Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2015
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) - 1.5y(n-1) + 0.5y(n-2) = 0; y(-1) = 1, y(-2) =0.

1B. Explain linearity, periodicity and symmetry properties of DFT.

1C. Consider the system function $H(z)=\frac{1-2z^{-1}+2z^{-2}-z^{-3}}{(1-z^{-1})(1-0.5z^{-1})(1-0.25z^{-1})}$; $|z|\succ 1$

i) Is this system stable? Ii) Sketch the pole-zero plot in z-domain.

(5+3+2)

2A. Describe the concept of linear filtering. Suggest and explain a method of filtering long length data through DFT-IDFT calculations.

2B. Compute the discrete time Fourier transform and 6 point DFT of the signal x(n) = {1,2,3,2,1}

2C. If X(k) is N-point DFT of x(n), determine N-point DFT of $x_c(n)=x(n)\cos(2\pi k_0/N)$; $0\le n\le N-1$

(5+3+2)

3A. Develop N point radix-2 DIF FFT algorithm. Illustrate with signal flow diagram and mention the computational advantage of this algorithm.

3B. Develop Goertzel algorithm for the evaluation of N-point DFT. Compare the computational requirement of this algorithm with that of direct DFT evaluation.

3C. The time domain signal x(n) corresponding to 4-point DFT sequence X(K) = [4,0,0,0] is -------

(5+3+2)

4A. It is required to have a 11-length linear phase digital FIR high pass filter with pass band 3KHz to 9Khz at an sampling frequency of 18 KHz. Determine the filter coefficients using Hamming window. Implement the system function in tapped delay line structural form.

4B. Briefly describe the design of FIR digital filters using frequency sampling technique.

4C. Determine the unit sample response h(n) of a 4-length linear phase FIR filter having frequency response $H_r(0) = 1$ and $H_r(\pi/2) = 0.5$

(5+3+2)

5A. Design a digital Butterworth filter with following specifications using bilinear transformation.
Pass band:0-500Hz; Stop band:2-4KHz; Gain at Pass band edge frequency = -1dB; Stop band attenuation=30dB; Sampling frequency=8KHz

5B. Design second order analog prototype Chebyshev type-1 filter. The ripple in the pass band should not exceed 1dB.

5C. Determine the poles and zeroes of digital transfer function corresponding to following analog transfer

function obtained by using impulse invariant transformation with sampling frequency 1Hz.

$$H(s)=\frac{1}{\left(s^2+\sqrt{2}s+1\right)}$$

(5+3+2)

6A. Develop and draw the lattice ladder structure for the filter,

$$H(z)=\frac{1+2z^{-1}}{\left(1+0.75z^{-1}+0.25z^{-2}\right)}$$

6B. Discuss the salient features of Bartlet method of PSD estimation.

6C. Define ARMA, AR and MA stochastic models.

(5+3+2)