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. Briefly classify discrete time systems based on their characteristics, with an example.

1B. Perform the linear convolution of the two sequences x(n)={1,2} and v(n)={3,4} using circular convolution.

1C. Test the causality of the following systems.

a) y(n) = x(n)-x(n-2)

b) y(n) = x(-n)

(5+3+2)

2A. Determine the inverse Z-transform of $X(Z)=1/(1- 0.8z^{-1}+ 0.12z^{-2})$

a) if ROC is, |z|>0.6

b) if ROC is, |z|<0.2

2B. Using Z-transform perform the deconvolution of response, $y(n)=2\ (0.4)^n\ u(n) - (0.2)^n\ u(n)$ and impulse response, $h(n)= (0.4)^n\ u(n)$, to extract the input x(n).

2C. State and prove the time reversal and linearity properties of Z-transform.

(5+3+2)

3A. A discrete LTI system is described by, y(n) = x(n) - x(n-1). Determine the frequency response and impulse response. Sketch the magnitude function and phase function.

3B. Compute the circular convolution of the following two sequences using DFT.

$x_1(n)=\{0,1,0,1\}$ and $x_2(n)=\{1,2,1,2\}$

(3+7)

4A. Determine the sequence q(n) to satisfy the following relation for an arbitrary x[n].

$$q[n] * x[n] = \sum_{k=n-M}^{n} x[k]$$

4B. Calculate the percentage saving in computations in a 512-point radix-2 FFT, when compared to direct DFT.

4C. Find the DFT of a sequence x(n)=(1 2 3 4 4 3 2 1) using DIT FFT algorithm.

(2+2+6)

5A. For the analog transfer function,

$$H(s) = \frac{2}{s^2 + 3s + 2}$$

determine H(Z) using impulse invariant transformation if T=1 Second.

5B. Design a Butterworth digital IIR lowpass filter using bilinear transformation by taking T=0.1 second, to satisfies the following specifications.

$0.6 \leq |H(e^{j\omega})| \leq 1.0$; for $0 \leq \omega \leq 0.35\pi$

$|H(e^{j\omega})| \leq 0.1$; for $0.7\pi \leq \omega \leq \pi$

5C. Realize the given system in direct form-II

$$H(Z) = \frac{1 - a\cos\omega_0 z^{-1}}{1 - 2a\cos\omega_0 z^{-1} + a^2 z^{-2}}$$

(2+6+2)

6A. Design a linear phase FIR lowpass filter using rectangular window by taking 7 samples of window sequence and with a cutoff frequency, $\omega_c = 0.2\pi$ rad/sample.

6B. Write a short note on i) Image segmentation

ii) Speech processing

(5+5)