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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

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

## END SEMESTER DEGREE EXAMINATIONS, JUNE - 2018

## 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. Find one sided z – transform of the following. **3**

*1. $x(n) = n\,a^{(n-1)}$ 2. $x(n) = \sin(\Omega_o n)$*

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) **2**

1D. Test for stability: $x(n) = 0.8^n\,u(-n-1)$ **2**

2A. Using Z transform, perform deconvolution of the response y(n) = {1, 4, 6, 6, 1, -10, -8} and impulse response h(n) = {1, 2, -1, -2} to extract input x(n) **4**

2B. Compute 4 point DFT of sequence x(n) = {0, 1, 2, 1}. Sketch the magnitude and phase spectrum **3**

2C. Compute the DFT of the sequence $x(n) = (-1)^n$ for the period N = 16. **3**

3A. In an LTI system the input x(n) = {1, 2, 3} and the impulse response h(n) = {-1, -1}. Determine the response of the LTI system by radix-2 DITFFT algorithm **4**

3B. Derive the relation between analog and digital frequency in impulse invariant transformation. **2**

3C. List any two difference between analog and digital filters. **2**

3D. Determine H(z) using impulse invariant transformation if T = 1 seconds.

$$H(s) = \frac{s^3}{(s+1)(s^2+s+1)}$$ **2**

4A. Design a Butterworth digital IIR low pass filter using impulse invariant transformation by taking T = 1 sec to satisfy the following specifications.

$0.9 \leq |H(e^{jw})| \leq 1.0$ ; for $0 \leq w \leq 0.35\ \pi$

$|H(e^{jw})| \leq 0.275$ ; for $0.7\ \pi \leq w \leq \pi$ **5**

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

$$H(Z) = \frac{0.0083 + 0.0251z^{-1} + 0.0251z^{-2} + 0.0083z^{-3}}{1 - 2.2821z^{-1} + 1.9589z^{-2} - 0.6264z^{-3}}$$ **5**

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

**5**

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

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