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ECE

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

Question Paper Code : 90480

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Electronics and Communication Engineering

EC 8553 — DISCRETE – TIME SIGNAL PROCESSING

(Common to : Biomedical Engineering / Computer and Communication Engineering / Electronics and Telecommunication Engineering / Medical Electronics)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the number of multiplications needed in the calculation of DFT and FFT with 8 pt sequence.
2. Compare overlap add and overlap save method.
3. What is the need for pre warping?
4. List the advantage of direct form II realisation when compared with direct form I realisation.
5. Define Gibb's Phenemenon.
6. What do you refer from limit cycle oscillations?
7. Differentiate Fixed Point and Floating Point number representations.
8. What is quantization error?
9. List the addressing modes of digital signal processer.
10. What do you understand from pipe line operation of Digital signal processer?

PART B — (5 × 13 = 65 marks)

11. (a) Summarize the following properties of DFT :

(i) Periodicity

(ii) Symmetry

(iii) Circular convolution

(iv) Linear filtering.

Or

(b) Illustrate the 8-pt DFT of a sequence $x(n) = \{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$.

12. (a) Obtain the direct form I, direct form II and cascade form realisation for the given system.

$$y(n) = 0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$$

Or

(b) An Analog filter has the transfer function $H(s) = \frac{10}{s^2 + 7s + 10}$. Design a digital filter equivalent using Impulse Invariant method for $T = 0.2$ sec.

13. (a) Design an ideal low pass filter with a frequency response

$$H_d(e^{jw}) = \begin{cases} 1 \text{ for } \frac{-\pi}{2} \le w \le \frac{\pi}{2} \\ 0 \text{ for } \frac{\pi}{2} \le |w| \le \pi \end{cases}.$$

Find the values of $h(n)$ for $N = 1$. Find $H(z)$.

Or

(b) Demonstrate the coefficients of a linear phase FIR filter of length $M = 15$ which has a symmetric unit sample response and a frequency response that satisfier the condition.

$$H_r\left(\frac{2\pi K}{15}\right) = \begin{cases} 1 & k = 0, 1, 2, 3, 4 \\ 0.4 & k = 5 \\ 0 & k = 6, 7 \end{cases}$$

14. (a) Describe the quantization process and errors introduced due to quantization.

Or

(b) For the II order IIR filter, the system fraction is $H(z) = \frac{1}{(1 - 0.5z^{-1})(1 - 0.45z^{-1})}$. Examine the effect of shift in pole location with 3 bit coefficient representation in direct and cascade forms.

15. (a) Give detailed note about Arithmetic Instructions.

Or

(b) Draw the various architecture used in digital signal processer. Explain each in brief.

PART C — (1 × 15 = 15 marks)

16. (a) For the given specifications, design an Chebyshev digital filter using Impulse Invariance Transformation.

$$0.9 \le |H(w)| \le 1 \quad \text{for } 0 \le w \le 0.25\pi$$
$$|H(w)| \le 0.24 \quad \text{for } 0.5\pi \le w \le \pi$$

Or

(b) Using linear convolution construct $y(n) = x(n) * h(n)$ for the sequence $x(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$ and $h(n) = \{1, 2\}$. Compare the result with by solving the problem with Overlap Add method and Overlap Save method.