Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
APRIL 2018
SUBJECT: ADVANCED DIGITAL SIGNAL PROCESSING (ECE - 4005)

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

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. (i) For a DSP system, a sampling rate of 40,000 Hz is used. The anti-aliasing filter is a Butterworth low pass filter with a cut-off frequency of 8000 Hz, and the percentage of aliasing level at the cut-off frequency is required to be less than 1%, determine the order of the anti-aliasing low pass filter.

(ii) For a DSP system, a sampling rate of 16,000 Hz is used. The anti-aliasing filter is a second order Butterworth low pass filter with a cut-off frequency of 3.4 kHz. Determine the percentage of aliasing level at the cut-off frequency.

1B. Given an analog signal $x(t) = 5\cos(2\pi \times 2000t) + \cos(2\pi \times 5000t)$ for $t \geq 0$ which is sampled at a rate of 8000Hz. Sketch the original signal spectrum and the recovered analog signal spectrum if an ideal low pass filter with a cut off frequency of 4000Hz is used to recover the original signal.

1C. Explain the use of filters in decimator and interpolator?

(5+3+2)

2A. Illustrate the multistage scheme used for decimation with the help of frequency responses of associated filters. Assume that the decimation factor $M=M_1M_2$.

2B. What is an adaptive filter? List the basic issues in an adaptive implementation.

2C. Draw and discuss the poly phase implementation of an M-fold decimator

(5+3+2)

3A. Describe the two channel quadrature mirror (QMF) filter bank and derive the condition for aliasing cancellation.

3B. Show that the mean square error *J* is a quadratic function of the weight *w* in one-tap adaptive filter.

3C. Discuss the conservation and compaction of energy in case of *Haar* transform with an example.

(5+3+2)

4A. What is homomorphic processing? Explain the signal model for homomorphic processing of the speech signal.

4B. Derive Wiener-Hopf equation and express it in the matrix form.

4C. Explain the relationship of spaces spanned by the scaling and wavelet functions.

(5+3+2)

5A. Draw the cannonic form representation of homomorphic system for convolution. Also, describe the system with the help of a block diagram.

5B. List important applications of adaptive filters. Detail any one.

5C. What is cepstral analysis? Explain.

(5+3+2)