Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

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

END SEMESTER EXAMINATION APRIL/MAY 2017

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 signals based on their characteristics with an example for each.

1B. Test the following systems for linearity.

i) $y(n) = x(n^2)$ ii) $y(n) = x^2(n)$

1C. For a discrete time signal x(n) ={-2,-1,-1,0,1,2,3}, find y(n) = x(-n+2).

(5+3+2)

2A. Find the output y(n) of a filter whose impulse response is h(n)={1,1,1,1} and input signal x(n)={3,-1,0,1,3,2,0,1,2,1} using overlap-add method.

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

2C. State and explain any two properties of z-transform,

(5+3+2)

3A Find the inverse Z transform of the following sequences

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

3B Compute 8 point DFT of the following sequence. Also plot magnitude and phase spectrum of it.

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

3C Bring out the mathematical relation between DFT and Z transform.

(4+4+2)

4A. Determine the frequency response $H(e^{jw})$ for the system and plot the magnitude and phase response.$y(n) + \frac{1}{4}y(n-1) = x(n) - x(n-1)$

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

(5+5)

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

Pass band ripple ≤ 3dB at 0.5π rad

Stop band attenuation ≥ 15dB at 0.75π rad

5B. What are the basic building blocks of realization structure of digital system? Obtain the direct form-I and II structure realizations for the LTI system described by the system function,

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

(6+4)

6A. Design the linear phase FIR lowpass filter using hanning window by taking 11 samples of window sequence and with a cutoff frequency of ω_c=0.2π rad/sample.

6B. Write a short note on i) Biomedical signal processing ii) Speech recognition system.

(5+5)

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