Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

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

END SEMESTER EXAMINATIONS, APRIL/MAY 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. Determine the impulse response of the discrete time LTI system using Z transform. **5**

$y(n) - 4\,y(n-1) + 4\,y(n-2) = x(n) - 5\,x(n-3)$

Give the importance of location of poles for stability in Z domain.

1B. Determine the Z transform and their ROC of the following discrete time signals. **3**

$a)\ 0.3^n$ u(n) + 0.8^n u(-n-1) b) Cos(Ω_0 nT)

1C. State the linearity and time shifting property of Z transform with the mathematical expressions. **2**

2A. Find the inverse Z transform of the following **4**

a) $X(z) = \frac{1}{1+4.5\,z^{-1}+3.5\,z^{-2}}$ b) $X(z) = \frac{1+z^{-1}}{1-z^{-1}+0.5\,z^{-2}}$

2B. Compute 8 point DFT of the following sequence. Also plot magnitude and phase spectrum of it. **4**

$$x(n) = \begin{cases} \frac{2}{6}; & 0 \le n \le 2 \\ 0; & otherwise \end{cases}$$

2C. Bring out the mathematical relation between DFT and Z transform. **2**

3A. Determine the response of an LTI system with impulse response h (n) = {-1, -1} for the input x (n) = {1, 2, 3} using radix 2 DIT FFT algorithm. **4**

3B. Briefly explain the impulse invariant and bilinear frequency transformation techniques **2**

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

3D. The first 5 points of 8-point DFT of a real valued sequence are **{**28, -4+j9.565, - 4+j4, -4+j1.656, -4**}.** Determine the remaining points. State the property of DFT used to solve this problem. **2**

4A. Design a Butterworth digital IIR low pass filter using bilinear transformation by taking T = 1 sec to satisfy following specifications. **5**

Pass band ripple ≤ 3dB at 0.5π rad
Stop band attenuation ≥ 15dB at 0.75π rad

4B. What are the basic building blocks of realization structure of digital system? Obtain the direct form-II structure realizations for the LTI system described by the system function, **3**

$$H(Z) = \frac{8z^3 - 4z^2 + 11z - 2}{(z - \frac{1}{4})(z^2 - z + \frac{1}{4})}$$

4C. By impulse invariant method, obtain the digital filter transfer function and the difference equation for $H(s) = \frac{1}{(s+1)}$. **2**

5A. Design a linear phase FIR high pass filter using hamming window, with a cut-off frequency, $w_c = 0.8\pi\ rad/sample$ and N = 7. **5**

5B. With relevant mathematical expressions and example, explain Bartlet method of Power Spectral Density estimation **5**

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