

B.Tech. Degree VI Semester Examination, April 2009**CS/EC/EI/EE 601 DIGITAL SIGNAL PROCESSING**
(1999 Scheme)

Time: 3 Hours

Maximum Marks: 100

I a) Test the stability, causality, time invariance and linearity of the system $y(n) = n x(n)$. (10)

b) Obtain the inverse transforms of

i)
$$Y(z) = \frac{1}{(1+z^{-1})(1-z^{-1})^2} \text{ROC } |z| > 1$$
 (10)

ii)
$$X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}} \text{ROC } |z| > 1$$

OR

II a) Determine the impulse response and step response of the system $y(n) = e^k y(n-1) - x(n)$ given that $y(n) = 0$ for $n < 0$. (10)

b) i) State and prove the delay property of Z transforms. (5)
ii) Explain the terms Convolution and Correlation. (5)

III a) State and prove the periodicity, symmetry and shift properties of DFT. (10)

b) Compute the DFT Co-efficients using decimation in Frequency algorithm $x(n) = \{1, 2, 3, 4, 1, 2, 3, 4\}$. (10)

OR

IV a) Explain the following terms
i) Circular Convolution
ii) In place computation
iii) Butterfly structure (10)

b) With necessary equations and flow graphs explain decimation in frequency FFT algorithm for an 8 point sequence. (10)

V a) Explain the frequency sampling method of designing FIR filters. (10)

b) Design an FIR filter satisfying the following specifications using Fourier Series Method.

$$H(e^{j\omega}) = 0 \quad 0 \leq |\omega| \leq \pi/3$$

$$= 1 \quad \text{otherwise} \quad (10)$$

OR

VI a) State the principle of windowing. What are the desirable characteristics of a window? (10)

b) Design an FIR low pass filter with the following specifications.

$$|H(j\Omega)| = 1; \text{ for } \Omega \leq 3 \text{ rad/sec}$$

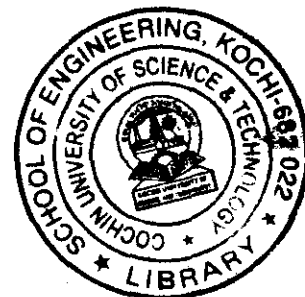
$$= 0, \text{ for } \Omega > 3 \text{ rad/sec}$$

Sampling frequency 12 rad/sec

Use Hamming window with $N = 9$

(10)

(Turn over)



- VII a) Using the first order sections obtain (i) Cascade form realization and (ii) parallel form realization, for

$$H(z) = \frac{(1+0.5z^{-1})(1+0.25z^{-1})}{(1-0.5z^{-1})(1-0.25z^{-1})(1-0.125z^{-1})} \quad (10)$$

- b) Obtain the digital filter H(z) corresponding to $H_a(s) = \frac{s^3}{(s+1)(s^2+s+1)}$ using bilinear transformation with T = 1s (10)

OR

- VIII a) Design a digital butter worth filter satisfying the constraints

$$0.707 \leq |H(e^{j\omega})| \leq 1 \text{ for } 0 \leq \omega \leq \frac{\pi}{2}$$

$$|H(e^{j\omega})| \leq 0.2 \text{ for } \frac{3\pi}{4} \leq \omega \leq \pi$$

- With T = 1 Sec and using impulse invariance, realize the filter using parallel form. (10)
b) Explain Bilinear transformation. (10)

- IX a) Explain any two applications of DSP (10)
b) Explain limit cycle oscillations? Why this problem does not exist in FIR filters. (10)

OR

- X a) Explain truncation and rounding errors in digital filters. (10)
b) Describe the architecture of a DSP Processor. (10)
