Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SIXTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
MAY/JUNE 2016
SUBJECT: LINEAR AND DIGITAL CONTROL SYSTEMS **(ECE - 306)**

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

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed
- Graph sheets will be issued on request

1A.	Find the state variable matrix equation for the circuit shown in Fig. 1A. Let the state variables are $x_1 = v_{1,}\ x_2 = v_2$ and $x_3 = i$
1B.	For the block diagram shown in Fig. 1B, find the CLTF using block diagram reduction technique.
1C.	Derive for controller function using deadbeat algorithm.
	(5+3+2)
2A.	Using RH Criteria find the range of gain K for the system shown in Fig. 2A that will cause the system to be stable,unstable and marginally stable. Also find the frequency of oscillation for marginal stability.
2B.	A single loop feedback system have path gains $G(s) = \frac{2}{s+1}$ and $H(s) = \frac{1}{s+10}$. Find its response for unit step input. What is the steady state response of the system for the same input?
2C.	State and prove properties of state transition matrix.
	(5+3+2)
3A.	For the mechanical system shown in Fig. 3A, equivalent T-V analogous circuit with the help of all necessary equations.
3B.	Write an expression for response of a second order system for unit step input and hence derive for maximum overshoot.
3C.	Explain Controllability and Observability of a system.
	(5+3+2)
4A.	For the unity feedback system represented as $G(s) = \frac{(s+1)}{s^2(s+10)}$, draw the Root Locus and comment on stability.
4B.	For system equation determine characteristic equation, Eigen values, State transition matrix and transfer function Y(s)/U(s) $$\dot{\boldsymbol{X}} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \boldsymbol{X} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \boldsymbol{u} \text{ and } \mathbf{Y} = [\mathbf{0\ 1}]\mathbf{X}$$

	(5+5)
5A.	Derive frequency response specifications of a second order prototype system. Find the magnitude and phase responses for the system with $G(s)=\dfrac{10(s+3)}{s(s+5)(s+10)}$ at 500 rad/sec.
5B.	For a unity feedback system with $G(s) = \frac{1}{s(s+1)}$ followed by ZOH design a controller D(z) so that the response to the unit step is c(n)=0,0.5,1,1,1 ………. Given sampling period T= 1 second.
	(5+5)
6A.	For the Discrete control system shown in Fig. 6A, derive the closed loop pulse transfer function for sampling period T= 1 and T=2 seconds.
6B.	Draw the Nyquist plot $G(s) = \frac{1}{s(s+1)(s+2)}$ and find gain margin.
	(5+5)

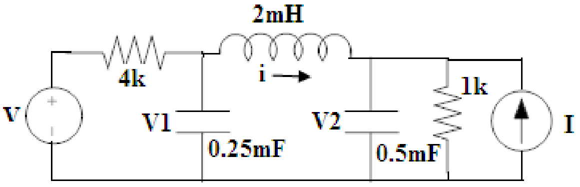

Fig. 1A

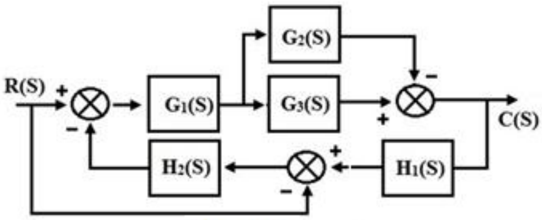

Fig. 1B

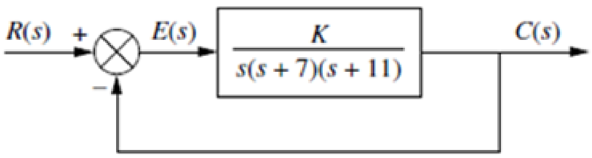

Fig. 2A

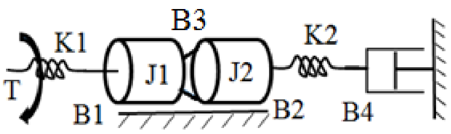

Fig. 3A

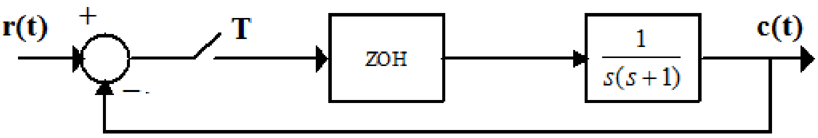

Fig. 6A