Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SECOND SEMESTER M.TECH (DEAC) DEGREE END SEMESTER EXAMINATION
MAY/JUNE 2016
SUBJECT: ADVANCED DIGITAL SIGNAL PROCESSING (ECE - 504)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Explain the basic interpolation operation. Derive expression for the spectrum of interpolated signal in terms of original spectrum. What is the role of interpolation filters?

1B. For the system shown in Fig.Q1.B, determine y(n) in terms of x(n).

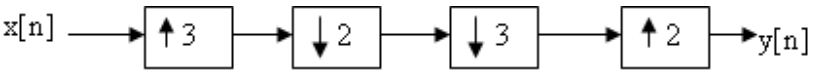

Fig. Q1.B

1C. Certain analog signal band limited to 3.3 KHz is sampled at twice the Nyquist rate to get discrete signal x(n). What is the maximum integer by which this can be decimated so that there is no aliasing?

(5+3+2)

2A. Explain the principle of IFIR design. It is required to implement 96 KHz to 1 KHz down converter. If the overall decimation filter has f_p=450 Hz, δ_p=0.01 dB and δ_s=60dB, get the specifications of individual filters for IFIR design (Assume interpolation factor of 48, ie. take 96=48x2).

2B. Show that there is no phase distortion in a normal alias-free QMF bank using linear-phase FIR filters. Explain why the filter length should be even.

2C. For the system shown in Fig. 2.C, determine the output sequence y(n). All the input signals have same sampling rate.

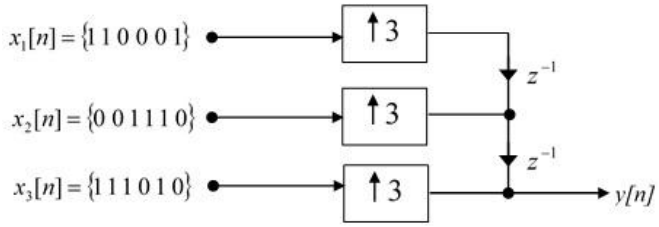

Fig. 2.C

(5+3+2)

3A. Describe the uniform DFT filter bank for the computation of N-point DFT. Draw the implementation block diagram of DFT filter bank using poly-phase filters and estimate the cost of such filter bank if N=32. The base filter has length 51.

3B. Explain the concept of optimum and adaptive filtering. Write the Widrow-Hopf equation for optimum filter and LMS equation for adaptive tapped delay line filters.

3C. Draw the convergence characteristics of LMS algorithm. How to choose convergence parameter?

(5+3+2)

4A. Describe the concept of optimum predictor. Derive expression for the optimum predictor coefficients for one step, M tap optimum predictor.

4B. Describe the functioning of Correlation canceler loop (CCL).

4C. Write the implementation block diagram of LMS algorithm.

(5+3+2)

5A. Derive expressions for the cepstrum of signals that can be expressed as sum of exponentials.

5B. Explain the concept of homo-morphic signal processing. Discuss the signal model for such applications.

5C. Draw the block diagram of homo-morphic system for the computation of cepstrum using DFT. How to select the DFT length?

(5+3+2)

6A. Certain signal with Z-transfer function $X(z) = \frac{0.95 + z^{-1}}{(1 - 0.8z^{-1} + 0.64z^{-2})}$ is transmitted over multipath channel having impulse response h(n) = δ(n) + 0.8δ(n-10) + 0.64δ(n-20). Determine the cepstrum of the received signal. Explain how the echoes can be suppressed from the received signal.

6B. Compare parametric and non- parametric method of PSD estimation.

6C. What is the role of autocorrelation function in estimating PSD?

(5+3+2)