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BIELE-014

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

00514

Term-End Examination

December, 2014

BIELE-014 : MULTIRATE SYSTEMS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **seven** questions. Use of calculator is permitted. Each question carries equal marks. Missing data, if any, may be suitable assumed.*

1. (a) What is an up-sampler and a down-sampler in multirate signal processing ? *5*

(b) Discuss Nyquist criterion used in sampling theorem. *5*

2. (a) Discuss aliasing effect caused by down-sampling. *5*

(b) Discuss interpolation technique used for up-sampling. *5*

3. (a) Obtain the two-fold expanded signal y(n) of the input signal x(n), given as

$$x(n) = \begin{cases} n, & n > 0 \\ 0, & \text{otherwise} \end{cases}$$ *5*

(b) Explain the polyphase form of the Quadrature Mirror Filter (QMF) bank. *5*

4. Implement a two-stage decimator for the following specifications : *10*

Sampling rate of the input signal = 20,000 Hz

M = 100

Passband = 0 to 40 Hz

Transition band = 40 to 50 Hz

Passband ripple = 0·01 dB

Stop band ripple = 0·002 dB

5. Discuss the following :

(a) M-Channel QMF Band *5*

(b) Alias-free and PR condition *5*

6. (a) What are digital filter banks ? Give some applications where these filters are used. *5*

(b) What are uniform DFT filter banks ? Explain in detail. *5*

7. Derive the input-output relation for a uniform DFT synthesis filter bank with

(a) Type-I decomposition *5*

(b) Type-II decomposition *5*

8. (a) What are multi-level filter banks ? *5*

(b) Explain filter banks with equal and non-equal filter passbands. *5*

9. Design a Linear-phase FIR filter which satisfies the following specifications : *10*

Sampling frequency = 8000 Hz

Passband = $0 \leq F \leq 75$ Hz

Transition band = $75 \leq F \leq 80$ Hz

Passband ripple : $\delta_1 = 10^{-2}$

Stopband ripple : $\delta_2 = 10^{-4}$