01201

B.TECH. IN ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

December, 2013

BIELE-014 : MULTIRATE SYSTEMS

Time : 3 hours   *Maximum Marks : 70*

Note :   *Answer **any seven** questions.   Each question carries **equal** marks.*

1. (a)   What is the need for multirate signal   **5**
           processing ? Also give some example of
           multirate digital systems.
    (b)   What are the characteristics of comb filter ?   **5**

2.   Obtain the two fold expanded signal $y(n)$ of the   **10**
     input signal $x(n)$. $x(n) = \begin{cases} n, & n > 0 \\ 0 & \text{otherwise} \end{cases}$
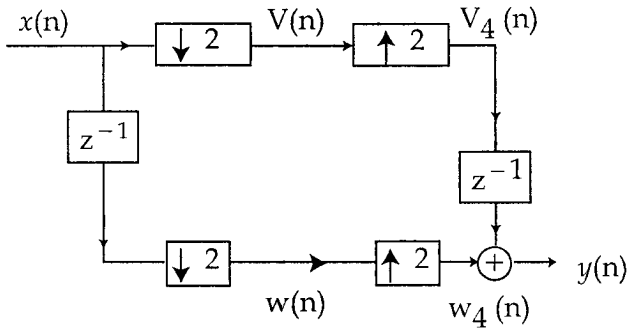
3. (a)   Obtain the expression for the output $y(n)$ in   **5**
           terms of $x(n)$ for the multirate system given
           as follows :

$x(n) \longrightarrow \boxed{\uparrow 5} \longrightarrow \boxed{\downarrow 20} \longrightarrow \boxed{\uparrow 4} \longrightarrow y(n)$

    (b)   What are the errors in QMF filter banks ?   **5**

4.   Explain two channel Quadrature mirror filter   **10**
     bank with detailed analysis and also find aliasing
     component (AC) matrix.

5. Consider a Multrirate system shown in given figure, find $y(n)$ as a function of $x(n)$. **10**

6. Explain the design of Inter-polator and decimator with suitable example. **10**

7. Implement a two stage decimator for the following specifications. Sampling rate of i/p signal $= 20,000$ Hz
    $M = 100$.
    Passband $= 0$ to 40 Hz
    Transition band $= 40$ to 50 Hz
    Passband ripple $= 0.01$
    Stop band ripple $= 0.002$ **10**

8. A digital system is characterised by the difference equation $y(n) = 0.9 \, y(n-1) + x(n)$ with $x(n) = 0$ and initial condition $y(-1) = 12$. Determine the deadband of the system. **10**

9. Write short note on **any two** of the following :
    (a) Sub band coding gain **5+5=10**
    (b) Necessary and perfect conditions for perfect reconstruction
    (c) Power symmetry in QMF bank