

**B.Tech. - VIEP - ELECTRONICS AND
COMMUNICATION ENGINEERING
(BTECVI)**

Term-End Examination

June, 2016

00866

BIELE-014 : MULTIRATE SYSTEMS

Time : 3 hours

Maximum Marks : 70

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

1. (a) What is sampling rate conversion ? 3
- (b) Consider the analog signal
- $$x_a(t) = 3 \cos 100 \pi t.$$
- (i) Determine the minimum sampling rate required to avoid aliasing.
- (ii) Suppose that the signal is sampled at the rate $F_s = 200$ Hz. What is the discrete time signal obtained after sampling ?
- (iii) Suppose that the signal is sampled at $F_s = 75$ Hz. What is the discrete time signal obtained after sampling ? 7

2. Define multirate systems and list their advantages. Also give some examples of multirate digital systems. 5+5

3. Give the Perfect Reconstruction (PR) of Quadrature Mirror Filter (QMF) banks. List the steps involved in the design of an alias-free QMF bank. What is Power Symmetry in QMF bank ? 4+3+3

4. What are the Perfect Reconstruction systems in an M-channel filter bank ? Also give the necessary and sufficient conditions for perfect reconstruction. 5+5

5. Design a Perfect Reconstruction system and determine an expression for sub-band coding gain. 4+6

6. What is an M-channel linear phase Perfect Reconstruction FIR QMF bank ? Give the synthesis procedure of these types of filters. 3+7

7. Explain the basic multirate operations involved during up sampling and down sampling processes both in time domain and frequency domain. 5+5

8. Define a uniform DFT filter bank and explain the decimated uniform DFT filter bank for polyphase representation. 3+7

9. What are Quantization effects ? What are the various types of quantization effects which occur in filter banks ? Explain in brief. 2+3+5

10. Write short technical notes on any *two* of the following : 2×5=10

- (a) Amplitude and Phase Distortion
 - (b) Aliasing and Imaging
 - (c) Round-off Noise and Limit Cycle
 - (d) Sub-Nyquist Sampling
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