C 6117 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2010

EC/AI/IC/BM 04 602—DIGITAL SIGNAL PROCESSING

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer all questions.

Part A

I. (a) State and prove any two properties of DFT.

(b) Explain the efficient computation of the DFT of two real sequence using FFT algorithm.

(c) A digital system is described by the difference equation

$$y(n) = 0.9\, y(n-1) + x(n)$$

with $x(n) = 0$ and initial condition $y(-1) = 12$. Determine the dead-band of the system.

(d) Obtain direct-form and cascade form realizations for the system function of an FIR filter given by

$$H(z) = \left[1 - 0.25z^{-1} + (3/8)z^{-2}\right]\left[1 - 1/8z^{-1} - 0.5z^{-2}\right].$$

(e) What is a linear phase filter ? What conditions are to be satisfied by the impulse response of an FIR system in order to have a linear phase ?

(f) What is bilinear transformation ? Explain.

(g) What is pipelining ? Explain.

(h) Explain any *two* special instructions for DSP operations.

($8 \times 5 = 40$ marks)

Part B

II. (a) (i) Find the response of an LTI system with impulse response $h(n) = \{6, -7\}$ for the input $x(n) = \{2, -6, -12\}$ using DFT. (10 marks)

(ii) Explain frequency analysis of signals using the DFT. (5 marks)

Or

(b) (i) Derive decimation-in-time radix-2 FFT algorithm. (9 marks)

(ii) Define the following with respect to wavelet transform :

(1) Mother wavelet.

(2) Continuous wavelet transform and its inverse transform.

($2 + 4 = 6$ marks)

Turn over

III. (a) (i) Determine the lattice structure corresponding to the FIR filter described by the system function :

$$H(z) = 1 + 0.9z^{-1} - 0.8z^{-2} + 0.5z^{-3}.$$

(12 marks)

(ii) What are the advantages of lattice structure over direct-form FIR structure ? (3 marks)

Or

(b) (i) Explain coefficient quantization effects in direct-form realization of IIR filters. (10 marks)

(ii) Explain what is meant by limit cycle oscillations. (5 marks)

IV. (a) (i) Explain design of FIR filter by frequency sampling. (8 marks)

(ii) Explain the characteristics of practical frequency selective filters with neat diagram. (7 marks)

Or

(b) Design a Butterworth filter using bilinear transformation to meet the following constraints :

$$\frac{1}{\sqrt{2}} \leq |H(w)| \leq 1 \text{ . for } 0 \leq w \leq \frac{\pi}{2}$$

$$0 \leq |H(w)| \leq 0.2 \text{ for } \frac{3\pi}{4} \leq w \leq \pi.$$

(15 marks)

V. (a) (i) Draw the block diagram of basic generic hardware architecture for signal processing and explain. (9 marks)

(ii) Explain hardware multiplier accumulator with block diagram. (6 marks)

Or

(b) (i) Explain the architecture of a hardware FIR digital filter with neat diagram. (8 marks)

(ii) Explain the principles of very long instruction word architecture. (7 marks)

[4 × 15 = 60 marks]