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

Question Paper Code: 46401

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

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 numbers of multipliers and adders are required for a 5 point DFT?
   (a) 20,25 (b) 25,20 (c) 11.6,5.8 (d) 5.8,11.6

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. In impulse invariant method , relationship between ω and Ω is given by,
   (a) $\Omega = \frac{2}{T_s}\tan(\frac{\omega}{2})$ (b) $\omega = \frac{\Omega}{T_s}$
   (c) $\Omega = \frac{1}{T_s}\tan(\frac{\omega}{2})$ (d) $\omega = \Omega T_s$

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. In subband coding, the input signal is first split into number of non-overlapping frequency by

   (a) Signal distortion
   (b) Quantization effects
   (c) New sampling rate can be arbitrarily selected
   (d) Both (a) and (b)

10. What value should the bandwidth of x(n) has to be reduced in order to avoid aliasing?

    (a) F/D (b) F/2D (c) F/4D (d) none of these

PART - B (5 x 2 = 10 Marks)

11. What are the differences and similarities between DIF and DIT algorithms?

12. Mention any two procedures for digitizing the transfer function of an analog filter.

13. Write the equation of Hamming and Blackman window functions.

14. What are the advantages of floating point pointarthimatic?

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

PART - C (5 x 16 = 80 Marks)

16. (a) Consider the finite duration sequence x (n) = {1, 2, 3, 4,-5, 6, 7, 8} Compute the eight point DFT using the in-place Radix-2 decimation in time algorithm of the sequence. (16)

Or

(b) Compute the linear convolution of finite duration sequences h(n)={1, 2} and x(n)={1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1} by overlap add method. (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 high pass filter with a minimum passband attenuation of 2.5dB at Ωp=20rad/sec and the stop band attenuation of 30 dB at Ωs=50rad/sec use bilinear transformation with the sampling time of 1 sec. (16)

18. (a) Design a FIR Linear phase, Digital filter approximating the ideal high-pass filter

with a frequency response $H_d(e^{j\omega}) = \begin{cases} 1 & for \ \frac{\pi}{4} \le |\omega| \le \pi \\ 0 & |\omega| < \frac{\pi}{4} \end{cases}$

(i) Determine the co-efficient of 11 tap filter based on the window method Hanning.
(ii) Determine and plot the magnitude and phase response of the filter. (16)

Or

(b) Using a rectangular window technique, design a low pass filter with a pass band gain of unity, cut-off frequency of 1000 *Hz* and working at a sampling frequency of 5 *KHz*. The length of the impulse response should be 7. (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) Explain in detail about two basic operations in Multirate Signal Processing. (16)