2002 SCHEME

USN | | | | | | | | | |

EE55

Fifth Semester B.E. Degree Examination, December 2010
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. State and prove the following properties of DFT:
i) Frequency shift ii) Convolution in time domain iii) Linearity. **(12 Marks)**

b. Evaluate the circular convolution of the two sequences
$x_1(n) = \{ 1, 2, 3, 1 \}$
$x_2(n) = \{ 4, 3, 2, 2 \}$ **(08 Marks)**

2 a. Compute 6-point DFT of $x(n) = \cos\frac{2\pi}{6}.n$ **(10 Marks)**

b. Let x(n) be N-point real sequence with N-point DFT, X(k) (N even). In addition, x(n) satisfies the following symmetry property:

$$x(n+\frac{N}{2}) = -x(n), \quad n = 0, 1, 2 \ldots\ldots\ldots \frac{N}{2}-1$$

Show that X(k) = 0 for k even. **(10 Marks)**

3 a. Compute 8-point DFT using DIT-FFT algorithm

$$x(n) = \cos\frac{\pi}{2}.n$$

b. Draw the computational flow diagram and indicate all intermediate values. **(12 Marks)**

c. Explain the DSP processor TMS320 architecture. **(08 Marks)**

4 a. Consider 8-point DIT-FFT flow diagram (graph):
i) What is the gain of the signal path that goes from x(7) to X(2).
ii) Write an expression for X(3) using the operation indicated by signal flow graph. **(10 Marks)**

b. Explain the decimation-in-frequency algorithm for 8-point FFT computation. **(10 Marks)**

5 a. Transform the single pole lowpass Butterworth filter with system function $H(s) = \frac{\Omega p}{s+\Omega p}$ into a highpass filter of cutoff frequency Ωc and a bandpass filter with band edge frequencies Ωc_1 and Ωc_2. **(08 Marks)**

b. Derive an expression for frequency response (magnitude and phase response) of symmetric FIR filter for odd and even length. **(12 Marks)**

6 a. Design a digital symmetric lowpass linear phase FIR filter having desired frequency response

$H_d(w) = e^{-j2w}$ $\quad o \le |w| \le \pi/2$
$= 0$ $\quad$ Otherwise **(14 Marks)**

b. Employ hamming window of length 5. **(06 Marks)**

Compare FIR and IIR filters.

7 Design a digital lowpass filter to meet the following specifications:

Passband ripple : ≤ 1 dB
Passband edge : 4 kHz
Stopband attenuation: ≥ 20 dB
Stopband edge : 6 kHz
Sampling rate : 24 kHz

The filter is to be designed using bilinear transformation on analog Butterworth system functions. **(20 Marks)**

8 a. Obtain Direct-form-I, Direct-form-II, cascade and parallel structures for the system function

$$H(z) = \frac{2(1-z^{-1})(1+\sqrt{2}z^{-1}+z^{-2})}{(1+0.5z^{-1})(1-0.9z^{-1}+0.81z^{-2})}$$ **(15 Marks)**

b. Realize the system function $H(z) = 1+\frac{3}{2}z^{-1}+\frac{4}{5}z^{-2}+\frac{5}{9}z^{-3}+\frac{1}{9}z^{-4}$ using direct form II. **(05 Marks)**

* * * * *