BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE) B.Tech.Sem - VI COMPUTER :SUMMER- 2022 SUBJECT : DIGITAL SIGNAL PROCESSING

Day : Friday
Date : 17-06-2022

S-13659-2022

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Time: 02:30 PM-05:30 PM

Max. Marks: 60

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagram WHEREVER necessary.
- 4) Assume suitable data, if necessary.
- Q.1 Determine whether the following systems are Causal, Linear and Time (10) Invariant.

$$i)$$
 $y(n) = x(n).u(n)$

ii)
$$y(n) = x(n) + n x(n-2)$$

iii)
$$y(n) = x(2n) + 6$$

OR

Obtain linear convolution of following discrete time signals using graphical (10) method.

$$x(n) = \{1, 2, 3, 4\}$$

$$h(n) = u(n) - u(n-4)$$

Q.2 Define the terms auto correlation and cross correlation.

Compute the cross correlation between (10)

$$x(n) = \{1, 1, 0, 1\} & y(n) = \{4, -3, -2, 1\}$$

OR

Differentiate between linear and circular convolution. Determine circular (10) convolution of following sequences using 4 point DFT and IDFT.

$$x_1(n) = \{1, 2, 3, 1\}$$

$$x_2(n) = \{4, 3, 2, 1\}$$

Q.3 Determine Inverse Z- Transform

i)
$$X(Z) = \frac{1}{(Z-1)(Z-3)}$$
 ROC: $1 < |Z| < 3$

ii)
$$X(Z) = \frac{5Z}{6Z^2 - Z - 1}$$
 ROC: $\frac{1}{3} < |Z| < \frac{1}{2}$

OR

State and prove following properties of Z transform.

i) Linearity ii) Scaling

Determine Z Transform and ROC of

$$x(n) = \left(\frac{1}{2}\right)^n \{u(n) - u(n-10)\}$$

(10)

(10)

Q.4 Compare direct form I with form II of IIR filter structures.

Determine direct form I and II realization for following LTI system. y(n) = x(n) - x(n-1) + 2x(n-2) - 3x(n-4) (10)

OR

Draw signal flow graph for implementing direct form II of causal LTI system (10) with

$$H(Z) = \frac{1 + \frac{1}{5}Z^{-1}}{\left(1 - \frac{1}{2}Z^{-1} + \frac{1}{3}Z^{-2}\right)\left(1 + \frac{1}{4}Z^{-1}\right)}$$

Q.5 Explain the design steps for IIR filter design using Bilinear Transformation (10) method. What is Frequency warping problem and how it can be compensated?

OR

Compare Impulse Invariance method with Bilinear Transformation method. (10) Explain Butterworth filter Approximation.

Q.6 Describe Speech Recognition, Speech Synthesis and Echo cancellation with (10) neat diagrams.

OR

Draw and explain architecture of DSP processor TMS320C 64X. (10)