Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: CONTROL THEORY [AAE 353]

REVISED CREDIT SYSTEM

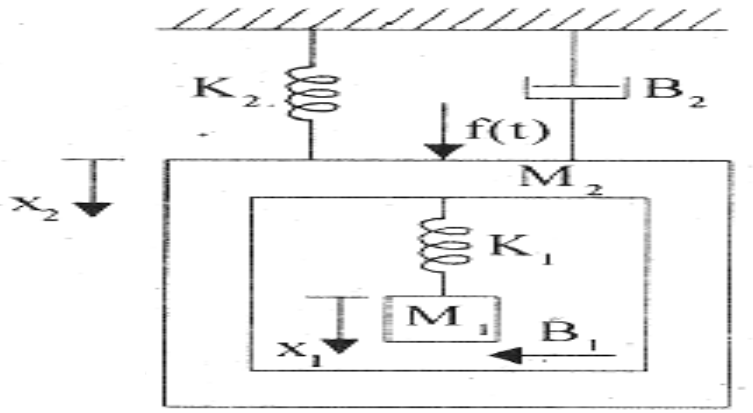
Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A. Draw and explain the functioning of an automobile driving control system. **(2)**

1B. Derive the mathematical model of the system shown below. **(5)**



1C. What is the use of finding transfer function of a system? Explain with proper derivation. **(3)**

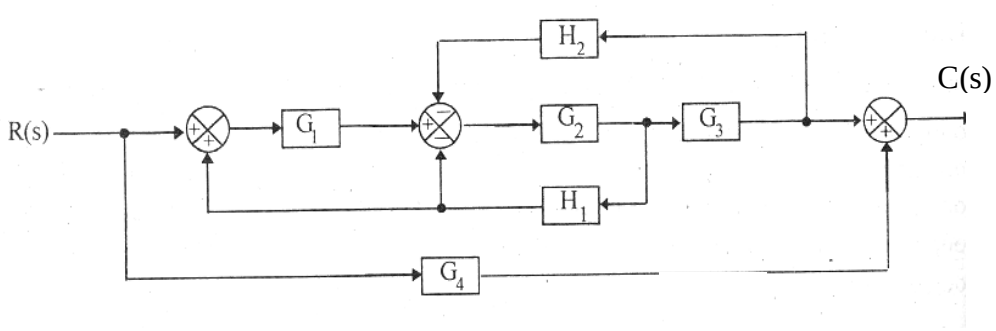
2A. Derive the state space form of armature controlled DC motor. **(3)**

2B. Derive the state space form of $H(s) = \frac{s^3+7s^2+12s+4}{(s^2+2s+1)(s^2+3s+1)}$ **(5)**

2C. How to convert state space form to transfer function? **(2)**

3A. Define controllability. Also explain Kalman's test for controllability. **(2)**

3B. Find the transfer function of the system below using Masons gain formula. **(5)**



3C. Explain any eight rules for reducing a block diagram. **(3)**

4A. For a closed loop system **(4)**

$$G(s) = \frac{16}{s(s+0.8)}$$, H(s)= Ks+1

What is the response to a unit step input? If damping ratio is 0.5, calculate the peak time, rise time, settling time and peak overshoot.

4B. Check the stability using Routh Hurwitz method for the system **(2)**

$$s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$$

4C. Consider a unity feedback system with closed loop transfer function **(4)**

$\frac{Ks+b}{s^2+as+b}$. Find the open loop transfer function .Also show that steady state error for an unit ramp input is $\frac{a-K}{b}$

5A. Draw the root locus of **(5)**

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

5B. Explain The terms gain margin and phase margin. **(3)**

5C. Explain various types of controllers with suitable diagrams and equations. **(2)**

6A. Design a lag compensator for the system **(5)**

$G(s) = \frac{K}{s(1+2s)}$ so that phase margin is 40 degrees and steady state error for ramp input is less than 0.2

6B. Explain the lead compensator design steps using root locus. **(3)**

6C. Explain various noise models used in control system analysis and design. **(2)**