Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

SIXTH SEMESTER B.TECH. (INSTRUMENTATION & CONTROL ENGG.)

END SEMESTER EXAMINATIONS, JUNE 2017

SUBJECT: DIGITAL SIGNAL PROCESSING [ICE 3202]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Obtain and sketch the impulse response of the following sequence using z transform. **4**

y(n)= 0.4 x(n) + x(n-1) + 0.2 x(n-2) + x(n-3) + 0.6 x(n-4).

1B. With mathematical expressions, explain any two properties of z-transform. **3**

1C. Determine the z-transform and ROC of the discrete time signal x(n) = u(n) **3**

2A. Using Z transform, perform deconvolution of the response **3**

y(n) = {1, 4, 6, 6, 1, -10, -8} and impulse response h(n) = {1, 2, -1, -2} to extract input x(n)

2B. Compute 4 point DFT of sequence $x(n) = 1 \qquad for\ 0 \leq n \leq 2.$ **3**
Sketch the magnitude and phase spectrum

2C. Bring out two difference between DIT and DIF radix-2 FFT. **2**

2D. List any four properties of DFT. **2**

3A. Compute 8- point DFT of x(n) by radix-2 DITFFT **5**
x(n) = {2, 1, 2, 1, 1, 2, 1, 2}.

3B. Derive the relation between analog and digital frequency in bilinear transformation. **3**

3C. Bring out the difference between analog and digital filters. **2**

4A. Design a Butterworth digital IIR low pass filter using impulse invariant transformation by taking T = 1 sec to satisfy the following specifications. **5**
$0.707 \leq |H(e^{j\omega})| \leq 1.0$; for $0 \leq \omega \leq 0.3\ \pi$
$|H(e^{j\omega})| \leq 0.2$; for $0.75\ \pi \leq \omega \leq \pi$

4B. Obtain the direct form-II structure realizations for the LTI system described by the system function, **3**

$$H(Z) = \frac{0.0221z^{-1} + 0.055z^{-2} + 0.0091z^{-3}}{1 - 2.2887z^{-1} + 2.1808z^{-2} - 0.977z^{-3} + 0.171z^{-4}}$$

4C. For the second order Butterworth LPF, sketch the poles on s-plane and hence obtain the normalized transfer function of it. **2**

5A. Design a linear phase FIR low pass filter using a rectangular window of length 7 with the cutoff frequency $w_c = 0.2\pi\ rad/sample$. **5**

5B. With relevant mathematical expressions, explain Periodogram and Bartlet method of PSD estimation. **5**

********** END **********