T = 1 SEC : (10)

$$0.8 \leq \left|H(e^{j\omega})\right| \leq 1 \quad 0 \leq \omega \leq 0.2\pi, \quad \left|H(e^{j\omega})\right| \leq 0.2 \quad 0.6\pi \leq \omega \leq \pi.$$

Or

(b) (i) Design a 9 tap FIR band reject filter with $\omega_{c1} = 1$ rad/sec and $\omega_{c1} = 2$ rad/sec. Use rectangular and hamming window. (10)

(ii) List the steps involved in frequency sampling method of FIR filter design. (6)

13. (a) (i) Brief about the quantization errors in DSP. (10)

(ii) Compare fixed point and floating point arithmetic. (6)

Or

(b) (i) Explain the characteristics of a limit cycle oscillation with respect to the system described by $y(n) = 0.65y(n-2) + 0.52y(n-1) + x(n)$. Determine the dead band of the fitter. (10)

(ii) Describe the analytical model of a sample and hold circuit. (6)

14. (a) (i) Derive the expression for Energy spectral density of the signal $x(t)$. (6)

(ii) What is a periodogram? Describe the periodogram method of power spectrum estimation in detail. (10)

Or

(b) (i) Explain how DFT is useful in power spectrum estimation. (6)

(ii) Compare the various non parametric methods of power spectrum estimation. (10)

15. (a) (i) Which type of architecture is preferred for DSP applications? Why? (6)

(ii) With block diagram explain the complete architecture of TMS 320C5X. (10)

Or

(b) (i) With examples describe the addressing modes of C5X processor. (10)

(ii) Describe the MAC unit architecture with extended features. (6)