Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016
SUBJECT: DIGITAL SIGNAL PROCESSING (ECE - 303)

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

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

1A. Define unilateral z-transform. Using unilateral z-transform, compute y(n) for n≥0 for
y(n) - y(n-1) - y(n-2) = 0; y(-1) = 0 and y(-2) =1

1B. Impulse response of certain causal LTI system is $h[n] = \{\underset{\uparrow}{1}, 1\}$. Determine the response of the system for the periodic input $x[n] = 5 - 2\cos(\frac{\pi}{2}n) + 10\sin(\frac{3\pi}{2}n)$.

1C. Draw the magnitude response and z-domain pole-zero plot for the system h(n) = 2δ(n+1) + δ(n) +2δ(n-1)

(5+3+2)

2A. Derive radix-2 DIT FFT algorithm. Illustrate with signal flow diagram.

2B. For a given real sequence x (n) =δ (n+1) +2δ (n) +δ (n-1). Compute the sequence y (n) if Y (K) = X^2(K), where X(K) is the 4 point DFT of x(n).

2C. State periodicity and circular convolution property of DFT.

(5+3+2)

3A. With relevant mathematical analysis, describe overlap-add method of linear filtering through DFT-IDFT calculations.

3B. Deduce second order Goertzel filter for the computation of N-point DFT.

3C. Define group delay. What is the group delay for N-length linear phase FIR filter?

(5+3+2)

4A. Using bilinear transformation method, design third order digital Butterworth Low pass filter. The filter has 3-dB frequency of 500 Hz at sampling frequency of 5000 Hz.

4B. Explain impulse invariant method of digitising analog filter.

4C. Suggest the location of zeros of system function H(z) for a notch filter to suppress 100Hz signal. Assume sampling frequency of 1kHz.

(5+3+2)

5A. Compute the coefficients of 11-length digital linear phase FIR high-pass filter with cut-off frequency of 1kHz at sampling frequency of 5kHz. Use causal Hamming window.

5B. For N-length FIR filter having impulse response h[n], prove that the system function $H(z) = (1 - z^{-N})\sum_{k=0}^{N-1}\frac{H[k]/N}{1 - e^{j\frac{2\pi k}{N}}z^{-1}}$ where H(K) are the DFT coefficients of h(n).

5C. Mention the basic building blocks for implementing digital filter system function.

(5+3+2)

6A. Realise the following IIR filter using direct forms 1 and 2 and cascade structures.

$$H(z)=\frac{\left(1+2z^{-1}\right)}{\left(1-0.25z^{-1}\right)\left(1-2z^{-1}+3z^{-2}\right)}$$

6B. Describe Welch method of PSD estimation.

6C. Bring out two major differences between parametric and non- parametric methods of PSD estimation.

(5+3+2)