USN | | | | | | | | | | |

06ME71

Seventh Semester B.E. Degree Examination, June/July 2011
Control Engineering

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Missing data may be suitably assumed.

PART – A

1 a. With suitable example the explain regulator system and follow-up system. **(06 Marks)**

b. What are the requirements of an ideal control system? Explain them. **(04 Marks)**

c. Discuss, giving equations, the effect of the following controller on the system:
i) Proportional plus derivative controller, ii) Proportional plus Integral controller. **(10 Marks)**

2 a. Obtain the transfer function $\frac{Y_1(S)}{F(S)}$ of the mechanical system shown in Fig. Q2 (a) and draw a schematic diagram of an equivalent electrical circuit using force-voltage analogy. **(12 Marks)**

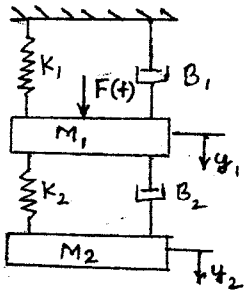


Fig. Q2 (a)

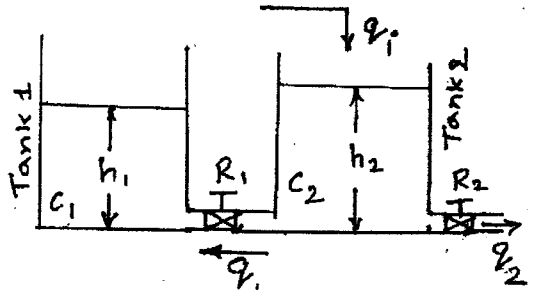


Fig. Q2 (b)

b. Fig. Q2 (b) shows the liquid level system in which q is flow rate, C is hydraulic capacitance, R is hydraulic resistance and h is head of liquid. Obtain the transfer function $\frac{Q_2(S)}{Q_i(S)}$. **(08 Marks)**

3 a. Obtain the closed loop transfer function of the block diagram shown in Fig. Q3 (a).

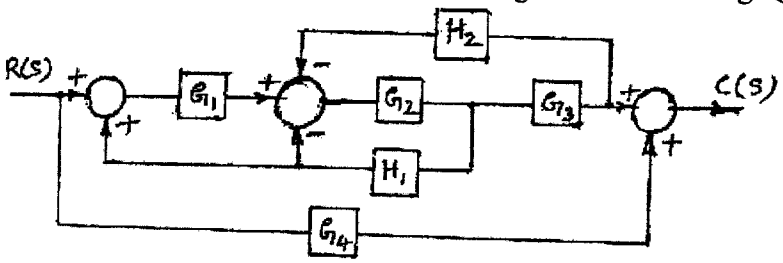


Fig. Q3 (a)

b. For the signal flow graph shown in Fig. Q3 (b), determine C/R using mason's gain formula. **(10 Marks)**

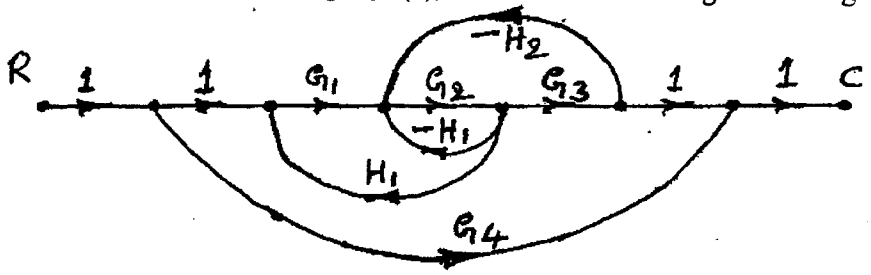
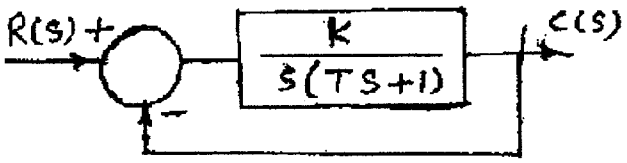


Fig. Q3 (b) **(10 Marks)**

4 a. A second order control system is represented by the differential equation; $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} = 4 \times x(t)$; $y(o) = \dot{y}(o) = 0$. Obtain its total response for unit step input. **(08 Marks)**

b. When the system shown in Fig. Q4 (b) is subjected to a unit step input, it responds as shown. Determine the value of K and T from the response curve.



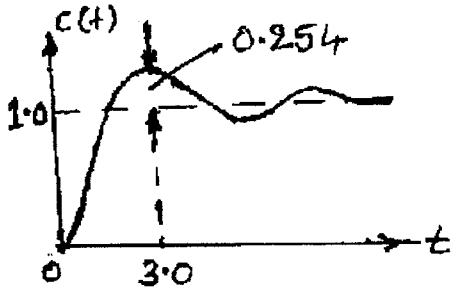


Fig. Q4 (b) **(06 Marks)**

c. The characteristic equation of a system is given by $S^2+6S^3+11S^2+K=0$. Determine the range of K for the system to be stable. Use Routh criterion **(06 Marks)**

PART – B

5 a. Sketch the polar plot for $GH(S) = \frac{1}{(S+P_1)(S+P_2)}$ where $P_1, P_2 > 0$. **(05 Marks)**

b. The OLTF of a system is given by $GH(S) = \frac{K(T_1S+1)}{S^2(T_2S+1)}$; $K, T_1, T_2 > 0$.

Sketch the Nyquist plot for $T_1 < T_2$ and ascertain system stability. **(15 Marks)**

6 A unity feedback system has $G(S) = \frac{K}{S(S+1)(S+10)}$. Draw Bode plot and determine the value of K so that the gain margin of the system is 20db. **(20 Marks)**

7 Draw the root locus plot using guidelines for the OLTF

$G(S)H(S) = \frac{K(S+2)}{S(S^2+2S+2)}$ Discuss stability of the system as a function of K. **(20 Marks)**

8 a. Explain the need for system compensation. List the types of compensators used. **(10 Marks)**

b. Write notes on:

i) Lag Compensator.

ii) Lead Compensator. **(10 Marks)**

* * * * *