Reg. No.											

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

III SEMESTER B. Tech. (BME) DEGREE MAKE-UP EXAMINATIONS DEC/JAN 2019-20

SUBJECT: SIGNALS & SYSTEMS (BME 2155)

(REVISED CREDIT SYSTEM)

Thursday, 2nd January 2020: 8.30 AM to 11.30 AM

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to Candidates:

Answer ALL questions.
Missing data may suitably be assumed.

1A. Find the inverse Z-transform of the sequence, $X(z) = \frac{z}{3z^2-4z+1}$ for the following ROCs: 04

(i) $|z| > 1$ (ii) $|z| < \frac{1}{3}$ (iii) $\frac{1}{3} < |z| < 1$

1B. The signal $x(n) = \{1,\ 0.5\}$ is applied to a system with frequency response $H(w)$, and the resulting output is $y(n) = \delta(n) - 2\delta(n-1) - \delta(n-2)$. Find $H(w)$ and $h(n)$. 03

1C. Consider a continuous-time signal, 03

$x(t) = 2\,cos(2000\pi t) + 3\,sin(6000\pi t) + 8\,cos(12000\pi t)$.

Determine the Nyquist rate required to sample the signal, and the corresponding discrete-time sequence.

2A. The impulse responses associated with the two LSI systems, are given by: 04

$h_1(n) = \left(\frac{1}{5}\right)^n u(n)$ and $h_2(n) = 2\delta(n-1) + 5\delta(n-2)$

Find the overall impulse response, if the two systems are connected:

(i) in series, and (ii) in parallel

2B. A discrete-time signal is given by $x[n] = \{3, 2, 1, \underset{\uparrow}{0}, 1, 2, 3\}$. 03

Sketch each of the following versions of the signal.

(i) $x[n]u[1-n]$ (ii) $x[n]\{u[n+2]-u[n]\}$ (iii) $x[n]\delta[n-1]$

2C.	Determine whether the system described by $H(z)=\frac{2z+1}{z^2+z-\frac{5}{16}}$ is both causal & stable.	03
3A.	Is the discrete-time system defined by $y[n]=x[n]+n\,x[n-1]$ a Linear and Shift-invariant system? Justify.	04
3B.	Find the 4-point DFT of a discrete-time sequence, $x(n)=\left\{\frac{1}{3},\frac{1}{3},\frac{1}{3},0\right\}$ using Matrix method.	03
3C.	Investigate the causality and stability of the following LSI systems. Justify your answers. (i) $h(n)=\left(-\frac{1}{2}\right)^n u(n-1)$ (ii) $h(n)=(2)^n u(-n)$	03
4A.	Consider a FIR filter described by the difference equation, $y(n)=x(n)+x(n-1)$. (i) Determine the frequency response $H(w)$ of the filter and sketch its magnitude over $-\pi \leq w \leq +\pi$. (ii) What is the impulse response $h(n)$ of the filter? (iii) Identify the filter.	04
4B.	Prove the following: (i) $x(n)*\delta(n)=x(n)$ (ii) $x(n)*\delta(n-n_0)=x(n-n_0)$	03
4C.	What is the Z-transform of the sequence that has DTFT $X(w)=1+\cos(w)$? Also find the sequence $x(n)$.	03
5A.	Using the Z-transform, find the impulse response of a causal system described by the difference equation, $y(n)-\frac{1}{4}y(n-1)-\frac{3}{8}y(n-2)=-x(n)+2x(n-1)$. Check for stability of the system (justify your answer).	04
5B.	The impulse response of a causal discrete-time LSI system is given by $h[n]=\{1,1,1,1,-1,-1\}$. Determine and sketch the output $y[n]$ of this system to the input $x[n]=\delta[n-2]-\delta[n-4]$, without direct convolution.	03
5C.	Using DTFT, Evaluate $y(n)=x(n)*h(n)$ where $x(n)=\{1,1,1,1\}$ and $h(n)=\{1,1,1\}$.	03