

Reg. No. :

**D 4215**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Fourth Semester

Information Technology

IT 1252 – DIGITAL SIGNAL PROCESSING

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the sampling theorem
2. State any two properties of LTI systems.
3. Show the saving in time in performing FFT as against DFT.
4. Draw the basic butterfly of the Radix —4 DIT algorithm.
5. Use the backward difference for the derivative and the convert the analog filter to digital filter given  $H(s) = \frac{1}{S^2 + 16}$ .
6. State the relationship between the analog and digital frequencies when converting an analog filter to digital filter using bilinear transformation.
7. Compare FIR and IIR filters.
8. Draw the direct form I structure of the FIR filter.
9. What is quantization?
10. What is limit cycle oscillation?

11. (a) (i) Determine the Z-transform and compute the ROC of the following signal  $x(n) = \left(\frac{1}{3}\right)^n u(-n)$ . (10)
- (ii) State and explain the scaling and time delay properties of Z transform. (6)

Or

- (b) Using graphical representation determine and sketch the cross correlation of the following two signals (16)

$$x(n) = \{2, -1, 3, 7, 1, 2, -3\}$$



$$y(n) = \{1, -1, 2, -2, 4, 1, -2, 5\}$$



12. (a) Given  $x(n) = \{0, 1, 2, 3, 4, 5, 6, 7\}$  find  $X(k)$  using DIT FFT algorithm. (16)

Or

- (b) Given  $x(n) = 2^n$  compute  $X(k)$  using DIF FFT algorithm for  $N=8$  and  $n \geq 0$ . (16)

13. (a) Determine  $H(z)$  for a butterworth filter satisfying the following constraints

$$\sqrt{0.5} \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq \frac{\pi}{2}$$

$$|H(e^{j\omega})| \leq 0.2 \quad 3\pi/4 \leq \omega \leq \pi$$

With  $T = 1$  s. Apply impulse invariant transformation. (16)

Or

- (b) Determine  $H(z)$  for a chebyshev filter satisfying the following constraints

$$0.707 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.1 \quad 0.5\pi \leq \omega \leq \pi$$

With  $T = 1$  s. Apply bilinear transformation (16)

14. (a) Draw the structures of cascade and parallel realizations of (16)

$$H(z) = \frac{(1 - z^{-1})^3}{(1 - 0.5z^{-1})(1 - 0.125z^{-1})}$$

Or

- (b) The desired frequency response of a low pass filter is

$$H_d(e^{j\omega}) = e^{-j2\omega}, \quad -\pi/4 \leq \omega \leq \pi/4$$

$$0, \quad \pi/4 < |\omega| \leq \pi$$

Determine  $h_d(n)$ . Also determine  $h(n)$  using the rectangular window with  $M = 5$ . Determine the frequency response  $H(e^{j\omega})$  of the designed filter. (16)

15. (a) State and explain the number representation and the various quantization errors due to the resultant of number representation. (16)

Or

- (b) (i) State and explain the sample and hold circuit (8)

- (ii) Explain about any one application of DSP. (8)