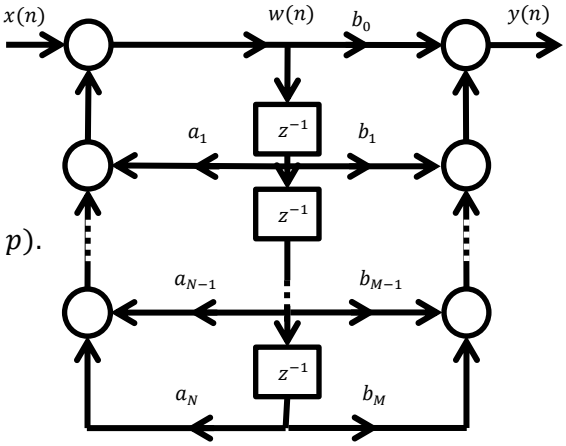
Experiment No: 7 Filter Structure Realizations

1. Write a user defined function to implement Direct Form II realization of an IIR system. *function y=DirectIIR(B,A,x)*. The Pseudo Code is given below.

```
For all input samples n
    Sum1 = Sum2 = 0
    For p→N to 1
        If n − p ≥ 1
            Sum1 = Sum1 + a(p) × w(n − p).
            If p ≤ M
                Sum2 = Sum2 + b(p) × w(n − p).
            End
        End
        w(n) = Sum1 + x(n).
        y(n) = Sum2 + b0 × w(n).
    End
End
```



PS: Here $a = -1 * A(2{:}end), b0 = B(1), b = B(2{:}end), N = length(a), M = length(b)$.

2. Generate a digital band-pass elliptical filter with the following code.

   *[B,A]=ellip(N,-20*log10(.99),20,[.3 .4]);* with *N=5*.

3. Use the Direct Form II function to calculate the step response of the filter and compare it with the responses obtained from the inbuilt command *step*().

4. Use *tf2sos*() function from Octave which converts a system into a cascade of second order system and use this to perform a cascade implementation of the elliptical filter from Exp. No. 8.

   *[B,A]=ellip(N,-20*log10(.99),20,[.3 .4]);* with *N=5*.

5. Use the Direct Form II function to calculate the step response of the filter using a cascade of equations and compare it with the responses obtained from Exp. No. 8. (use the same code)

6. You may also compare the processing time in both cases using the “tic” and “toc” functions of octave. Comment on the same.