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Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, February 2015
(2013 Scheme)
Electronics and Communication
Stream : Signal Processing
TSC 1004 : MULTIRATE SYSTEM AND WAVELETS

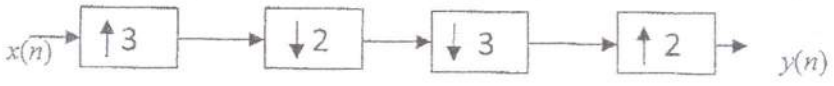
Time : 3 Hours Max. Marks : 60

***Instruction**: Answer **any two** questions from **each** Module.*

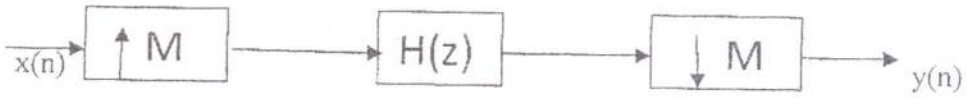
Module – I

1. a) Derive the relation between input and output spectra for an M-fold decimator. Illustrate with an example. 5

   b) For the system shown in the Fig. below, find simplified expression for y(n) in terms of x(n). 5



2. a) Derive output Y(z) of the system shown below in terms of the polyphase components of H(z). 5



   b) Develop a two band polyphase decomposition of the following transfer function

$$\frac{2+3.1z^{-1}+1.5z^{-2}}{1+0.9z^{-1}+0.8z^{-2}}.$$ 5

3. What is the necessary and sufficient condition for perfect reconstruction ? Show that M-channel uniform DFT filter bank is a perfect reconstruction system. Also find the synthesis filters in the DFT filter bank. 10

P.T.O.

Module – II

4. Given $\Psi(t) = \begin{cases} 1, & 0 \le t < \frac{1}{2} \\ -1, & \frac{1}{2} \le t < 1 \\ 0 & \text{otherwise} \end{cases}$ and $\psi_{m,n}(t) = 2^{-m/2}\psi(2^{-m}t - n), m, n \in Z$. **10**

Prove that the set of functions $\{\psi_{m,n}(t)\}_{m,n\in Z}$ forms an orthogonal basis for $L_2(R)$.

5. Describe the necessary conditions to be considered for deriving orthogonal wavelet system coefficients. **10**

6. Describe digital filter implementation of Haar wavelet decomposition. **10**

Module – III

7. Give the advantages of biorthogonal wavelet system over orthogonal system. Also explain signal representation using biorthogonal wavelet system. **10**

8. Derive Daubechies wavelet system with three vanishing moment (a 6-tap wavelet system) using frequency domain approach. **10**

9. Explain in details the application of wavelets in denoising. **10**
