Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

I SEMESTER M.TECH (INDUSTRIAL AUTOMATION AND ROBOTICS, MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, DEC 2015 – JAN 2016

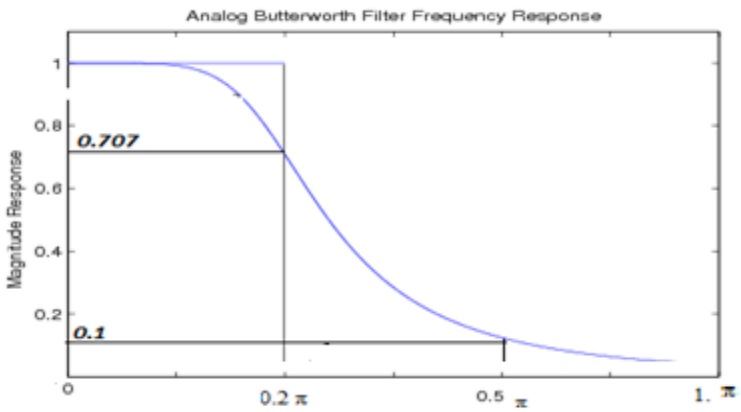
SUBJECT: SIGNAL PROCESSING AND APPLICATIONS [MTE 509]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Transform Tables to be provided
- Missing data may be suitably assumed.

1A. Design a digital IIR filter for the following magnitude response. **(6m)**



1B. Compare and contrast between IIR and FIR filters. **(4m)**

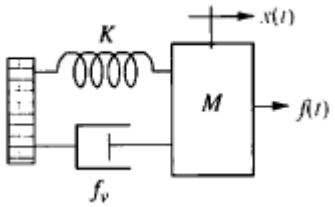
2A. Explain briefly any application of signal processing with neat block diagrams. **(6m)**

2B. Realize the digital filter given $H(s) = \frac{z^2+5z+6}{z^3+6z^2+11z+6}$ **(4m)**

3A. Categorize whether the system $y(n) = nx(n) + 1/(x(n-1))$ as linear, non-linear, static-dynamic, time variant-invariant, causal-noncausal. **(4m)**

3B. Find the output if $x(n) = \{[1],2,-1,1\}$ and $h(n) = \{1,[0],1,1\}$ **(2m)**

3C. A packaging industry is doing the labelling using a plunger as shown below. Find the transfer function in z domain and the response of the system in discrete domain. **(4m)**



4A. State dirchlets conditions. What is the significance of dirchlet's conditions in signals. **(3m)**

4B. Find the z transform of the following f(t) = $\left(\frac{1}{3}\right)^n u(n)$. Also mention the region of convergence. **(5m)**

i. f(n) ii. a^nf(n) iii. f(-n) iv. nf(n)

4C. $x(n)$= {4,2,−1,[1],3,2,1,5} represent the sequence as sum of elementary functions. **(2m)**

5A. Design an FIR digital filter with n = {0,1,2,3} whose magnitude response is $H(e^{jw})$ = e^{-3jw} for $-\frac{3\pi}{2} \leq w \leq \frac{3\pi}{2}$, and zero elsewhere. Also the weighting factor w(n) = 1 for all n. **(6m)**

5B. Find y(n) = x(n)*h(n) in z domain if x(n) = 2^n u(n-5) and h(n) = {1,[0],1,1,}. Also mention the region of convergence of y(n). **(4m)**

6A. Design a third order digital butterworth filter that pass the frequency signals beyond analog frequency of Ωc = 2.5 rad/sec. **(10m)**