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

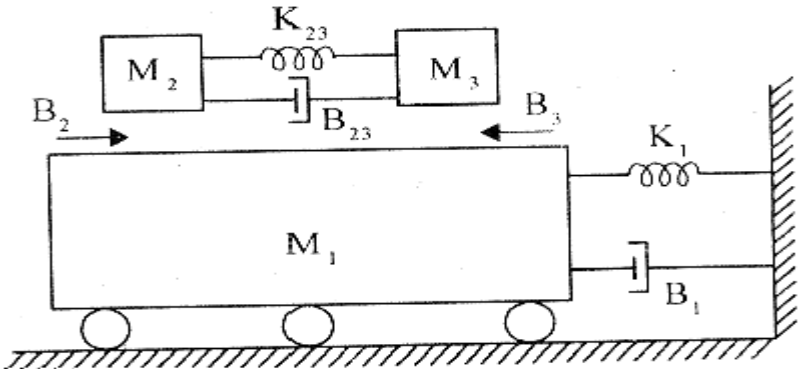
Instructions to Candidates:

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

1A. Explain the basic structure of feedback control system. **(2)**

1B What are the basic elements used for the mechanical modelling of systems? **(3)**

1C Derive the mathematical model of the given system. **(5)**



2A Derive the state space model of field controlled DC motor. **(3)**

2B. Find the state space form of the transfer function **(5)**

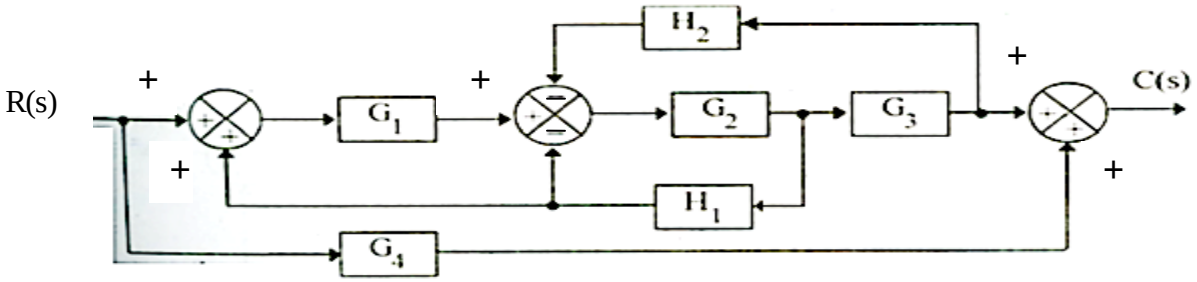
$$\frac{24}{s^3+9s^2+26s+24}$$

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

3A. Define observability. Explain Kalman's test for observability. **(2)**

3B. Explain Mason's gain formula. Write all the relevant equations and briefly explain each term. **(3)**

3C. Find the closed loop transfer function of the system given below using block reduction technique. **(5)**



4A. A unity feedback closed loop system has open loop transfer function, $\frac{0.4s+1}{s(s+0.6)}$.Find the response to unit step input. Also find time response specifications. **(3)**

4B. Check the stability of the system using Routh Hurwitz technique **(3)**

$$s^5+s^4+4s^3+24s^2+3s+63=0$$

4C. A unity feedback system has the forward transfer function **(4)**

$G(s) = \frac{K1(2s+1)}{s(5s+1)(1+s)^2}$ .When the input is r (t) =1+6t, determine the value of K1 so that the steady state error is less than 0.1.

5A. Draw the Bode plot and find the value of K for gain cross over frequency 5 rad/sec. **(5)**

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$$

5B. How to find angles of arrival and departure in the case of root locus method? **(2)**

5C. Explain various types of controllers with suitable diagrams and equations **(3)**

6A. Explain the process of lag compensator design using Bode plot. **(3)**

6B. Plant transfer function is $\frac{K}{s(s+8)}$Design a compensator that maintains peak overshoot 16.5%,but reduces the settling time by a factor of 2. **(5)**

6C. Explain non-minimum phase systems. **(2)**