Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SIXTH SEMESTER B.Tech. (I & C E) DEGREE END SEMESTER EXAMINATION
May/June 2015
SUBJECT: DIGITAL SIGNAL PROCESSING (ICE - 306)

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

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

1A. For the given system, y[n]=ax[n]+b, where a and b are arbitrary constants. Test for the following properties: a) Stability b) Causality c) Linearity d) Time Invariance e) Memory

1B. A discrete time signal x[n] is defined as x[n] ={0,1,2,3,3}. Sketch x[n], x[n-2] and x[-n].

1C. List any four advantages of digital signal processing.

(5+3+2)

2A. Compute the output y[n] of a system whose impulse response is h[n]= { 1,2 } and the input to the system is x[n]={ 1,2,-1,2,3,-2,-3,-1,1,1,2,-1}. Use overlap save method.

2B. Consider a discrete time LTI system described by

y[n] – ½ y[n-1] =x[n] +½ x[n-1]. Compute the frequency response H(w) of the system.

2C. State the linearity and the time shift properties of Z-transforms.

(5+3+2)

3A. Compute the Z-transform of: $x[n] = 3\left(-\frac{1}{2}\right)^n$ u(n) $- 2\,[3^n u(-n-1)]$.

Identify the poles and sketch the Region of convergence.

3B. Point out the importance of FFT algorithms? Explain how FFT reduces the number of computations in comparison to direct DFT.

3C. State and justify the linearity property of DFT.

(5+3+2)

4A. With the help of a neat signal flow diagram using basic butterflies, explain the 8 point radix 2 DITFFT algorithm.

4B. If $H(s) = \frac{1}{(s+1)(s+2)}$, compute the corresponding H(z) for the digital filter using impulse invariance method for sampling frequency of 5 samples per second.

4C. Compare any four features of Butterworth and Chebyshev filters.

(5+3+2)

5A. Calculate the order and cut-off frequency of an analog filter with maximally flat response in the passband and an acceptable attenuation of 4dB at 20rad/sec. The attenuation in the stopband should be greater than 12dB beyond 30rad/sec.

5B. Develop the cascade form structure for the following system function:

$$H(Z) = \frac{1 + \frac{1}{5}z^{-1}}{\left(1 - \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2}\right)\left(1 + \frac{1}{4}z^{-1}\right)}$$

5C. Explain the basic principle of FIR filter design using frequency sampling method.

(5+3+2)

6A. Design a symmetric FIR low pass filter whose desired frequency response is given as,

$$Hd(w) = \begin{cases} e^{-j\omega\tau} \text{ for } |w| \leq wc \\ 0 \quad \text{otherwise} \end{cases}$$

The length of the filter is 7 and w_c = 1 rad/sample. Use Hamming window for the filter design.

6B. Explain the role of digital signal processing in speech processing applications.

6C. List any four applications of Digital Signal processing in Image processing.

(5+3+2)