

Z 6055

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Elective

Power Systems Engineering / Power Electronics and Drives /
Embedded System Technologies

CI 1602 — DIGITAL SIGNAL PROCESSING

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the expression for convolution sum in time domain and frequency domain.
2. Compare DFS with DFT.
3. Distinguish between DIT and DIF algorithm.
4. Differentiate Z-transforms with Fourier Transform.
5. Write the window function of Kaiser windowing technique.
6. Compare BLT with IIV method of transformation techniques in the design of Filters.
7. Draw the frequency response of QMF and Brick Filter.
8. Explain aliasing. Suggest a method to overcome it.
9. Compare fixed point and floating point architecture of DS processors.
10. Write the basic difference between TMS 320 C 50 and C 54 processors.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Obtain the bank flow diagram of computation of 8 point 8 DFT using DIF-FFT algorithm with necessary expression. (8)

- (ii) Compute the DFT of $x(n) = \left\{ \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0 \right\}$ using the above algorithm. (8)

Or

- (b) (i) State and prove the convolution and differentiation properties of DFT. (8)

- (ii) State the properties of ROC. Obtain the ROC for the infinite duration double sided sequence $x[n] = [\gamma]^n \cdot u(n) - (\beta)^n u(-n-1)$. (8)

12. (a) (i) Find the convolution of $x(n) = \alpha^n u(n)$ with $h(n) = \beta^n u(n)$ where $\alpha \neq \beta$. (6)

- (ii) Find the solution of $y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = \left(\frac{1}{4}\right)^n$ for $n \geq 0$ with $y(-1) = 4$ and $y(-2) = 10$. (10)

Or

- (b) (i) Test for causality, time invariance, stability, linearity and memory less for $y(n) = \sum_{k=n-2}^{n+4} x(k)$. (10)

- (ii) Find N-point DFT for $x(n) = a^n$ for $0 < a < 1$. (6)

13. (a) (i) Discuss the performance of rectangular Hanning window and Blackman window function. (6)

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

$$H_d(e^{jw}) = \begin{cases} e^{j3w}, & -\frac{3\pi}{4} \leq w \leq \frac{\pi}{4} \\ 0, & \frac{3\pi}{4} < |w| \leq \pi \end{cases}$$

Determine $H(e^{jw})$ for $m = 7$ using Hamming window.

(10)

Or

- (b) Design a digital IIR filter that satisfies the following constraint using Bilinear transformation. Assume $T = 1$ sec.

$$0.9 \leq |H(e^{j\omega})| \leq 1, \quad 0 \leq \omega \leq \pi/2$$
$$|H(e^{j\omega})| \leq 0.2, \quad 3\pi/4 \leq \omega \leq \pi$$

Note : The designed filter should have monotonic frequency response. (16)

14. (a) (i) With block diagram, explain sub-band coding of speech signals. (8)
- (ii) Describe filter bank implementation of wavelet analysis and synthesis function. (8)

Or

- (b) Consider the design of a typical decimator used in voice band modem application. The signal $x(n)$ with sample rate $F_s = 512$ kHz is decimated by a factor $D = 64$ to give signal at 8 kHz. Assume pass band of a signal is 0 to 3.4 kHz and 3.4 kHz to 4.4 kHz is transition band. Assume pass band and stop band attenuations are to be 0.2 dB and 80 dB. Show that 2 stage implementation of decimator is efficient than single stage implementation. (16)

15. (a) Discuss the functional block diagram of any one TMS DSP processor and explain. (16)

Or

- (b) (i) Explain different addressing modes of TMS DSP processor. (8)
- (ii) Write an assembly language program to convolve two sequences and to do multiplication. (8)