Reg. No. : | | | | | | | | | | |

Question Paper Code: 46401

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

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)

1. 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

2. 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

3. 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

4. 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 occuring 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 over lap 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.

$$0.8 \leq |H(w)| \leq 1; \quad 0 \leq w \leq 0.2\pi$$
$$|H(w)| \leq 0.2; \quad 0.6\,\pi \leq w \leq \pi$$

(16)

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

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

(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…}. Obtain the decimated signal with a factor of 2 and the interpolated signal with a factor of 2. (8)

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