KUMARAGURU college of technology
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Register Number:……..

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

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. Number of additions to be performed in the computation of 16-Point DFT using DIT-FFT is ---

   a) 32 b) 64

   c) 256 d) 512

2. Which one of the following is correct?

   a) $X((-k))_N = X(N+k)$ b) $X((-k))_N = X(N-k)$

   c) $x((-n))_N \leftrightarrow X(N+n)$ d) $R_{xy}(k) \leftrightarrow X(k)Y(k)$

3. How many delay elements and multipliers are required to realize the following function in direct form? $H(Z) = 1 - 0.5\, z^{-1} + 0.4z^{-2} + 0.66\, z^{-3} + 0.33z^{-4}$

   a) 4,5 b) 4,4

   c) 5,4 d) 5,5

4. The condition for the impulse response to be anti-symmetric is ----------

   a) h(n) = -h(N-1-n) b) h(n) = h(-n)

   c) h(n) = h(N-1-n) d) h(n) = h(N-1)

5. In Impulse Invariance method, analog frequency is given by ----------

   a) (2/T) tan(ω /2) b) ω/T

   c) T/ ω d) (T/2) tan(ω /2

6. Which of the following is true for chebyshev analog filter?

   a) In type I, the magnitude is monotonic in pass band and equi-ripple in stop band

   b) In type I, the magnitude is monotonic in pass band and equi-ripple in stop band

   c) In type II, the magnitude is monotonic in pass band and equi-ripple in stop band

   d) In type II, the magnitude is monotonic in pass band and stop band

7. For the transfer function $H(z) = 1/(1-0.45z^{-1})$ when the co-efficient is quantized to 3 bits by truncation the original and shifted poles are respectively,

a) 0.45,0.5 b) 0.45, 0.375

c) -0.45,-0.5 d) -0.45,-0.375

8. The error due to the quantization of the output of multiplier is called --------quantization error.

a) Co-efficient b) Product

c) Input d) Overflow

9. Number of data bus and address bus in 54X are------- and--------- respectively.

a) 2,3 b) 3,2

c) 3,4 d) 4,3

10. Fixed point arithmetic operations are performed by---------- units.

a) .L b) .M

c) .S d) .L, .S and .D

PART B (10 x 2 = 20 Marks)

11. Compute DFT of a sequence x(n)={-2,2,1,-1}using matrix method.
12. Sketch the basic butterfly structures for DIT and DIF-FFT algorithms.
13. Draw the cascade form of the FIR filter whose system function is

$$H(Z) = (1 + 3.5\, z^{-1} + 4.5z^{-2})\,(1 + 1.18\, z^{-1} - 2.6z^{-2})$$

14. What are the desirable characteristics of the frequency response of window function?
15. Determine the order of the analog Butterworth filter that has a -2 db pass band attenuation at a frequency of 20 rad/sec and atleast -10 db stop band attenuation at 30 rad/sec.
16. Compare Butterworth and Chebyshev filters.
17. Calculate the quantization noise introduced in a ADC with step size 0.6 .
18. Compare fixed point and floating point arithmetic.
19. What does the following keyword signify in the instruction set of 54X?

a) pmad b)dst c)smem d)1k

20. List the various functional units in C6X CPU.

PART C (5 x 14 = 70 Marks)

21. a) i) State and prove any two properties of DFT. (6)

ii) Compute 8- point DFT of x(n) = {2,1,2,1,1,2,1,2} using DIT-FFT algorithm. (8)

(OR)

b) i) Compute the circular convolution of $x_1(n)$ =[1,-2,3,0] & $x_2(n)$ = [2,0,-4,0] using DFT&IDFT. (7)

ii) Perform linear convolution of the following sequences by overlap save method. (7)
x(n) = {1,2,3,-1,-2,-3,4,5,6} and h(n) = {2,1,-1}

22. a) i) Design a symmetric FIR lowpass filter with the desired frequency response of (8)

$$H_d(e^{j\omega}) = e^{-j3\omega} \quad -\pi/2 \le \omega \le \pi/2$$
$$0 \qquad \pi/2 \le |\omega| \le \pi$$

Use Hanning window.

ii) Express the system function (6)
$H(z)=(1/2)+(1/3)z^{-1}+(1/4)z^{-2}+z^{-3}+(1/4)z^{-4}+(1/3)z^{-5}+(1/2)z^{-6}$ using direct form and linear phase form FIR filter structures.

(OR)

b) i) Compare the characteristics of various windows used for designing FIR filters. (6)

ii) Consider an FIR lattice filter with co-efficients $k_1 = 0.5$, $k_2 = 0.25$ and $k_3 = 0.15$, (8)
Determine the FIR filter co-efficients for the direct form structure.

23. a) For the constraints $0.6 \le |H(e^{j\omega})| \le 1$, $0 \le \omega \le 0.35\pi$,
$|H(e^{j\omega})| \le 0.1$, $0.7\pi \le \omega \le \pi$ with T= 0.1 sec ,
determine system function H(z) for a digital butterworth IIR lowpass filter using bilinear transformation.

(OR)

b) i) The Analog Transfer function H(s)=2/(s+1)(s+2).Determine H(Z) .Using (7)
Impulse Invariant Transformation. Assume T=1sec.

ii) Apply Bilinear Transformation to $H(s) = 2/s^2 + 3s + 2$ and find H(z).Assume (7)
a) T=0.1 sec and b) T= 1sec.

24. a) i) The system functions of the individual sections in cascade realization of the two (10)
first order digital filter are given as

$$H_1(z) = 1/(1 - 0.35z^{-1}) \text{ and } \quad H_2(z) = 1/(1 - 0.62z^{-1})$$

Draw the product quantization noise model of the system and determine the overall output noise power.

ii) Add $(0.625)_{10}$ and $(-0.375)_{10}$ using one's complement and two's complement (4)
addition.

(OR)

b) What are limit cycles and dead band? A digital system is characterized by
$y(n) = -0.875y(n-1)+x(n)$, where $x(n) = 0.75$, $n=0$
$= 0$, $n>0$
Determine the dead band of the system when x(n)=0 and initial condition y(-1)=12. Choose 4-bits for quantization.

25. a) i) Draw and explain the architecture of TMS320C54x processor. (10)

ii) Compare Von Neumann, Harvard and modified Harvard architectures. (4)

(OR)

b) What are different categories of instruction set of TMS320C54x? Explain any five categories with examples.

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