

C 3189

**B.E /B.TECH. DEGREE EXAMINATION, MAY/JUNE 2007.**

**Fifth Semester**

(Regulation 2004)

**Electronics and Communication Engineering**

**EC 1302 – DIGITAL SIGNAL PROCESSING**

( Common to B.E . ( Part-Time) Fourth Semester Regulation 2005 )

Time: Three hours

Maximum: 100 marks

Answer ALL Questions

**PART A – ( 10 X 2 = 20 marks)**

1. The first five DFT coefficients of a sequence  $x[n]$  are  $X(0)=20$ ,  $X(1)=5+j2$ ,  $X(2)=0$ ,  $X(3)=0.2+j0.4$ ,  $X(4)=0$ . Determine the remaining DFT coefficients.
2. What are the advantages of FFT algorithm over direct computation of DFT.
3. Show that the filter with  $h(n)=[-1, 0, 1]$  is a linear phase filter.
4. Find the digital transfer function  $H(z)$  by using impulse invariant method for the analog transfer function  $H(s) = \frac{1}{s+2}$ . Assume  $T=0.5$  sec.
5. Identify the various factors which degrade the performance of the digital filter implementation when finite word length is used.

6. What is meant by limit cycle oscillation in digital filters.
7. Define power spectral density and cross power spectral density.
8. What are the disadvantages of non-parametric methods of power spectral estimation?
9. Differentiate between Von Neumann and Harvard architectures.
10. State the merit and demerit of multiplexed memories.

**PART B- (5 X 16 = 80 marks)**

1. (a) (i) Prove the following properties of DFT when  $H[K]$  is the DFT of an  $N$ -point sequence  $h[n]$

- (1).  $H[K]$  is real and even when  $h[n]$  is real and even.
- (2).  $H[K]$  is imaginary and odd when  $h[n]$  is real and odd.

(8)

- (ii) Compute the DFT of  $x[n] = e^{-0.5n}, 0 \leq n \leq 5$ .

(8)

Or

- 11.(b) (i) From the first principles obtain the signal flow graph for computing 8-point DFT using radix-2 decimation in frequency FFT Algorithm.

(8)

- 11.(b) (ii) Using the above signal flow graph compute DFT of

$$x[n] = \cos\left(\frac{n\pi}{4}\right), 0 \leq n \leq 7$$

(8)

2. (a) A bandpass FIR filter of length 7 is required. It is to have lower and upper cut-off frequencies of 3KHz and 6KHz respectively and is intended to be used with a sampling frequency of 24 KHz. Determine the filter coefficients using Hanning Window. Consider the filter to be causal.

(16)

12. (b) Determine  $H(z)$  for a Butterworth filter satisfying the following specifications

$$0.8 \leq |H(e^{jw})| \leq 1 \quad 0 \leq w \leq \pi/4$$

$$|H(e^{jw})| \leq 0.2 \quad \pi/2 \leq w \leq \pi$$

Assume  $T=0.1$  sec Apply belivnar transformation Method.

3. (a) (i) Consider the transaction of negative fraction numbers represented in  $(\beta+1)$  –bit fixed point binary form including sign bit. Let  $(\beta-b)$  bit be truncated. Obtain the range of truncation errors for signed magnitude, 2's complement and 1's complement representations of the negative numbers. (8)

13. (a) (ii) The coefficients of a system defined by

$$H(z) = \frac{1}{(1 - 0.4z^{-1})(1 - 0.55z^{-1})}$$

are represented in a number with a sign

Bit and 3 data bits. Determine the new pole locations for (1) direct Realization and (2) cascade realization of first order system. Compare the Movements of new poles away from the original ones in both the cases (8)

- 13.(b) (i) Consider  $(b+1)$  bit (including sign bit) bipolar A/D converter. Obtain an expression and (2) cascade realization of first order system. Compare movements of the new poles away from the original ones in both the cases. (8)

- 13.(b) (ii) A causal IIR filter is defined by the difference equation  $y[n]=x[n]-0.9y[n-1]$ . The unit sample response  $h[n]$  is computed such that the computed values are rounded to one decimal place. Show that the filter exhibits dead hand effect. Determine the dead band range. (8)

14. (a) (i) Compute the autocorrelation and power spectral density for the signal  $X(t) = A \cos(2\pi f_o t + \phi)$  when  $A$  and  $f_o$  are constants.  $\phi$  is a random variable which is uniformly distributed over the interval  $(-\pi, \pi)$  (8)

- (ii) Explain briefly the periodogram method of power spectral estimation. (10)

Or

- (b) (i) Describe briefly Barlett, Welch and Blackman-Turkey methods of Power spectral estimation (10)

- (ii) Determine the frequency resolution of the Barlett, Welch and Blackman-Turkey methods of power spectral estimation for a quality Factor  $Q=20$ . Assume that overlap in Welch's method is 50% and the Length of the sample is 2000. (6)

- 15.(a) (i) Explain what is meant by instruction pipelining. Explain with an Example, how pipelining increases the through put efficiency. (8)

(ii) Explain the operation of TDM serial ports in P-DSPs. (8)

Or

15.(b) (i) With a suitable diagram describe the functions of multiplier / adder unit of TMS 320C54X. (8)

(ii) Explain the operation of CSSU of TMS 320C 54X and explain its use considering the Viterbi operator. (8)

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