Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University, Manipal – 576 104

V SEM. B.TECH. (MECHANICAL ENGINEERING) DEGREE END SEM (MAKE UP) EXAMINATIONS DECEMBER 2015/JANUARY 2016

SUBJECT: AUTOMATIC CONTROL ENGINEERING (MME 343)
REVISED CREDIT SYSTEM

Time: 3 Hours. (08/01/2016) MAX.MARKS: 50

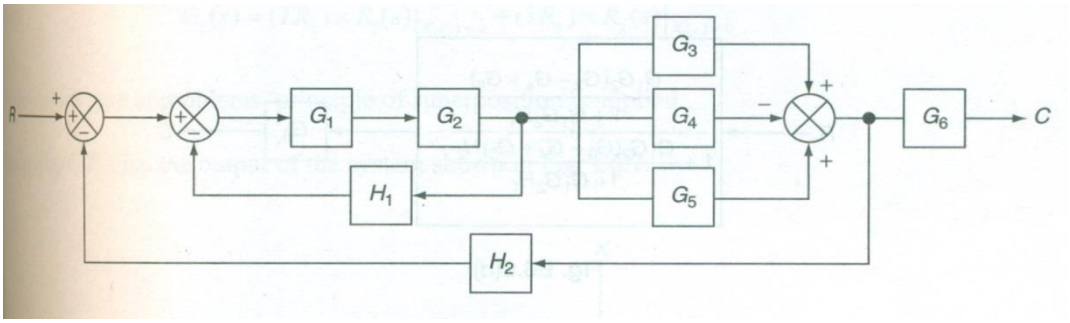
Instructions to Candidates:

- Answer **ANY FIVEFULL** questions.

1A) Explain with suitable example the working of a multi variable control system **(05)**

1B) Draw the Niquist diagram of a control system which has a open loop transfer function G(s)H(s) = $\frac{10(s+3)}{(s)(s-1)}$. Ascertain the stability of closed loop system . **(05)**

2A) Simplify the block diagram given in Fig Q2A , and determine the overall transfer function.



(05)

Fig Q2A

2B) Derive the expression for the time response of a second order underdamped control system for unit step input. **(05)**

3A) Examine the stability of the closed loop control system with the characteristic equation $s^5 + s^4 + 3s^3 + 3s^2 + 4s + 8 = 0$ using Routh's stability criteria. **(03)**

3B) Plot the Bode diagram for the unity feed back control system with the open loop transfer function G(s) = $\frac{2.5(2+s)}{s^2(1+s)}$ and comment on the stability of the closed loop system. **(05)**

3C) Write note on closed loop direct digital control system . **(02)**

4A) Plot the root locus or a unit feedback system with the feed forward transfer function G(s) =$\frac{K}{s(s+4)(s^2+4s+20)}$ and determine the marginal value of K for stability **(05)**

4B) Determine the state transition matrix for the matrix A =$\begin{bmatrix} 4 & -2 \\ 0 & 5 \end{bmatrix}$ **(05)**

5A) What is the difference between static and dynamic error constants ? Explain. **(02)**

5B) Determine the transfer function of the water level systems shown in Fig Q 5B. **(04)**

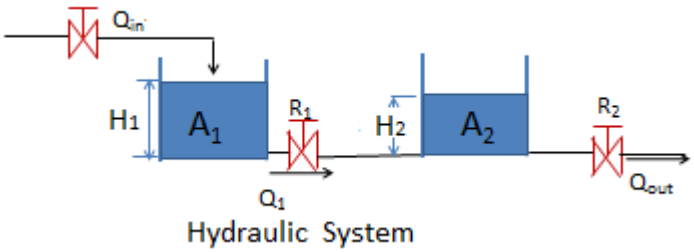


Fig Q 5B.

5C) A D –C motor with load J Kg-m^2 and damping C N-s-m/rad . The torque constant is K_t. An integral control K_i is introduced in series. With the help of block diagram , show that the steady state error for unit step input $e_{ss} = \frac{C}{K_i K_t}$. **(04)**

6A) A control system has the feed forward transfer function G(s) = $\frac{K}{s(s+3)}$ and feed back transfer function H(s) =1. For this system, determine the minimum value of K to keep the steady state error with in 0.06 when subjected to a ramp input 0.2t. **(03)**

6B) Define the following,

i) Maximum peak overshoot ii) rise time iii) settling time for a second order underdamped system. **(03)**

6C) Design a compensator for a closed loop control system which has G(s) = $\frac{1}{s(s+1)}$ to satisfy the following conditions i) Phase margin is atleast 45^0 and ii) steady state velocity error <0.01 for unit ramp input. **(04)**