

**B.Tech. Degree VI Semester (Supplementary) Examination,
October 2009**

CS/EI/EE 601 DIGITAL SIGNAL PROCESSING

(2002 Scheme)

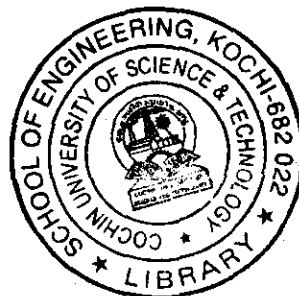
Time: 3 Hours

Maximum Marks: 100

- I a) (i) Find the convolution of the signals
$$x(n) = \begin{cases} 1 & \text{for } n=0,1 \\ 2 & \text{for } n=2,3 \\ 0 & \text{elsewhere} \end{cases}$$
$$h(n) = \delta(n) - \delta(n-1) + \delta(n-2) - \delta(n-3) \quad (5)$$
- (ii) Determine the response of the initially relaxed system characterized by the impulse response $h(n) = (1/2)^n u(n)$ to the input signal $x(n) = 2^n u(n)$. (5)
- b) Check the linearity, time invariance, causality and stability of the following systems
- i) $y(n) = nx(n)$
- ii) $y(n) = \cos \omega_0 n$ (10)
- OR**
- II a) (i) Write short notes on system function. (5)
- (ii) State and explain the time reversal and differentiation property of z -transform. (5)
- b) Find the inverse z -transform of $X(z) = \frac{z(z^2 - 4z + 5)}{(z-3)(z-1)(z-2)}$ for ROC
- (i) $2 < |z| < 3$ (ii) $|z| > 3$ (iii) $|z| < 1$ (10)
- III a) (i) Perform the circular convolution of the following sequences
 $x(n) = \{1, -1, 2, -2\}$ $h(n) = \{1, 2, 3, 4\}$ (5)
- (ii) Explain the relationship of DFT to Z -transform. (5)
- b) Find the linear convolution of the sequences
 $x(n) = \{1, -1, 2, -2, 3, -3, 4, -4, 5, -5, 6, -6\}$ and $h(n) = \{1, 1\}$
using overlap add method. (10)
- OR**
- IV a) Explain DIF FFT algorithm. (10)
- b) Determine the DFT values of the sequence $x(n) = \{2, 2, 2, 2, 1, 1, 1, 1\}$ using radix 2 DIT FFT algorithm. (10)
- V a) (i) Explain Gibbs oscillations. (5)
- (ii) Write short notes on windowing. (5)
- b) Explain frequency sampling method of FIR filter design. (10)

OR

(Turn over)



- VI a) Design an ideal low pass filter with a frequency response
- $$Hd(e^{j\omega}) = 1 \text{ for } -\pi/3 \leq \omega \leq \pi/3$$
- $$= 0 \text{ elsewhere}$$
- Use Fourier series method for the design choosing $N = 11$. (10)
- b) Obtain the direct form, cascade form and lattice structure realization of the FIR systems given by $H(z) = 1 + 2z^{-1} + 3z^{-2} + 4z^{-3} + 3z^{-4} + 2z^{-5} + z^{-6}$. (10)
- VII a) (i) Write short notes on prewarping. (5)
(ii) Compare FIR and IIR filters. (5)
- b) Obtain the direct form I, direct form II, cascade and parallel form realization for the following system. (10)
- $$y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2).$$
- OR**
- VIII a) Using the bilinear transform, design a high pass filter, monotonic in pass band with cut off frequency of 1000 Hz and down 10dB at 350 Hz. The sampling frequency is 5000 Hz. (10)
- b) Design a chebyshev low pass filter with the following specifications. (10)
- $$\alpha_p = 1 \text{ dB ripple in the pass band } 0 \leq \omega \leq 0.2\pi \quad \alpha_s = 15 \text{ dB in the stop band}$$
- $$0.3\pi \leq \omega \leq \pi \text{ using Impulse invariance.}$$
- IX a) Draw and explain the architecture of typical DSP Processor. (10)
- b) Explain any two applications of DSP. (10)
- OR**
- X a) (i) Write short notes on product quantization error. (5)
(ii) Write short notes on signal sealing. (5)
- b) With an example explain limit cycle oscillations. (10)
