Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SECOND SEMESTER M.TECH (E & C) DEGREE END SEMESTER EXAMINATION - APRIL / MAY 2017

SUBJECT: ADVANCED DIGITAL SIGNAL PROCESSING (ECE – 5202)

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

Instructions to candidates

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

1A. Certain bandlimited signal $x(n)$ with spectrum $X(w)$ is decimated by integer factor M. Derive expression for the spectrum of the decimated signal in terms of $X(w)$. If $x(n) = \frac{\sin(\pi n/3)}{\pi n}$, estimate the maximum integer decimation factor M_x so that original signal can be recovered from the decimated signal. Draw the spectrum of $x(n)$ and decimated signal when decimated by M_x.

1B. Draw the frequency response of decimation filter. Discuss the multistage implementation of decimation filters.

1C. Draw the block diagram of fractional rate converter for decimation by 1.5. Draw the frequency response of the filter to be used if the signal to be decimated is bandlimited to $2\pi/3$ radians.

(5+3+2)

2A. Draw the block diagram of M-channel QMF bank and derive the condition for no aliasing.

2B. Deduce poly-phase type 1 structure for IIR filter. Certain causal filter is described by the difference equation y(n) = x(n) + 0.5y(n-1). Obtain two-component type1 poly-phase structure for this filter.

2C. Draw the block diagram of 4-point DFT filter bank and the frequency response of each filter.

(5+3+2)

3A. What is the need for adaptive filter? Derive steepest descent algorithm used to update the weights in an adaptive Wiener filter.

3B. Describe the functioning of adaptive linear combiner. Explain one application of such system.

3C. Write the LMS algorithm for updating the filter weights of tapped delay line filter. Draw the implementation block diagram of 2-tap LMS filter.

(5+3+2)

4A. With block diagram and mathematical relations, describe homo-morphic system for de-convolution.

4B. Describe the computation of complex cepstrum of minimum phase signals from real cepstrum.

4C. Compute the complex cepstrum of the signal $x(n) = (0.5)^n \cos\left(2\pi n/3\right) u(n)$

(5+3+2)

5A. Explain the principles of parametric and non-parametric PSD estimation. Discuss in detail the Welch method of PSD estimation.

5B. Suggest an adaptive filter to enhance the SNR of unknown pilot carrier received by the receiver. Explain the functioning of the same.

5C. Write the model system function and difference equation for generating AR and MA random processes.

(5+3+2)