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

Question Paper Code: 55B04

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

Fifth Semester

Biomedical Engineering

15UBM504 - PRINCIPLES OF DIGITAL SIGNAL PROCESSING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. How many complex multiplications are need to be performed for each FFT algorithm? CO1- R

   (a) (N/2)logN (b) $N\log_2 N$ (c) $(N/2)\log_2 N$ (d) None of the mentioned

2. In IIR Filter design by the Bilinear Transformation, the Bilinear Transformation is a mapping from CO2- R

   (a) Z-plane to S-plane (b) S-plane to Z-plane

   (c) S-plane to J-plane (d) J-plane to Z-plane

3. Which of the following is introduced in the frequency sampling realization of the FIR filter? CO3- R

   (a) Poles are more in number on unit circle

   (b) Zeros are more in number on the unit circle

   (c) Poles and zeros at equally spaced points on the unit circle

   (d) None of the mentioned

4. How many quantization errors are present in one complex valued multiplication? CO4- R

   (a) One (b) Two (c) Three (d) Four

5. FFT length in Barlett method is CO5- R

(a) Zero (b) One (c) L=$\frac{0.9}{\Delta f}$ (d) None of the above

PART – B (5 x 3= 15Marks)

6. Compare the advantages of FFT over DFTs. CO1- Ana

7. Write the properties of Butterworth filter? CO2- R

8. Define Gibbs Phenomenon. CO3- R

9. Define dead band. CO4- R

10. List the advantages and disadvantages of Nonparametric Power Spectrum Estimation. CO5- R

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) Apply DFT and IDFT method for the given sequences h(n) = {1, 2, 3, 4} and x(n) = {1, 2, -2, 1} to find circular convolution. CO1- App (16)

12. (a) If $H_a(S) = \frac{1}{(s+1)(s+2)}$, find the corresponding H(z) using impulse invariant method for sampling frequency of 5 samples/Second. CO2- App (16)

Or

(b) Solve the following pole – zero IIR filter into a lattice ladder structure. CO2- App (16)

$$H(z) = \frac{1 + 2z^{-1} + 2z^{-2} + z^{-3}}{1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}}$$

13. (a) Design an ideal high pass filter with a frequency response CO3- Ana (16)

$H_d(e^{j\omega})$= 1 for $\frac{\pi}{4} \leq |\omega| \leq \pi$

$= 0$ 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) (i) Determine the frequency response of FIR filter defined by $y(n) = 0.45\,x(n) + x(n-1) + 0.45\,x(n-2)$. Calculate the phase and group delay. CO3- Ana (6)

(ii) Estimate the filter coefficient h(n) for N=7 obtained by sampling CO3- Ana (10)

$$H_d(e^{j\omega}) = e^{-j(N-1)\omega/2} \quad for \quad 0 \le |\omega| \le \frac{\pi}{2}$$

$$0 \quad for \quad \frac{\pi}{2} \le |\omega| \le \pi$$

14. (a) Explain in detail the errors resulting from rounding and truncation. CO4- Ana (16)

Or

(b) i) Analyze the effects of co-efficient quantization in FIR filter? CO4- Ana (7)

ii) Distinguish between fixed point and floating point arithmetic. CO4- Ana (9)

15. (a) Explain discrete wavelet transform. CO5- U (16)

Or

(b) Explain the Welch method of power spectrum estimation. CO5- U (16)