B.Tech. Degree VI Semester Examination, April 2008

CS/EC/EI/EE 601 DIGITAL SIGNAL PROCESSING

(1999 Scheme)

Time: 3 Hours Maximum Marks: 100

I a) Check whether the following systems are causal, time invariant, linear and stable.

i) $y(n) = ne^{x(n)}$

ii) $y(n) = \sum_{K=-\alpha}^{n} x(k)$ (10)

b) Find the linear convolution of $x_1(n) = \{\underset{\uparrow}{1}, 2, 1, 2\}$ and $x_2(n) = \{2, 1, 2\}$ (4)

c) Prove that an LTI system is stable if its impulse response h(n) is absolutely summable. (6)

OR

II a) Find the input $x(n)$ of the system if the impulse response $h(n)$ and the output $y(n)$ as given below:

$$h(n) = \{\underset{\uparrow}{1}, 2, 3, 2\}$$

$$y(n) = \{\underset{\uparrow}{1}, 3, 7, 10, 10, 7, 2\}$$ (10)

b) Find the inverse Z transform of $X(z) = \dfrac{1+3z^{-1}}{1+3z^{-1}+2z^{-2}}$; $|z| > 2$. (10)

III Determine the response of an LTI system by radix – 2 DITFFT whose input is $x(n) = \{1, 1, 1\}$ and impulse response is $h(n) = \{-1, -1\}$. (20)

OR

IV a) Find the circular convolution of the sequences $x_1(n) = \{\underset{\uparrow}{2}, 1, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 4\}$ using DFT and IDFT method. (12)

b) State and prove the time shifting properly of DFT. (8)

V a) Design a low pass filter using rectangular window by taking 9 samples of $w(n)$ and with a cut off frequency of 12 rad/sec. (15)

b) What are the design steps for linear phase FIR filter design? (5)

OR

VI a) An FIR filter is given by the different equation $y(n)2xn + \frac{4}{5}x(n-1) + \frac{3}{2}x(n-2) + \frac{2}{3}x(n-3)$. Determine the lattice form. (10)

b) Design an ideal band pass filter with a frequency response $H_d(e^{j\omega}) = 1$ for $\pi/4 \le |\omega| \le 3\pi/4 = 0$.

Otherwise Find the values of $h(n)$ for $N = 11$. (10)

(Turn Over)

II a) Obtain the direct Form I and direct Form II realization of discrete time system represented by the transfer function::

$$H(z) = \frac{8z^3 - 4x^2 + 11z - 2}{(x - 1/4)(z^2 - z + 1/2)}$$ (10)

b) What are the advantages and disadvantages of bilinear transformation? (5)

c) Compare IIR and FIR filters. (5)

OR

III Design a Butterworth IIR digital filter using bilinear transformation for the specifications :

$$1/\sqrt{2} \le |H(\omega)| \le 1.0 \quad ; \quad 0 \le \omega \le 0.2\pi$$

$$|H(\omega)| \le 0.08 \quad ; \quad 0.4\pi \le \omega \le \pi$$ (20)

X a) Draw and explain the block diagram of a typical DSP processor. (12)

b) Discuss any two applications of DSP. (8)

OR

a) Explain the effects due to truncation rounding and quantisation in IIR Systems. (12)

b) What is meant by limit cycle? How it can be eliminated? (8)

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