Con. 5861–10.   (REVISED COURSE)

(3 Hours)   [Total Marks : 100

N.B. : (1) Question **No. 1** is **compulsory**.

      (2) Attempt any **four** questions out of the remaining **six** questions.

      (3) Draw **suitable** diagrams and graphs wherever **necessary**.

      (4) **Figures** to the **right** indicate **full** marks.

1. (a) Explain the difference between Butterworth, Chebyshev and Elliptical filters. **10** Mention their merits and demerits. Derive expression for the order of Butterworth filter.

    (b) What is Frequency Warping ? When do we use Bilinear transformation **10** technique ? What is an antialiasing filter ? Why it is used ?

2. (a) Explain the working principle of a switched capacitor filter. What are the **10** necessary conditions for the implementation of a switched capacitor filter. What type of switches are used and what are its advantages ? Explain its implementation in a typical op-amp based integrator.

    (b) Using bilinear transformation design a Digital Bandpass Chebyshev **10** filter with the following specification α_p = 2 dB in the passband, (950 Hz) $\leq$ f $\leq$ (1150 Hz) α_s = 20 dB in the stopband, $0 \leq$ f $\leq$ (550 Hz) and (2150 Hz) $\leq$ f $\leq$ ∞ sampling frequency f = 8 KHz.

3. (a) Write difference between IIR and FIR filter. Explain frequency sampling **10** method using suitable example.

    (b) Convert the following pole-zero IIR filter into a lattice-ladder structure :– **10**

      $y(n) = -0.9 \, y(n-1) + 0.8 \, y(n-2) - 0.5 \, y(n-3)$

         $+ \, x(n) + 2x(n-1) + 3x(n-2) + 2x(n-3)$

4. (a) Explain a Linear phase FIR filter for the case of constant phase delay and **10** group delay, using suitable equations. Draw Impulse response sequences of symmetric sequences for (i) N odd and (ii) N even.

    (b) A low pass digital filter has following specifications :–   **10**

      $0.8 \leq |H(e^{jw})| \leq 1$ for $0 \leq w \leq 0.2 \, \pi$

      $|H(e^{jw})| \leq 0.2$ for $0.6 \, \pi \leq w \leq \pi$

    Determine the order of Chebyshev and Butterworth filter to meet the following specification.

5. (a) What is an adaptive filter ? What are its advantages ? Which type of problem **10** can be solved using adaptive filter.

    (b) Convert a second order Butterworth filter (Low Pass) to Digital filter using **10** impulse invariant techniques.

4. (a) Explain a Linear phase FIR filter for the case of constant phase delay and group delay, using suitable equations. Draw Impulse response sequences of symmetric sequences for (i) N odd and (ii) N even.   **10**

   (b) A low pass digital filter has following specifications :—   **10**

   $$0.8 \leq |H(e^{jw})| \leq 1 \qquad \text{for } 0 \leq w \leq 0.2\,\pi$$
   $$|H(e^{jw})| \leq 0.2 \quad \text{for } 0.6\,\pi \leq w \leq \pi$$

   Determine the order of Chebyshev and Butterworth filter to meet the following specification.

5. (a) What is an adaptive filter ? What are its advantages ? Which type of problem can be solved using adaptive filter.   **10**

   (b) Convert a second order Butterworth filter (Low Pass) to Digital filter using impulse invariant techniques.   **10**

6. (a) Design a Butterworth bandstop filter with 2 dB passband edges of 30 Hz and 100 Hz and 40 dB stopband edges of 50 Hz and 70 Hz.   **10**

   (b) Explain Basic Weiner filter.   **10**

   OR

   Explain the method of matched Z–transform.

7. (a) Explain Decimation and Interpolation. When it is required ? Take suitable examples.   **10**

   (b) Explain subband coding (**Or**) Quadrature mirror filtering.   **10**

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