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

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

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

ONLINE GRADE IMPROVEMENT/MAKE-UP EXAMINATIONS, AUGUST - 2021

SUBJECT: DIGITAL SIGNAL PROCESSING [ICE 3251]

TIME: 2 HOURS 07-08-2021 **MAX.MARKS: 40**

Instructions to candidates: Answer any *FOUR FULL* questions.

Missing data may be suitably assumed.

1A. A system has an impulse response $h[n] = a^n u[n]$, determine its output for the following inputs.

i) $x[n] = n + 1; 0 \leq n \leq 2$; ii) $x[n] = u[n]$

1B. State and prove i) up sampling; ii) right shifting properties of the Z-transform.

(5+5)

2A. Determine the Z-transform for the following sequences

i) $x[n] = n\left(-\frac{1}{2}\right)^n u[n] * \left(\frac{1}{4}\right)^{-n} u[-n]$ ii) $p[n] = -u[-n-1] + \left(\frac{1}{2}\right)^n u[n]$

2B. Determine sequence x[n] for which

$$X[z] = \frac{0.4}{1 - 0.7z^{-1}} + \frac{0.25}{1 - 5z^{-1}}$$

where the ROC includes the unit circle. Determine x(0).

(5+5)

3A. State and prove circular time shift and time reversal properties of DFT.

3B. Compute 8-point DFT of the discrete time signal, x(n) = {1, 2, 1, 2, 1, 3, 1, 3} and plot the magnitude spectrum.

(5+5)

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

4B Define impulse invariance transformation? What for it is used? Obtain a relation between analog and digital frequency using impulse invariance transformation.

(5+5)

5A. Determine the poles of a lowpass Butterworth filter for N = 3. Sketch the location of poles on s-plane and hence determine the analog normalized transfer function of lowpass filter.

5B. Obtain the digital filter H(Z) from given H(s)

$$H(s) = \frac{2s}{s^2 + 0.2s + 1}.$$

Given the sampling period is 2 seconds. Use bilinear transformation technique.

(5+5)

6A. Given $\boldsymbol{H(z) = \frac{0.44Z^{-1} + 0.36Z^{-2} + 0.02Z^{-3}}{1 + 0.4Z^{-1} + 0.18Z^{-2} - 0.2Z^{-3}}}$ Obtain the direct form I and direct form II realization.

6B. Compare any five features of Butterworth and Chebyshev filter design methods.

(5+5)

****