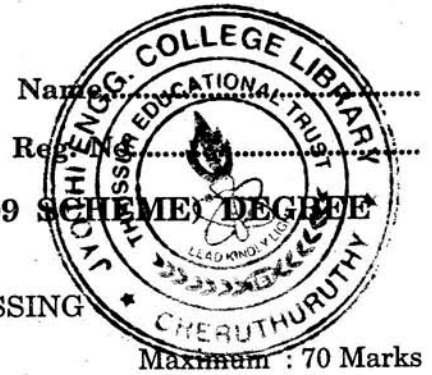


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**SIXTH SEMESTER B.TECH. (ENGINEERING) (09 SCHEME) DEGREE EXAMINATION, APRIL 2015**

AI 09 601—DIGITAL SIGNAL PROCESSING

Time : Three Hours

Maximum : 70 Marks

**Part A**

*Answer all questions.*

- I. 1 Find the DTFT of  $\{1, -2, 2, 3\}$ .
- 2 State and prove time shifting property of DTFT.
- 3 Does  $1 + \frac{1}{2}z^{-1}$  represent a IIR system? Justify your answer.
- 4 Why is quantisation used in digital systems?
- 5 What is meant by pipelining?

(5 × 2 = 10 marks)

**Part B**

*Answer any four questions.*

- II. 1 Discuss any *three* applications of FFT.
- 2 Find the 4-point DFT of the sequence  $x(n) = \{2, 1, 4, 3\}$  by DIF FFT algorithm.
- 3 Draw the direct form II structure of:

$$y(n) = -\frac{13}{12}y(n-1) - \frac{9}{24}y(n-2) + x(n) + 4x(n-1).$$

- 4 A prototype low-pass filter has the system function as  $\frac{1}{s^2 + 3s + 2}$ . Obtain a band-pass filter with  $\Omega_0 = 3 \text{ rad/s}$  and  $Q = 12$ .
- 5 Find the filter order for the following specifications :

$$\sqrt{0.5} \leq |H(w)| \leq 1; 0 \leq w \leq \frac{\pi}{2}$$
$$|H(w)| \leq 0.2; \frac{3\pi}{4} \leq w \leq \pi$$

with  $T = 1 \text{ S}$ . Use impulse invariant method.

- 6 Discuss the features of TMS 320 series processor.

(4 × 5 = 20 marks)

Turn over

## Part C

- III. (a) Compute the circular convolution of the sequences  $\{1, 2, 0, 1\}$  and  $\{2, 2, 1, 1\}$  using DFT approach.

Or

- (b) Find  $X(k)$  of  $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$  using DIT FFT algorithm.

- IV. (a) Realise the given system in cascade and parallel forms :

$$H(z) = \frac{1 + \left(\frac{1}{3}\right)z^{-1}}{\left[1 - \left(\frac{1}{2}\right)z^{-1} + \left(\frac{1}{3}\right)z^{-2}\right] \left[1 - \left(\frac{1}{3}\right)z^{-1} + \left(\frac{1}{2}\right)z^{-2}\right]}$$

Or

- (b) Explain the effects of quantisation in the realisation of digital structures.

- V. (a) Design a Butterworth digital filter using bilinear transformation. The specifications of the desired low-pass filter are :

$$0.9 \leq |H(w)| \leq 1 ; \quad 0 \leq w \leq \pi/2$$

$$|H(w)| \leq 0.2 ; \quad \leq \frac{3\pi}{4} \leq w \leq \pi$$

when  $T = 1$  S.

Or

- (b) (i) Explain the characteristics of Chebyshev filters and Butterworth filters.

(7 marks)

- (ii) Discuss the concept of causality and its implications.

(3 marks)

- VI. (a) (i) Discuss the concept of pipelining and extended parallelism.

- (ii) Discuss the Harvard computer architecture.

Or

- (b) Discuss a design of a fast multiplier.

[4 × 10 = 40 marks]