Exam.Code:0925
Sub. Code: 33591

2125

B. E. (Information Technology)
Seventh Semester
PCIT-701: Digital Signal Processing

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

Q.1
i. Is the signal: $\mathbf{y(n)= \cos(n/8)\ \cos(n\ \pi\ /8)}$ periodic? If yes, what is its fundamental period?
ii. What is the z transform of $\mathbf{n^2u(n)}$? Draw the ROC also.
iii. What is the reduction in complex additions and multiplications if FFT algorithms are used to find N point DFT?
iv. Define Canonical Filter Structures.
v. Name four unique features of Digital Signal Processors. (2x5)

PART A

Q.2a Explain five real life applications of DSP.
b Find out whether the $\mathbf{y(n) = n^2x(-n) + 3x(n^2)}$ system is
i. Static
ii. Linear
iii. Time invariant
iv. Causal
v. Stable (5,5)

Q.3 For a discrete time LTI system output **y(n)** is $\mathbf{2(1/3)^n u(n)}$ when the input **x(n)** is **u(n).** Using Z-transformation and its inverse.
a) Find the impulse response **h(n)** of the system.
b) Find the output **y(n)** when the input **x(n)** is $\mathbf{(1/2)^n u(n).}$ (5,5)

Q.4a Explain the following properties of DFT
i. Periodicity ii. Linearity iii. Symmetry
b Compute the 8 point DFT of the sequence $\mathbf{x(n) = \{-1,0,2,0,-4,0,2,0\}}$ using the radix-2 DIT algorithm. Follow exactly the signal flow graph and show the calculation of all intermediate values. (3,7)

PART-B

Q.5a Obtain the direct form II and parallel structures for the system:
$\mathbf{y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)}$
b Explain the architecture of ADSP 21XX family of processors with block diagram. (5,5)

Q.6a What are the two main methods of IIR filter design? Also compare them.
b Design a digital IIR filter using BLT method, if the analog filter is specified by

$$H_a = \frac{s+0.1}{(s+0.1)^2+16}\ ;\ \omega_r = \pi/2.$$ (3,7)

Q.7a Derive the condition for linear phase in FIR filters. Explain where and why FIR filters are useful.
b Design the symmetric FIR low pass filter for which desired frequency response is $\mathbf{H_d(\omega) = e^{-j\omega\tau}}$ **for** $\mathbf{|\omega| \le \omega_c}$ **and 0 elsewhere.** The length of the filter should be 7 and $\omega_c = 1$ radians/sample. Make use of the Hanning Window having: $\omega(n) = \frac{1}{2}\left[1 - \cos\frac{2\pi n}{M-1}\right]$. (3,7)

x-x-x