Reg. No. | | | | | | | | | | |

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

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

END SEMESTER DEGREE EXAMINATION, JUNE - 2019

SUBJECT: DIGITAL SIGNAL PROCESSING [ICE 3202]

TIME: 3 HOURS MAX. MARKS: 50

Instructions to candidates :*Answer ALL questions and missing data may be suitably assumed.*

1A State and prove correlation property of Z-transform and differentiation in Z-domain.

1B Find the inverse Z-transform for $X(z)=\frac{z^2}{z^2-z+0.5}+\frac{z-3}{z^2+5z+4}$

1C The Z-transform of $x(n)=e^{-n-2}u(-n-2)$ is _____.

(4+5+1)

2A Compute the DFT of $x(n)=\{1,-1,0,-1,1,0,-1,0\}$.

2B Determine the response of LTI system when the input sequence $x(n)=\{-2,-1,0,2\}$ by radix 2 DIT-FFT. Given the impulse response of the system is $h(n)=\{1,-1,-1,1\}$.

2C Obtain the linear convolution of the following sequences using DFT method.

$$x(n)=\{-1,-1\} \text{ and } h(n)=\{1,2\}$$

(5+3+2)

3A Obtain the unnormalized transfer function of an analog Butterworth lowpass filter for the specifications:

$0.9 \le |H(e^{j\omega})| \le 1.0$; $0 \le \omega \le 0.35\pi$

$|H(e^{j\omega})| \le 0.275$; $0.7\,\pi \le \omega \le \pi$

T=1s. Assume impulse invariant transformation.

3B Given that the normalized transfer function of an analog IIR filter is:

$$H(s)=\frac{0.0914}{s^3+0.4865s^2+0.4351s+0.0914}$$

Obtain the Direct form-II structure of its digital form. Assume bilinear transformation, with T=1s.

3C Is it possible to transform a linear phase analog filter model into its digital form using bilinear transformation? Justify your answer.

(4+4+2)

4A Design a linear phase FIR low pass filter using rectangular window with $w_c = 0.2\pi$ rad/sample and N = 7.

4B List the design procedure for high pass digital Chebyshev IIR filter.

4C Justify the linear phase characteristics of a FIR filter.

(5+3+2)

5A Design a FIR high pass digital filter with cut-off frequency of 1.5kHz and sampling frequency of 5kHz with 7 samples using Fourier series method.

5B Explain Periodogram and give the steps involved in Bartlet method of PSD estimation.

5C List the different types in non-parametric method of power spectrum estimation.

(5+3+2)

****