ACHARYA INSTITUTE OF TECHNOLOGY
Bangalore - 560090

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

10ME/PM82

Eighth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Control Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define: i) System; ii) Controller; iii) Open loop system; iv) Closed loop system; v) Feed back, with examples. **(05 Marks)**

b. With the help of block diagram, explain i) PI ii) PID. **(10 Marks)**

c. List the advantages and disadvantages of i) Proportional controller; ii) Integral controller. **(05 Marks)**

2 a. Write the differential equations governing the mechanical system shown. Also draw F-V and F-C analogous circuits. **(14 Marks)**

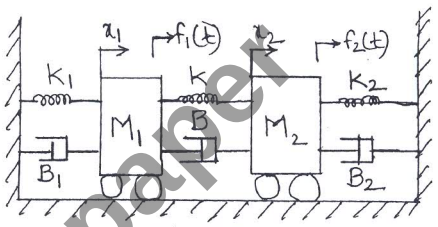

Fig.Q.2(a)

b. Obtain the transfer function for the given thermal system. **(06 Marks)**

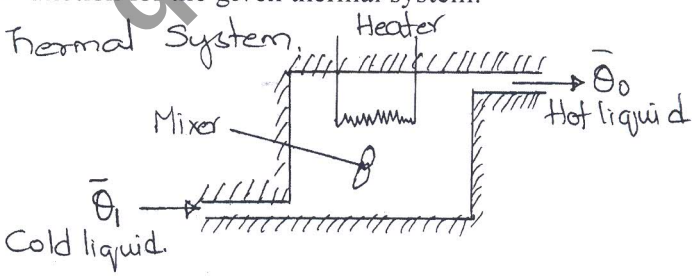

Fig.Q.2(b)

3 a. Reduce the block diagram and obtain control ratio $\frac{C(s)}{R(s)}$. **(10 Marks)**

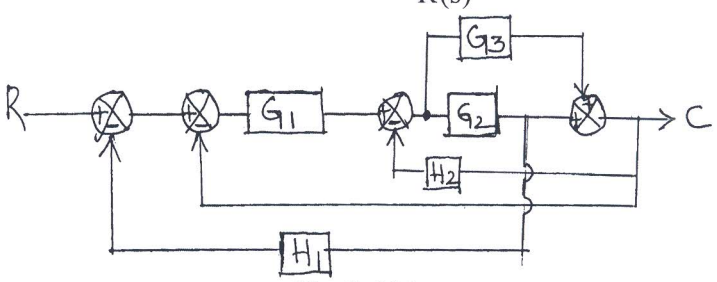

Fig.Q.3(a)

b. Obtain the overall TF $\frac{C(s)}{R(s)}$ of the SFG given: **(10 Marks)**

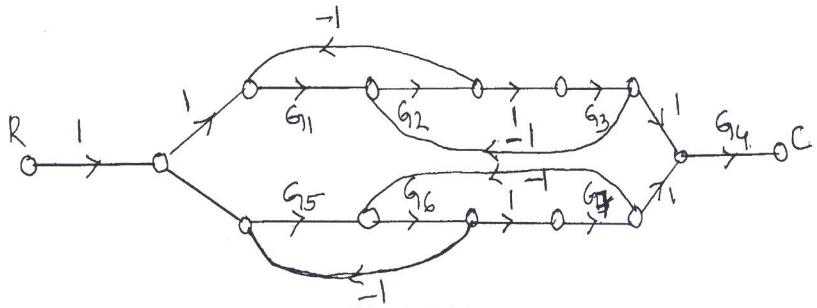

Fig.Q.3(b)

4 a. Define: i) Time response; ii) Step signal; iii) Ramp signal; iv) Parabolic signal; v) Impulse signal. **(05 Marks)**

b. Derive an expression for response of 1st order system for unit step input. **(05 Marks)**

c. A unity feedback CS has an OLTF $G(s) = \frac{10}{s(s+2)}$. Find tr, $\%M_p$, t_p, t_s for a step input of 12 units. **(05 Marks)**

d. Using R-H criterion, determine the stability of the system represented by the characteristic equation $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$. **(05 Marks)**

PART – B

5 a. Construct a Nyquist plot for a feedback control system whose OLTF is given by $G(s)H(s) = \frac{5}{s(1-s)}$. Comment on the stability of open loop and closed loop system. **(14 Marks)**

b. Define with respect to Nyquist plot, i) Gain Margin; ii) Phase Margin; iii) Relative stability. **(06 Marks)**

6 Sketch the bode plot for the following TF and determine phase margin and gain margin.

$$G(s) = \frac{75(1+0.2s)}{s(s^2+16s+100)}.$$ **(20 Marks)**

7 Sketch the root locus for UFB system whose open loop TF.

$$G(s) = \frac{K}{s(s^2+6s+10)}.$$ **(20 Marks)**

8 a. Define: i) State; ii) State variables; iii) State space; iv) State trajectory; v) State vector. **(05 Marks)**

b. Write a note on: i) Lag compensator; ii) Lead compensator. **(10 Marks)**

c. Explain the following terms with examples: i) Controllability; ii) Observability. **(05 Marks)**

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