No. of Printed Pages : 3

BIELE-014

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

00638

Term-End Examination

June, 2014

BIELE-014 : MULTIRATE SYSTEMS

Time : 3 hours *Maximum Marks : 70*

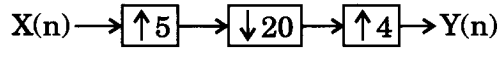
Note : *Answer any* ***seven*** *questions. All questions carry equal marks. Missing data may be suitably assumed. Use of calculator is permitted.*

1. (a) Explain the need for multirate digital signal processing. Discuss its significance in different media. *5*

(b) Discuss sampling of a continuous time signal and explain periodic sampling of the signal. *5*

2. (a) Explain sampling rate compression technique. *5*

(b) Obtain the expression for the output Y(n) in terms of X(n) for the multirate system given as follows. *5*



3. Discuss the construction of a two-channel Quadrature Mirror Filter (QMF) and explain the necessary condition for perfect reconstruction. *10*

4. (a) Explain type-1 polyphase decomposition in the realization of Finite Impulse Response (FIR) filters. *5*

   (b) Draw the block diagram of a multistage decimator and interpolator. *5*

5. Design a single-stage and two-stage interpolator to meet the following specifications : *10*

   $I = 20$

   Input sampling rate : 10,000 Hz

   Pass band : $0 \leq f \leq 90$ Hz

   Transition band = $90 \leq f \leq 100$ Hz

   Ripple : $\delta_1 = 10^{-2}$, $\delta_2 = 10^{-3}$

6. Consider the signal $X(n) = 9^n u(n)$, $|a| < 1$.

   (a) Determine the spectrum X(w).

   (b) The signal X(n) is applied to a decimator that reduces the rate by a factor of 2. Determine the output spectrum. *10*

7. (a) What are the errors in Quadrature Mirror Filter (QMF) bank ? *5*

   (b) Explain how alias-free QMF realisation is achieved. *5*

8. Discuss the following : *10*

(a) Linear phase FIR QMF bank

(b) IIR QMF bank

9. Design a decimator and a down sampler with an input signal x(n) having a cut-off frequency $\omega_c = \pi/2$, by a factor D = 2. Use Remez Algorithm to determine the coefficient of the FIR filter which has 0·1 dB ripple in the pass band and is down by at least 30 dB in the stop band. *10*
