Total No of Questions: [12] *SEAT NO. :*

[Total No. of Pages : *2*]

T.E. (Computer) 2008 Course
Digital Signal Processing

Time: 3 Hours *Max. Marks : 100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data if necessary***

SECTION I

Q1) **a)** State linearity and time invariant properties of a DT system and test it for $y(n) = x(n) \cos w_0 n$ [8]

b) With illustrations, explain shifting, folding and time scaling operations on discrete-time signals. [8]

OR

Q2) **a)** State and explain sampling theorem. [8]

b) Define linear convolution. Explain in brief different properties of convolution. [8]

Q3) **a)** Explain how DFT can be used for linear filtering. How N-pt. circular convolution can be used to obtain linear convolution? [12]

b) Define a Fourier Transform (FT). State any four properties of FT. [6]

OR

Q4) **a)** Find the FT and DFT of the sequence $x(n) = 0.5^n\ u(n) \quad 0 \le n \le 3$. [8]

b) Compare N point DFT with FT. What is the significance of N in DFT? Why it is necessary to have $N \ge L$ where L: length of a DT signal. [10]

Q5) **a)** Why z transform need to be specified only with ROC? What are the all possible ROCs for finite and infinite duration sequences? [8]

b) Compare DIT FFT and DIF FFT algorithm. [4]

c) Determine the z transform of following sequences: [4]

i) $x_1(n) = \partial(n-k)$

ii) $x_2(n) = \partial(n+k)$

OR

Q6) **a)** Determine the inverse z-transform of the following function [10]

$$X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$$ For following ROC,

i) ROC: $|z| > 1$

ii) ROC: $|z| < 0.5$

iii) ROC: $0.5 < |z| < 1$

b) Draw the basic butterfly structure and obtain the computational complexity of DIT FFT algorithm. [6]

SECTION – II

Q7) a) Explain the Geometric Construction method to obtain the phase and frequency response of the system. [10]

b) Define and obtain system function H(z) from N order general difference equation Express it for [6]

i) All zero system

ii) All pole system

OR

Q8) a) An LTI system is given by y(n) = y(n-1) + y(n-2) + x(n-1), [10]

i) Find the system function H(z)

ii) Draw a pole zero plot

iii) Calculate h(n) if possible.

b) Justify: All the poles of H(z) of a causal and stable system are inside the unit circle. [6]

Q9) a) Explain Gibbs phenomenon observed in FIR filter design. What are the desirable features of window functions to improve frequency response? [8]

b) State the transformation formula used in BLT method to design IIR filter. Obtain the relation showing the frequency warping effect and show it graphically. [8]

OR

Q10) a) What is the use of windowing? Define different types of window function. Why Kaiser window is commonly used for FIR filter design? [10]

b) Compare: Analog filter and Digital filter [6]

Q11) a) List the important functions of the following: [6]

i) Data Address Generators(DAGs)

ii) Program sequencer

iii) Barrel Shifter

b) A system is describe by H(z) is given by [12]

$$H(z) = 3 + \frac{4z}{z - \frac{1}{2}} - \frac{2}{z - \frac{1}{4}}$$

i) Does H(z) represent FIR or IIR filter, why?

ii) Obtain and draw direct form –I, direct form-II of IIR filter

OR

Q12) a) Explain in brief different type of internal buses present in ADSP 21xx processor. [10]

b) Realize a linear phase FIR filter structure having impulse response, [8]

$h(n) = \delta(n) + ½\,\delta(n-1) - ¼\,\delta(n-2) + ½\,\delta(n-3) + \delta(n-4)$.