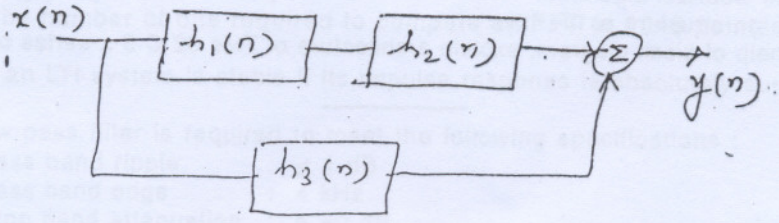
B.E Sem-VII (Rev) DT SP (2x7-) Nov/Dec 200

Con. 5278-05. (REVISED COURSE) PR-7712.
(3 Hours) [Total Marks : 100

N.B. (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.

1. (a) State whether each of the following statement is **true** or **false**, justify your answer in 2 to 3 sentences.
   (i) A stable filter is always causal. 2
   (ii) If a linear phase filter having Anti symmetric even number of coefficients, then the filter acts like a band pass filter only. 4
   (iii) IFT filters have recursive realization always. 2
   (iv) $H_1(z)$ and $H_2(z)$ both have zeros at (+ 0·5) and (-- 0·2). However $H_1(z)$ has both the poles at origin; whereas $H_2(z)$ has only one pole and it is situated at origin. Both the systems are causal FIR systems. 4

   (b) (i) A system has an overall impulse response as h(n) = { 7, -- 1, 3, 1, 7, 0, 6 } and is configured as shown below : 4



   $h_1(n) = 3u(n) - 2u(n-1) - u(n-2)$
   $h_2(n) = 2\,\delta(n) + \delta(n-2)$
   find $h_3(n)$.

   (ii) $x_1(n)$ = { 1, 2, 3, 4 } and $x_2(n)$ ={ 5, 6, 7, 8 } find $x_1(k)$ and $x_2(k)$ of the above sequences by performing DFT computation only once. 4

2. (a) Obtain a digital filter transfer function by applying impulse invariant transformation on the analog transfer function given 10

$$H_a(s) = \frac{s}{s^2 + 3s + 2}$$

using f_s = 1k samples/sec.

   (b) A low pass filter has the response 10

$$H(e^{jw}) = 2e^{-jw\alpha} \qquad |w| < \pi/2$$
$$= 0 \qquad \pi/2 < |w| < \pi$$

Find h(n) for transition width < π/32, calculate the window length and the value of α for
(i) Rectangular window (ii) Hamming window.

3. (a) An eight point sequence x(n) is given by $x_1(n)$ = { 1, 2, 3, 4, 5, 6, 7, 8 }
   (i) Find the DFT of $x_1(n)$ i.e. $x_1(k)$ using any one of the FFT technique. 6
   (ii) Let $x_2(n)$ = { 5, 6, 7, 8, 1, 2, 3, 4 }. Using appropriate DFT property and the answer of previous part, determine $x_2(k)$. 6
   (iii) Again use proper DFT property and find $x_3(k)$ where $x_3(n) = x_1(n) + x_2(n)$. 2

   (b) What is the difference between periodic convolution and circular convolution ? Explain how linear convolution can be implemented using circular convolution. 6

4. (a) For a linear shift invariant system— 10

$$h(n) = \delta(n-1) + \delta(n-2) + \delta(n-3)$$

find the frequency response $H(e^{jw})$. Plot the magnitude and phase response.

   (b) Determine the order and the poles of a low pass Butterworth filter that has a – 3 dB bandwidth of 500 Hz and an attenuation of 40 dB at 1000 Hz. Also draw the rough sketch of frequency response characteristics of the Butterworth filter. 10

5. (a) Find the inverse of— 10

$$X(z) = \frac{z}{(z-1)^2(z-2)}$$

   (b) Sketch the pole-zero plot of— 10

$$x(z) = z^2 + 2{\cdot}5z - 2{\cdot}5z^{-1} - z^{-2}$$

If x(n) is a linear phase sequence ? If yes plot the phase response for around 10 (ten) different values of w.

6. (a) Consider a causal linear time invariant system whose system function is—

$$H(z) = \frac{1 + \frac{1}{5} z^{-1}}{\left(1 - \frac{1}{2} z^{-1} + \frac{1}{3} z^{-2}\right)\left(1 + \frac{1}{4} z^{-1}\right)}$$

Draw the signal flow graph for implementation of the system in each of the following forms :

(i) Direct form I 4

(ii) Direct form II 4

(iii) Cascade form 4

(iv) Parallel form. 4

(b) Explain with example minimum, maximum and mixed phase system. 4

7. (a) Explain the Goertzel algorithm. 6

(b) Write note on structure of IIR filter. 6

(c) With the help of block diagram, explain architecture of TMs 32 C 5 x series of processors. 8