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B.E DEGREE EXAMINATIONS: MAY/JUNE 2013

Fifth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

ECE111**:** Digital Signal Processing

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The number of complex multiplications required using FFT with 64- point sequence is

   a) 4096 b) 264

   c) 192. d) 214

2. The Number of stages in the computation of N-point DFT in the Butterfly structure is

   a) $2\log_2 N$ b) $\log_2 N$

   c) N d) N^2

3. What is the minimum stop band attenuation of the low pass FIR filter designed using Hamming window?

   a) - 53 dB b) - 51 dB

   c) - 35 dB d) - 58 dB

4. Coefficient symmetry is important in FIR filters because it provides

   a) a smaller transition bandwidth b) less pass band ripple

   c) less stop band ripple d) a linear phase response

5. The bilinear transformation equation between s plane and z plane is ______

   a) $s=2/T\ (1-z^{-1}/1-z^{+1})$ b) $s=1/T\ (1-z^{-1}/1-z^{+1})$

   c) $s=T/2\ (1-z^{-1}/1-z^{+1})$ d) $s=3/T\ (1-z^{-1}/1-z^{+1})$

6. The digital transfer function H(z) by using impulse invariant method for the analog transfer function H(s) = 1/ (s+2) with T=0.1 sec.

   a) $H(z)=2/(1-e^{(-0.2)}z^{-1})$ b) $H(z)=1/(1-e^{(-0.1)}z^{-1})$

   c) $H(z)=2/(1-e^{(-0.1)}z^{-1})$ d) $H(z)=1/(1-e^{(-0.2)}z^{-1})$

7. Which realization is less sensitive to the process of quantization?

   a) Direct I form b) Cascade form

   c) Direct II form d) Parallel form

8. Calculate the improvement in signal to quantization noise ratio with an increase of 2 bits to the existing bit in quantizer.

   a) 12 dB b) 21 dB

   c) 24 db d) 6 dB

9. The addressing mode that is suitable for FFT computation is ---------------

a) Indirect addressing b) Circular mode

c) Bit reversed addressing d) Memory Mapped

10. The C6X processor is based on --------- architecture.

a) Modified Harvard b) Advanced Harvard

c) VelociTI d) Davinci

PART B (10 x 2 = 20 Marks)

11. Calculate the number of addition needed in calculation of DFT and FFT with 16 point sequence.
12. Explain How IDFT can be computed using FFT algorithm**.**
13. What is Gibbs phenomenon?
14. What is the principle of designing FIR filter using frequency sampling method?
15. Why impulse invariant method is not preferred in the design of IIR filters other than low pass filter?
16. What is bilinear transformation?
17. Why rounding is preferred to truncation in realizing digital filter?
18. What is coefficient quantization error?
19. What is meant by Code Composer Studio?
20. If a sum of 256 products is to be computed using a pipelined MAC unit, and if the MAC execution time of the unit is 100nsec, what will be the total time required to complete the operation?

PART C (5 x 14 = 70 Marks)

21. a) (i) Determine the 8-point DFT of x(n)={1,2,3,4,5,6,7,8 } using DIF-FFT algorithm.

(ii) Compute the output of linear filter described by h (n)={1,2,3,2,1} and input x(n)={1,1,1,1}

(OR)

b) (i) Determine the 8-point DFT of x(n)={1,1,1,1,1,1,1,0} using DIT-FFT algorithm.

(ii) Compute the Linear & circular convolution of the sequences. a(n) ={1,1,2,2} and b(n) = {1,2,3,4}.

22. a) Design an ideal high pass filter using Hanning window with N=11

$H_d(e^{j\omega}) = \begin{cases} 1 & -0.25\pi \le \omega \le 0.25\pi \\ 0 & 0.25\pi \le |\omega| \le \pi \end{cases}$

(OR)

b) The desired response of a LPF is

$H_d(e^{j\omega}) = \begin{cases} (e^{-j3\omega}) & -0.25\pi \le \omega \le 0.25\pi \\ 0 & 0.25\pi \le |\omega| \le \pi \end{cases}$

23. a) (i) Determine the cascade and parallel realizations for the system described by the system function

$$H(z) = \left(\frac{10\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{2}{3}z^{-1}\right)\left(1+2z^{-1}\right)}{\left(1-\frac{3}{4}z^{-1}\right)\left(1-\frac{1}{8}z^{-1}\right)\left[\left(1-\left(\frac{1}{2}+j\frac{1}{2}\right)z^{-1}\right)\right]\left[\left(1-\left(\frac{1}{2}-j\frac{1}{2}\right)z^{-1}\right)\right]} \right)$$

(ii) Transform an analog filter with the transfer function $H_a(s) = \frac{0.5(s+4)}{(s+1)(s+2)}$ into a digital filter using impulse - invariant technique.

(OR)

b) (i) Design a digital filter to satisfy the following characteristics.

(i) -3dB cutoff frequency of 0.5π rad.

(ii) Magnitude down at least 15dB at 0.75 π rad.

(iii) Monotonic stop band and pass band

Using bilinear transformation

(ii) Determine parallel realization for the system described by the system function

$$H(z) = \frac{(1-z^{-1})^3}{(1-\frac{1}{2}z^{-1})(1-\frac{1}{8}z^{-1})}$$

24. a) Show dead band effect on y(n) = .95 y(n-1)+x(n) system restricted to 4 bits .Assume x(0) =0.75 and y(-1)=0

(OR)

b) A cascade Realization of the first order digital filter is shown below ,the system function of the individual section are $H1(z)=1/(1-0.9z^{-1})$ and $H2(z) =1/(1-0.8z^{-1})$ .Draw the product quantization noise model of the system and determine the overall output noise power

25. a) (i) Describe the Memory mapped addressing & Stack addressing Modes of TMS320C54X Processors.

(ii) Explain Von Neumann, Harvard and Super-Harvard architectures.

(OR)

b) Draw and explain the architecture of TMS 320C67X processor

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