Total No. of Questions : 6]

SEAT No. :

P5024

[Total No. of Pages : 2

T.E. / Insem. - 522

T.E. (E & Tc)

DIGITAL SIGNAL PROCESSING

(2012 Pattern) (Semester - I)

Time : 1 Hour] *[Max. Marks :30*

Instructions to the candidates:

1) ***Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***All questions carry equal marks.***
5) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) a) What are the advantages and limitations of digital signal processing. **[4]**

b) Consider the analog signal

$x_a(t) = 5 \cos(2000\pi t) + 3 \sin(6000\pi t) + 10 \cos(12000\pi t)$ **[6]**

i) What is the Nyquist rate of the signal?

ii) If $F_s = 5000$ samples / sec., what is the discrete- time signal obtained after sampling?

iii) What is the analog signal $y_a(t)$ that can be reconstructed in (ii), if ideal interpolation is used?

OR

Q2) a) Explain the frequency relationship between continuous time and discrete time signals. **[3]**

b) What is the need of antialiasing filter in a DSP system? **[3]**

c) Determine which of the following pairs of vectors are orthogonal? **[4]**

i) $a_1 = [-2\ 1\ 3\ -1\ 1]$ & $b_1 = [4\ -1\ 0\ -1\ 8]$

ii) $a_2 = [1\ 3\ -2\ 2\ 4]$ & $b_2 = [5\ 2\ -3\ -1\ 2]$

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Q3) a) State and prove any two properties of DFT. **[4]**

b) Find the 4 point DFT of the following sequence x (n) = {1 2 3 4 }. **[4]**

c) Write short note on Overlap Save Method. **[2]**

OR

Q4) a) Find X (k) Using DIT FFT algorithm for N = 4. **[4]**

x(n) = {0 1 2 3}.

b) Compute the DCT of the following sequence x (n) = {1 2 4 7}. **[4]**

c) Write short note on Overlap Add Method. **[2]**

Q5) a) State and prove any two properties of Z transform. **[4]**

b) Find the Z transform of the following sequences and state ROC. **[6]**

i) $x(n) = a^n, \quad n \geq 0$

$= 0, \quad n < 0$

ii) $x(n) = \left(\frac{1}{3}\right)^{n-1} u(n-1)$

iii) $x(n) = \{1 \underset{\uparrow}{2} \; 3 \; 4\}$

OR

Q6) a) State the relationship between Z transform and DFT. **[3]**

b) Compute Inverse Z transform of

i) $X(z) = \frac{1}{(1+z^{-1})(1-z^{-1})^2} \quad \text{for} |z| > 1$

ii) $X(z) = \frac{1}{3z^2 - 4z + 1} \quad \text{for} |z| > 1$ **[5]**

c) Plot ROC and pole - zero pattern of $X(z) = \frac{z^4 - 1}{z^4}$ **[2]**

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