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Question Paper Code: 46401

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Sixth Semester

Electronics and Communication Engineering

14UEC601 - DIGITAL SIGNAL PROCESSING

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- How many stages of decimations are required in the case of a 64 point radix 2 DIT FFT algorithm?
(a) 8 (b) 6 (c) 4 (d) 3
- How many additions are required to compute N point DFT using radix 2 FFT?
(a) $\frac{N}{2}\log_2 N$ (b) $N \log_2 N$ (c) $\log_2 N$ (d) $N/2$
- What is the order of the normalized low pass Butterworth filter used to design an analog band pass filter with -3.0103dB upper and lower cut-off frequency of 50Hz and 20KHz and a stop band attenuation 20dB at 20Hz and 45KHz?
(a) 2 (b) 3 (c) 4 (d) 5
- If N_B and N_C are the orders of the Butterworth and Chebyshev filters respectively to meet the same frequency specifications, then which of the following relation is true?
(a) $N_C = N_B$ (b) $N_C < N_B$ (c) $N_C > N_B$ (d) Cannot be determined

5. Which region of the frequency specification has to be optimized to reduce side lobes of the FIR filter?
 - (a) Stop band
 - (b) Pass band
 - (c) Transition band
 - (d) None of these
6. Substitution of values for names whose values are constant, is done in
 - (a) Is a Recursive
 - (b) Use less memory
 - (c) Is Unstable
 - (d) Has linear phase response
7. Sign magnitude representation of $-7/8$ is
 - (a) 1.001
 - (b) 1.111
 - (c) 1.100
 - (d) 0.111
8. Which of the following is not a quantization error occurring in digital systems?
 - (a) Input quantization error
 - (b) Product quantization error
 - (c) Coefficient quantization error
 - (d) Output quantization error
9. Which of the following is the disadvantage of sampling rate conversion by converting the signal into analog signal?
 - (a) Signal distortion
 - (b) Quantization effects
 - (c) New sampling rate can be arbitrarily selected
 - (d) Both (a) and (b)
10. In subband coding, the input signal is first split into number of non-overlapping frequency by
 - (a) Low pass filter
 - (b) High pass filter
 - (c) Band pass filter
 - (d) Band stop filter

PART - B (5 x 2 = 10 Marks)

11. What is Zero padding? What is the purpose of it?
12. What is pre-warping?
13. Write the equation of Hamming and Blackman window functions.
14. Define zero input limit cycle oscillations

15. Give the steps in multistage sampling rate converter design.

PART - C (5 x 16 = 80 Marks)

16. (a) Compute the eight point DFT of the sequence {1, 1, 1, 1, 0, 0, 0, 0} using DIT and DIF algorithms. (16)

Or

(b) Perform Linear convolution of the following sequence by using overlap save and overlap add method. $X(n)=\{1,1,2,1,2,1,-1,-1\}$ and $h(n)=\{2,1\}$. (16)

17. (a) Write down steps to design digital filter using bilinear transform technique and using this, design a HPF with a pass band cutoff frequency of 1000Hz and down 10 dB at 350 Hz. The sampling frequency is 5000 Hz. (16)

Or

(b) Design a digital Butterworth filter using impulse invariance method satisfying the constraints. Assume $T = 1s$.

$$\begin{aligned} 0.8 \leq |H(w)| \leq 1; & \quad 0 \leq w \leq 0.2\pi \\ |H(w)| \leq 0.2; & \quad 0.6\pi \leq w \leq \pi \end{aligned} \quad (16)$$

18. (a) Design a filter using a Hamming window with $N=7$ with

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |\omega| \leq \pi \end{cases} \quad (16)$$

Or

(b) Design a LP FIR filter using Frequency sampling technique having cutoff freq of $\pi/2$ rad / sample. The filter should have linear phase and length of 17 (16)

19. (a) Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation $y(n)=0.95y(n-1)+x(n)$. Determine the dead band of the filter. (16)

Or

- (b) (i) What is quantization of analog signals? Derive the expression for the quantization error. (8)
- (ii) Summarize the addressing modes of Digital Signal Processor TMS320C5X. (8)
20. (a) Implement a two stage decimator for the following specifications:
Sampling rate of the input signal 10 kHz, $M=100$, Pass band= 0 to 50 Hz, Pass band ripple = 0.1 and Stop band ripple = 0.001. (16)

Or

- (b) (i) Explain the multistage implementation of sampling rate conversion with a block diagram. (8)
- (ii) A signal $x(n)$ is given by $x(n) = \{0, 1, 2, 3, 4, 5, 6, 0, 1, 2, 3, \dots\}$. Obtain the decimated signal with a factor of 2 and the interpolated signal with a factor of 2. (8)
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