Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent institution of MAHE, Manipal)

I SEMESTER M.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV 2018

SUBJECT: SIGNAL PROCESSING AND APPLICATIONS [MTE 5140]

REVISED CREDIT SYSTEM
(/ /2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer all questions.
- Data not provided may be suitably assumed

1A. Design a low pass filter and Determine the filter coefficients $h_d(n)$ for the following desired frequency response $H_d(e^{j\omega})$ and given windowing function $\omega(n)$. **5**

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega}, & -\pi/4 \le \omega \le \pi/4 \\ 0, & \pi/4 < |\omega| \le \pi \end{cases}$$

$$\omega(n) = \begin{cases} 1 & 0 \le n \le 4 \\ 0 & \text{otherwise} \end{cases}$$

1B. Describe with required sketches any one application of signal processing. **5**

2A. Discuss in detail about the concentric circle convolution method with an example. **5**

2B. Explain Bilinear transformation with relevant equations and diagram. **2**

2C. Apply bilinear transformation and obtain H(z) if **3**

$$H(s) = \frac{1}{(S+1)\text{^}2}$$

Where T=0.1s

3A. Determine H(z) for a Butterworth filter satisfying the following constraints **5**

$$\sqrt{0.5} \le |H(e^{j\omega})| \le 1 \qquad 0 \le \omega \le \pi/2$$

$$|H(e^{j\omega})| \le 0.2 \qquad 3\pi/4 \le \omega \le \pi$$

With T= 1s Apply impulse invariant transformation

3B State and prove linearity of system. **2**

3C. Sketch the output for following operations, for the signal x(t) shown in Fig.1

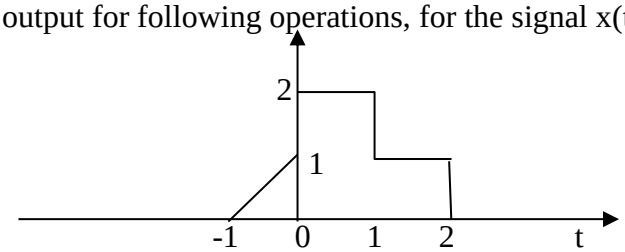

Fig.1 **3**

(I).X(t-2) (II) X(2t+3) (III) X((3/2)*t)

4B. Determine the z transform of the discrete time sequence and compute the roc of the sequence with proper justification. **5**

X(n) = {1,2,0, -4,3,2,1,6,5}

4C. Compare and contrast Digital filter and analog filters with an example. **5**

5A. Determine H(z) for the analog transfer function H(s), apply impulse invariant technique and take T =2s. **5**

$$H(s) = \frac{1}{(S+1)(S+2)}$$

5B. T Determine $H(e^{j\omega})$ for M=7 for the desired response $H_d(e^{j\omega})$ of a low pass filter using Hamming window method. **5**

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & -3\pi/4 \le \omega < 3\pi/4 \\ 0 & 3\pi/4 \le \omega \le \pi \end{cases}$$