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Question Paper Code: 95B04

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2024

Fifth Semester

Biomedical Engineering

19UBM504 - PRINCIPLES OF DIGITAL SIGNAL PROCESSING

(Regulation 2019)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10x 2 = 20 Marks)

1. How many stages of decimations are required in the case of a 64 point CO1- App
2. Write the differences and similarities between DIT and DIF? CO1- U
3. What is the advantage of direct form II realization when compared to direct form I realization? CO2- U
4. Compare IIR and FIR filters CO2- U
5. Define Gibbs Phenomenon. CO3- U
6. List different methods of realization of LTI system CO3- U
7. Define finite word length effects CO5- U
8. Give the formula for variance of noise source due to rounding off CO5- U
9. Compare Von Neumann and Harvard architecture in DSP CO6- U
10. What is MFLOPS CO6- U

PART – C (5 x 16= 80 Marks)

11. (a) Evaluate radix 2 – DIT FFT algorithm and obtain DFT of the sequence $x(n) = \{1,2,3,4,4,3,2,1\}$. CO1- App (16)
Or
(b) Derive radix- 2 to DIF-FFT algorithm and Draw the butterfly diagram of each stage considering $N=8$ CO1- U (16)

12. (a) (i) Design a low pass analog butterworth filter satisfying the following specifications $\alpha_p = 0.1 \text{ dB}$ $\alpha_s = 44 \text{ dB}$ $\omega_p = 20 \text{ rad/sec}$ and $\omega_s = 30 \text{ rad/sec}$ and $\omega_{sf} = 100 \text{ rad/sec}$ CO2- App (8)

- (ii) Realize the given LTI system using Form II method $y(n) = x(n) + 2x(n-1) + y(n-1)$ CO3- App (8)

Or

- (b) (i) Given the specifications $\alpha_p = 3 \text{ dB}$ $\alpha_s = 16 \text{ dB}$ $f_1 = 1 \text{ KHz}$ and $f_2 = 2 \text{ KHz}$. Determine the order of the filter using Chebyshev approximation find $H(s)$ CO2- App (8)

- (ii) Realize the given LTI system using parallel form $H(z) = \frac{1+z^{-1}}{1+\frac{1}{8}z^{-1})(1+\frac{1}{2}z^{-1})}$ CO3- App (8)

13. (a) Design an ideal high pass filter with a frequency response $H_d(e^{j\omega}) = 1$ for $\frac{\pi}{4} \leq |\omega| \leq \pi$ CO4- Ana (16)

$$= 0 \text{ for } |\omega| \leq \frac{\pi}{4}$$

Find the values of $h(n)$ for $N = 11$ using hamming window. Find $H(z)$ and determine the magnitude response.

Or

- (b) Determine the filter coefficients $h_d(n)$ obtained by sampling $H_d(e^{j\omega}) = e^{-j(N-1)\omega/2}$ for $0 \leq |\omega| \leq \frac{\pi}{2}$ for $N=7$ CO4- Ana (16)
- $= 0$ for $\frac{\pi}{2} \leq |\omega| \leq \pi$

14. (a) (i) Discuss the different types of errors occurs due to truncation and rounding-off CO5- U (8)

- (ii) Draw the product quantization noise model of the system given below $y(n) + 0.2y(n-1) + 0.5y(n-2) = x(n) + 2x(n-1)$ CO5- App (8)

Or

- (b) (i) With example discuss different types of number representation in Binary format CO5- U (8)
- (ii) For second order IIR filter $H(z) = \frac{1}{(1-0.5z^{-1})(1-0.45z^{-1})}$, study the effect of the shift in pole location with 3 bit coefficient representation in direct form and also comment on stability CO5- App (8)
15. (a) With neat diagram explain the functional blocks of TMS320C50 DSP CO6- U (16)
- Or
- (b) Discuss in detail the history of TMS processors and their applications CO6- U (16)

