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TOTAL NUMBER OF PAGES: 02

B.TECH

RCS4G002 / REE4G001 / REL4G001 / RIT4G002 / REC5C001

6TH SEMESTER REG/BACK EXAMINATION: 2022-23

DIGITAL SIGNAL PROCESSING

CST,CSEAI,CSE,CSEAIME,EEE,ELECTRICAL,CSIT,IT, BIOTECH

MAX MARKS: 100

TIME: 3 HOURS

Q CODE M415

ANSWER QUESTION NO.1 (PART-1) WHICH IS COMPULSORY, ANY EIGHT FROM PART-II AND ANY TWO FROM PART-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 Only Short Answer Type Questions (Answer All-10)

(02x10)

- Why we take the unit circle as a reference in Z-transform?
- Differentiate between convolution and correlation for discrete time signal.
- What is a non-recursive discrete time system?
- List the characteristics of adaptive filter.
- What is frequency wrapping, explain?
- Define the convolution property of DFT.
- Draw the block diagram of 2 point DIT-FFT and 2 point DIF-FFT.
- How many numbers of complex additions are there in a 8-point DIT-FFT computation?
- Find Z-transform of a unit step signal.
- Differentiate between linear and circular convolution.

Part- II

Q2 Answer Any Eight out of Twelve

(06x08)

- a) Let $x_1(n) = x_2(n) = \begin{cases} 1 & 0 \leq n \leq N-1 \\ 0 & \text{otherwise} \end{cases}$.

Find the circular convolution between $x_1(n)$, $x_2(n)$.

- b) If $x[n]$ is an even length sequence with an N-Point DFT $X(k)$, then determine the N-Point DFT of $y[n] = x[n] - x[n - N/2]$ in terms of $X(k)$.

- c) Show that for linear phase FIR filter $H(n) = H(N-1-n)$ and $\alpha = \frac{N-1}{2}$.

- d) Using partial fraction method, find the inverse z-Transform of the following

transfer function,
$$H(z) = \frac{8z^{-1} - 4}{8z^{-2} + 6z^{-1} + 1}$$
.

- e) Find the DIT-FFT of $x(n) = \{1, 2, -1, -2\}$ using butterfly structure.
- f) Compute N-point DFT of a sequence given by $x(n) = e^{-n}, 0 \leq n \leq 4$.
- g) List all properties of Z-transform.
- h) Explain the inverse modelling using adaptive FIR filters.
- i) For an analog system response $H(S) = \frac{b}{S+a}$ prove that $H(Z) = \frac{b}{T \left(\frac{1-Z^{-1}}{1+Z^{-1}} \right)^{+a}}$.
- j) Differentiate between impulse invariant and bilinear transform method for the design of IIR filters.
- k) Differentiate between DIT-FFT and DIF-FFT techniques with suitable examples.
- l) Draw an 8 point DIF-FFT structure for finding the IDFT of a sequence.

Part-III
(Answer Any Two out of Four)

Q3 Use the overlap add and overlap save method to find the long-division convolution between $x(n) = \{3, 1, 1, 1, 3, 1, 0, 1, 2, 1, 0, 1, 2, 1, 3, 0, 1\}$ and $h(n) = \{1, 2, 1, 2\}$ **(16)**

Q4 (a) List all the properties of DFT and show the proof of each property briefly. **(8+8)**

(b) The output of an impulse response is given by, $H(z) = \frac{6z(z^2 - 4)}{5z^3 - 4z^2 + 2z - 1}$, draw the block diagram of Direct-form-I b) Direct form-II

Q5 (a) $x(n) = 2^n$ find $X(K)$ using radix-2 DIT-FFT algorithm for $0 \leq n < 4$. **(8+8)**

(b) From $X(K)$ get back $x(n)$ using the DIF-FFT algorithm.

Q6 Write notes (any two) **(8+8)**

- a) Inverse Z-Transform
- b) Sampling and reconstruction of signal
- c) Adaptive Filtering