Seat No.: _____                                          Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY
## B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

**Subject code: 161905**                                          **Date: 07/01/2013**
**Subject Name: Control Engineering**
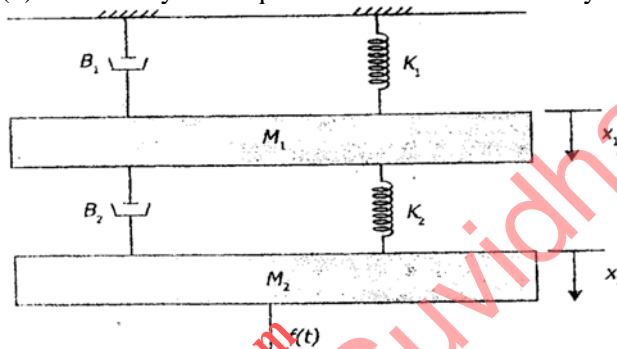**Time: 02.30 pm - 05.00 pm**                                 **Total Marks: 70**
**Instructions:**
1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1 (a)** (1) Define the following term.                                          **02**
   I.   Open loop control.
   II.  Close loop control.

(2) Obtain a system equation for the mechanical system shown in figure.          **05**



**(b)** Solve the block diagram shown in Figure Obtain its transfer function.          **07**



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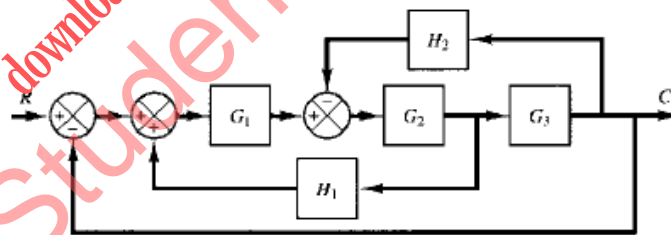
**Q.2 (a)** (1) What is the mathematical model?                                          **02**

(2) Obtain Transient response of first order systems to unit step input and obtain     **05**
the value of steady state error.

**(b)** What is a signal flow graph? What are Properties of signal flow graph? State     **07**
and explain Mason's gain formula for signal flow graph.
                                              **OR**
**(b)** Sketch the root loci for the following system.                                          **07**

$$G(s) = \frac{K}{s(s + 1)(s + 2)}, \qquad H(s) = 1$$
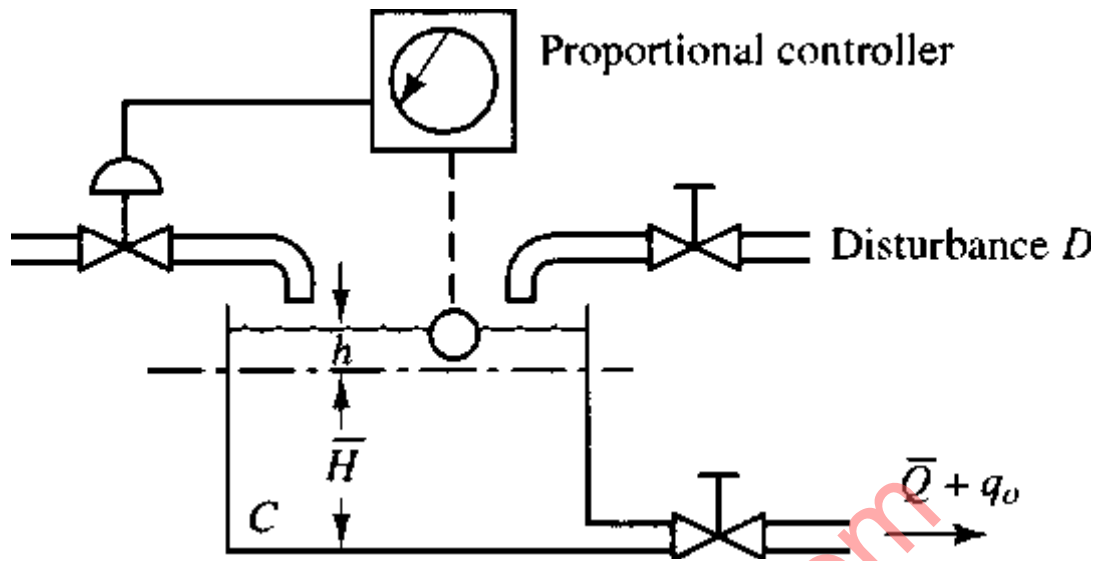
                                                                         P.T.O.

1

**Q.3** **(a)** (1) Define the following term. **02**
  I. Rise time.
  II. Delay time.

      (2) An unity feedback system has a loop transfer function **05**
$$G(s) = 10(S+1)/S(S+2)(S+5)$$
Determine:
  I. Stability gain.
  II. Step, ramp, parabolic error coefficient.

**(b)** Write a short note on state space representation of a control system. **07**
<div align="center"><strong>OR</strong></div>

**Q.3** **(a)** (1) State 'Angle condition' and 'Magnitude condition' of root locus method. **02**

      (2) Explain in detail about Proportional control action.

**05**

**(b)** Define programmable logic controller. What are the components of PLC? State **07** the Advantages & Disadvantages of it.

**Q.4** **(a)** (1) What is root locus method? **02**

      (2) Write a short note on Adaptive Control System. **05**

**(b)** Describe a DC servomotor control system. Draw the simplified block diagram **07** of the DC servo motor system. Derive the transfer function for the above system.
<div align="center"><strong>OR</strong></div>

**Q.4** **(a)** (1) Define Fuzzy Logic. **02**

      (2) Compare hydraulic and pneumatic control system. **05**

**Q.4** **(b)** Describe working of hydraulic proportional plus derivative controller and **07** derive expression for its performance.

**Q.5** **(a)** (1) Define hydraulic system. **02**
      (2) Write short note on Dashpots. **05**

**(b)** Describe working of hydraulic speed control for i.c. engine and derive **07** expression for its performance.

<div align="center"><strong>OR</strong></div>

**Q.5** **(a)** (1) Define following term **02**
  I. Proportional lag.
  II. Controlled lag.
    (2) Find the stability of control system having following characteristic **05** equation.

$$a(s) = s^6 + 4s^5 + 3s^4 + 2s^3 + s^2 + 4s + 4.$$

<div align="right">P.T.O.</div>

**(b)** Consider the liquid-level control system shown in Fig. Assume that the set **07** point of the Controller is fixed. Assuming a step disturbance of magnitude Do, determine the error. Assume that Do is small and the variations in the variables

<div align="right">2</div>

from their respective steady-state values are also small. The controller is proportional. If the controller is not proportional, but integral, what is the steady-state error?



Proportional controller

Disturbance $D$

$h$

$\bar{H}$

$C$

$\bar{Q} + q_o$

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