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. Using unilateral Z-transform solve the difference equation y(n) – (1/9)y(n-2) = x(n-1) with y(-1) = 1, y(-2) = 0 and x(n) = 2u(n).

1B. Find the overall system function of a cascade system having impulse responses $h_1[n] = 0.5^n u[n]$ and $h_2[n] = \left\{0, \underset{\uparrow}{\ } \frac{1}{2}, -\frac{1}{4}\right\}$.

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

i) Is this system stable? ii) Sketch the location of the poles in z-domain.

(5+3+2)

2A. With relevant mathematical analysis, describe overlap-save method of linear filtering 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. Define circular shift and circular convolution properties of DFT.

(5+3+2)

3A. Derive radix-2 DIF FFT algorithm. Illustrate with signal flow diagram.

3B. Develop the Goertzel algorithm for the evaluation of DFT. Mention the computational advantage.

3C. Determine the group delay of 11 length linear phase FIR filter.

(5+3+2)

4A. Using impulse invariant transformation method, design third order digital Butterworth Low pass filter with cut off frequency 1rad/sec.

4B. Explain bilinear transformation method of digitising analog filter.

4C. Suggest the location of poles of system function H(z) for a narrow band pass filter with center frequency 100Hz. Assume sampling frequency of 1KHz.

(5+3+2)

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

5B. Explain frequency sampling method of digital FIR filter design.

5C. For a FIR filter with 8 length symmetric filter coefficients write the frequency response. Also compute the group dely.

(5+3+2)

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

$$H(z) = \frac{\left(1 - 0.2z^{-1}\right)}{\left(1 + 0.5z^{-1}\right)\left(1 - 3z^{-1} + 2z^{-2}\right)}$$

6B. Explain Bartlet method of PSD estimation.

6C. Write the general AR and MA model equations.

(5+3+2)