UNIVERSITY OF PUNE

[4363]-254

T. E. (Computer Engineering)

Examination - 2013

DIGITAL SIGNAL PROCESSING

(2008 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 12 **[Total No. of Printed Pages :3]**

Instructions :

*(1) Answer **any three** questions from each section.*
*(2) Answers to the **two sections** should be written in **separate answer-books**.*
(3) Figures to the right indicate full marks.
(4) Neat diagrams must be drawn wherever necessary.
(5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
(6) Assume suitable data, if necessary.

SECTION I

Q1) a) Define a dscrete time system. Explain any three properties with suitable Example [10]

b) Define a Nyquist rate. What is the nyquist rate for the analog signal [06]

x(t)= 3 cos $50\pi t$ + 10sin 300 πt – cos 100 πt

OR

Q2) a) Define a periodic signal. Determine whether or not each of the following signal is periodic. In case a signal periodic, specify its fundamental period. [10]

i) x(n) = cos $(3\pi n)$

ii) x(n) = sin (3n)

iii) x(n) = cos $(n/8)$ cos $(\pi\, n/8)$

b) State and explain the sampling theorem. [06]

Q3) a) Obtain x(n) using linear transformation matrix for X(K) = {4, 1-j, -2, 1+j} [08]

b) What is DFT? Explain periodicity property of DFT [08]

OR

Q4) a) Define Discrete Fourier Transform (DFT). Why DFT is called N-point DFT? Explain the relationship between DTFT and DFT [08]

b) Obtain DTFT & sketch the magnitude spectrum for x(n) = u(n) – u(n– 4) [08]

Q5) a) Compare DIT FFT algorithm with DIF FFT algorithm. Draw basic butterfly structure for both. [08]

b) Find Z-transform of following signal [10]

i) x(n) = $a^n u(n-1)$

ii) x(n) = $a^n u(-n-1)$

OR

Q6) a) Obtain IZT using power series method for [08]

X(z) = $\frac{1}{1-az^{-1}}$ ROC:|z| < |a|

b) Explain in place computation and bit reversal in FFT [10]

SECTION II

Q7) a) With example, explain the method of simple geometric construction to obtain the phase and frequency of DT system. [10]

b) Obtain system function for y(n) + y(n−1) = x(n) − $^1/_2$ x(n−1). Also, [06]

determine and draw a pole zero plot.

OR

Q8) a) Define and obtain a system function H(z) from an N^{th} order general difference equation. Express it for- [10]

i) All zero system

ii) All pole system

b) Explain with an example how to test the causality of a system. [06]

Q9) a) The system function of the analog filter is given as H(s) = $\frac{(s+0.1)}{(s+0.1)^2+16}$ [10]

Obtain the system function of the digital filter using bilinear transformation is resonant at $w_r = {}^{\pi}/_2$

b) What are the advantages and disadvantages of FIR filters? [08]

OR

Q10) a) Compare impulse invariance method with bilinear transformation method for IIR filter. What is frequency warping associated with BLT method? How is it compensated? [10]

b) Explain Gibbs phenomenon observed in FIR filter design. State the desirable features of window functions. [08]

Q11) a) Draw architecture diagram of ADSP 21XX processor and explain in brief the function of each block. [16]

OR

Q12) a) Obtain direct form-I and direct form-II IIR filter structure for [08]

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$$

b) Realize a linear phase FIR filter structure having impulse response [08]

$$h(n) = \delta(n) + \frac{1}{2}\delta(n-1) - \frac{1}{4}\delta(n-2) + \delta(n-4) + \frac{1}{2}\delta(n-3)$$