Sr. No.....

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B.Tech, 8th SEMESTER

Digital Signal Processing (E-402),Scheme 2010

Time: 3 Hours **Max. Marks:60**

Instructions:
1. *It is compulsory to answer all the questions (2 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART –A

Q1 (a) What are energy and power signals? (2)

(b) Distinguish between FIR and IIR filters. (2)

(c) State sampling theorem. (2)

(d) What is region of convergence (ROC)? What is its significance? (2)

(e) Classify discrete time systems. (2)

(f) Why is multirate signal processing required? (2)

(g) Define sampling rate conversion. (2)

(h) List some applications of DSP. (2)

(i) What is the necessary and sufficient condition for the system stability? (2)

(j) Find the Nyquist rate & Nyquist interval for the signal (2)
$x(t) = 3\cos(2000\pi t) + 5\sin(6000\pi t) + 10\cos(12000\pi t)$

PART –B

Q2 (a) State and prove energy theorem and time shifting property of fourier transform. (6)

(b) Find the 4-point discrete fourier transform of the sequence $x(n) = \cos\frac{n\pi}{4}$. (4)

Q3 (a) Find the convolution of the two signals $x(n) = \{1,1,\underset{\uparrow}{0},1,1\}$ and $h(n) = \{1,-2,-3,\underset{\uparrow}{4}\}$ (5)

(b) Check the linearity, causality, time variance for the following system (5)
$y(n) = a[x(n)]^2 + bx(n)$.

PTO

Q4 (a) Find the z- transform of the following signal $x(n) = \cos n\theta\, u(n)$ (5)

(b) Using long division ,determine the inverse z-transform of (5)

$$X(z) = \frac{1}{1-\left(\frac{3}{2}\right)z^{-1}+\left(\frac{1}{2}\right)z^{-2}}$$

when (i) ROC : $|z| > 1$ and (ii) ROC : $|z| < \frac{1}{2}$

Q5 (a) Obtain the transformation formula for the bilinear transformation. Also apply bilinear transformation to $H(s) = \frac{2}{(s+1)(s+2)}$ with T=1sec and find H(z) (6)

(b) Obtain direct form II and cascade form realization for the following system (4)

$y(n) = -0.1\, y(n-1) + 0.2\, y(n-2) + 3x(n) + 3.6\, x(n-1) + 0.6\, x(n-2)$

Q6 (a) What are the desirable features of the window functions? A low pass filter is to be designed with the following desired frequency response (5)

$$H_d(e^{j\omega}) = \begin{cases} 1, & |\omega| \le \frac{2\pi}{5} \\ 0, & \text{otherwise} \end{cases}$$

Determine the filter coefficients $h_d(n)$ if the window function is defined as

$$w_R(n) = \begin{cases} 1, & -3 \le n \le 3 \\ 0, & \text{otherwise} \end{cases}$$

(b) Explain multistage decimators and interpolators with its merits and demerits. (5)

Q7 Write a short note on any two: (5+5)

i) Reconstruction of band limited signal from its samples.
ii) Effects of finite word length in digital filters.
iii) Digital filter banks

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