Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (AERONAUTICAL/AUTOMOBILE ENGINNERING)
END SEMESTER EXAMINATIONS, JULY 2017

SUBJECT: LINEAR CONTROL THEORY [AAE2204]

REVISED CREDIT SYSTEM

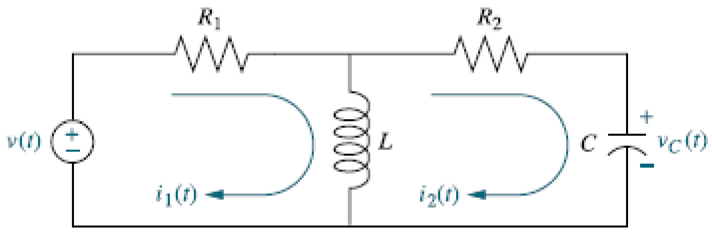
(21/06/2017)

Time: 3 Hours | MAX.MARKS: 50

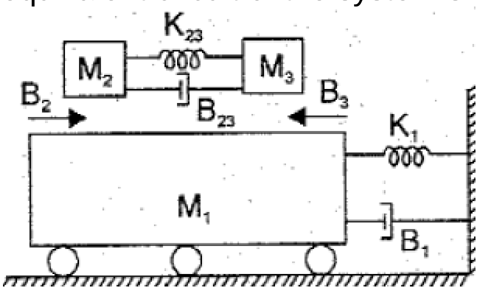
Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

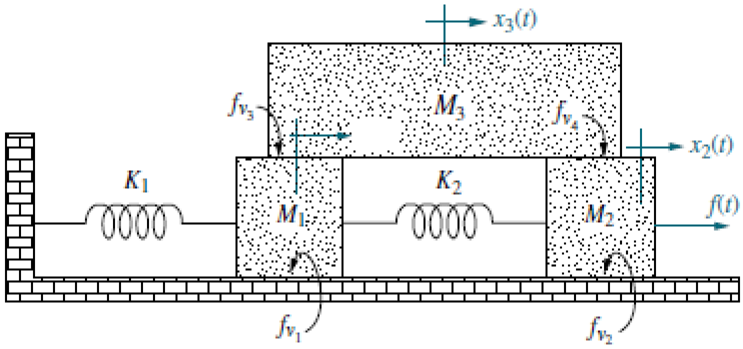
1A. Find the transfer function of the system shown figure shown below **(03)**



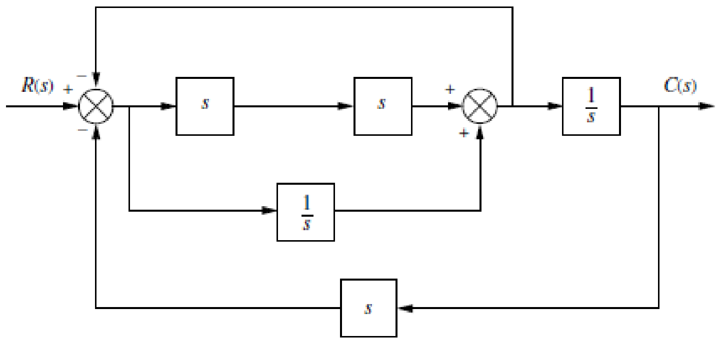
1B. Draw the force-voltage equivalent circuit of the system shown in figure shown **(05)**



1C. Write down the governing differential equation of the system shown below **(02)**

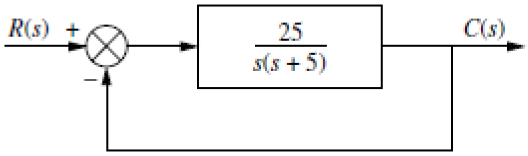


2A. Find the equivalent transfer function, T(s)= C(s)/R(s), for the system shown in Figure **(04)**

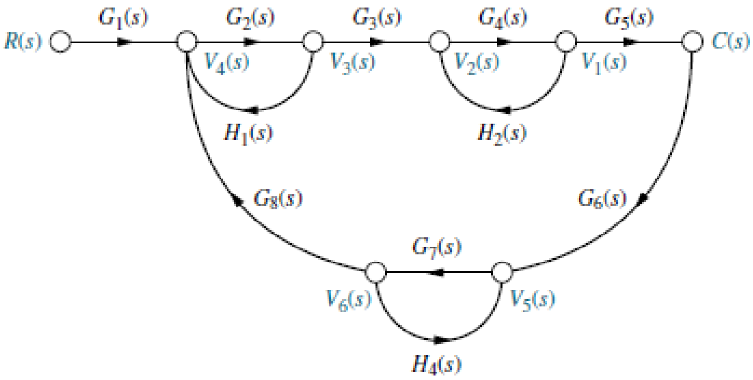


2B. The closed loop transfer function of a first order system is given by $\frac{C(s)}{R(s)} = \frac{1}{(Ts+1)}$. Determine its response to a unit step input. **(02)**

2C. For the system shown in figure below, find the peak time, percent overshoot, and settling time. **(04)**



3A. Find the transfer function, C(s)/R(s), for the signal-flow graph shown below **(05)**



3B. What is the physical significance of gain margin and phase margin **(02)**

3C. Open loop transfer function of a unity feedback system is given by, **(03)**
$G(s) = \frac{10(s+3)}{s^3(s+1)}$. Determine the position, velocity, and acceleration error constants.

4A. Draw the Asymptote plots for the transfer function **(05)**

$$G(s) = \frac{K(s+3)}{s(s+1)(s+2)}$$

4B. Draw the nature of the polar plot for a type 0 and order 3 system and type 1 order 1 system. **(02)**

4C. Determine if the system given the polynomial below is stable. **(03)**

$$s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 24s^2 + 23s + 15 = 0$$

5A. Sketch the Root locus for the following open loop transfer function. **(05)**

$$G(s) = \frac{K}{s(s^2 + 6s + 10)}$$

5B. Derive the state space representation of a typical spring-mass-dashpot system **(03)**

5C. Derive the transfer function model from the given linear state space model **(02)**

$$\begin{bmatrix}\dot{x}_1 \\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1 \\ -3 & -2\end{bmatrix}\begin{bmatrix}x_1 \\ x_2\end{bmatrix} + \begin{bmatrix}0 \\ 1\end{bmatrix}u \; ; \; y = \begin{pmatrix}1 & 0\end{pmatrix}\begin{bmatrix}x_1 \\ x_2\end{bmatrix} + (0)u$$