B.E. Sem. VII (Rev.) EXTC – Nov. 06

Discrete Time Signal Processing.

Nov. I Pr. 153

Con. 5115-06. **(REVISED COURSE)** **YM-5929**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions out of remaining **six**.
(3) Assume suitable data if **necessary**.

1. (a) Frequency Response of FIR filter is–
$H(e^{jw}) = e^{-j3w}(2 + 1{\cdot}8\cos 3w + 1{\cdot}2\cos 2w + 0{\cdot}5\cos w)$
Find–
(i) Impulse Response. **4**
(ii) Identify filter type based on passband. **2**
(b) $x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n) = \{5, 6, 7, 8\}$ **6**
Find $x_1(k)$ and $x_2(k)$ of above sequence by computing DFT only once.
(c) Find number of Real additions and Real multiplications required to find DFT for 32-point signal. Compare them with number of computations required if FFT algorithm is used. **4**
(d) One of the zeros of antisymmetric FIR filter is at $0{\cdot}5\angle 60$. Show locations of other zeros. What is minimum order of this filter ? **4**

2. (a) An FIR Filter is described by difference equation– **10**
$y(n) = x(n) + x(n-10)$
(i) Compute and sketch its magnitude and phase response.
(ii) Determine response to the input–
$$x(n) = 10 + 5\cos\left(\frac{2\pi}{5}n + \frac{\pi}{2}\right) \quad -\infty < n < \infty$$
(b) The desired frequency response of LPF is – **10**
$$H_d(e^{jw}) = e^{-3jw} \quad \text{for} \quad \frac{-3\pi}{4} \le w \le \frac{3\pi}{4}$$
$$= 0 \quad \frac{3\pi}{4} < |w| < \pi$$
Determine $H(e^{jw})$ for M = 7 using Hamming Window.

3. (a) $x(n) = \{1, 2, 3, 1\}$. Find DFT x(k) using x(k) obtained above and not otherwise, find DFT of following sequences **3**
(i) $x_1(n) = \{1, 0, 2, 0, 3, 0, 1, 0\}$ **3**
(ii) $x_2(n) = \{1, 2, 3, 1\ 1, 2, 3, 1\}$ **4**
(b) Develop DIT FFT algorithm for decomposing DFT for N = 6 and draw the flow graph. **10**

4. (a) DT system has transfer function.
$$H(z) = \frac{1}{1 - 0{\cdot}8z^{-1} + 0{\cdot}12z^{-2}}.$$
A four bit processor is used in which MSB represent sign bit and remaining 3 bits store quantized coefficients.
(i) What is the effect of quantization on pole location if direct form II is used for realization. **4**
(ii) If Cascade form is used for realization, then what is the change in pole values, after quantization. **4**
(iii) In which case (direct/Cascade form) shift from actual pole locations due to quantization is less. **2**
(b) Find output of the system using circular convolution if input x(n) and impulse response h(n) are given by. Use DFT/IDFT method– **10**
$x(n) = n + 1 \quad ; \quad 0 \le n \le 3$
$= 0 \quad ; \quad$ elsewhere
$h(n) = 2\,\delta(n) + 3\,\delta(n-1) + \delta(n-2)$

5. (a) A digital Low pass filter is required to meet following specifications. **10**

Passband Ripple	:	≤ 1 dB
Passband Edge	:	4 KHz
Stop band Attenuation	:	≥ 40 dB
Stop band Edge	:	6 KHz
Sample Rate	:	24 KHz

(i) Determine order of Butterworth filter which meets above specifications.
(ii) Determine cut of frequency of filter.
(b) Using Trapezoidal rule of integration, **10**
show that – $s = \frac{2}{T}\,\frac{1 - z^{-1}}{1 + z^{-1}}$ and $\Omega = \frac{2}{T}\tan\frac{w}{2}$

E... frequency warping effe...

6. (a) Consider a causal, LTI system–

$$H(z) = \frac{1 - \frac{1}{2} z^{-1}}{\left(1 - z^{-1} + \frac{3}{16} z^{-1}\right)\left(1 + \frac{1}{4} z^{-1}\right)}$$

Realize the system in each of the following forms. 4

(i) Direct form I 4

(ii) Direct form II 4

(iii) Cascade form 4

(iv) Parallel form 4

(b) Explain energy compaction capability of Discrete Cosine Transform. 8

7. (a) Explain any one method of Linear filtering if input data sequence is long. 8

(b) Explain Architecture of TMS 32 C 5X series of processors with the help of block diagram. 4

(c) Compare DSP processors with general purpose processor.