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06ME71

Seventh Semester B.E. Degree Examination, December 2012
Control Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART - A

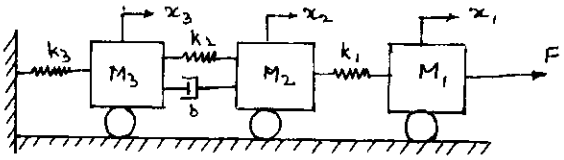
1 a. Distinguish between open loop and closed loop control systems, with suitable examples. **(06 Marks)**

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

c. What is control action? Briefly explain proportional, proportional plus derivative and proportional plus derivative plus Integral controllers, with the help of block diagrams. **(10 Marks)**

2 a. Write down the governing equations for the mechanical system shown in fig.Q2(a). Also sketch, equivalent Force – voltage and Force – current circuits using analogues quantities. **(13 Marks)**

Fig.Q2(a)



b. With the help of circuit diagram for armature controlled D – C motor, obtain transfer function, which relates angular displacement, θ of motor shaft to the armature input voltage, e_i. **(07 Marks)**

3 a. What are basic inputs subjected to control system? Which one is studied exhaustively in your syllabus and why? **(03 Marks)**

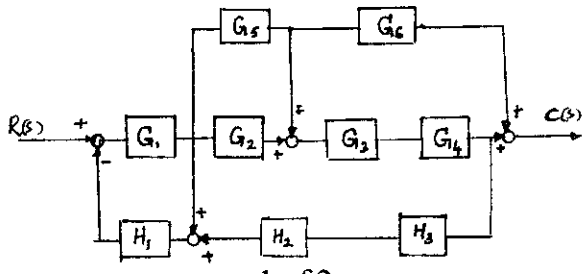
b. Obtain the expression for response of a second order system subjected to step input, when the damping ratio of the system is less than ONE. **(08 Marks)**

c. A under damped second order system is subjected to a step input of 4 units. If the first peak overshoot of 25% occurs at a time equal to 0.8 seconds, determine **(04 Marks)**
i) Rise time ii) Settling time iii) Damping coefficient and iv) Natural frequency.

d. Using R – H criteria, determine the stability of the system whose characteristic equation is given by $S^4 + 8S^2 + 4S + 12 = 0$. **(05 Marks)**

4 a. Reduce the block diagram given in fig. Q4(a) using block diagram reduction techniques and obtain control ratio, $\frac{C(s)}{R(s)}$. **(10 Marks)**

Fig.Q4(a)



b. What is MASON's gain formula? Using the same obtain the over all transfer function, $\frac{Y(s)}{X(s)}$ of the signal flow graph, given in fig. Q4(b). **(10 Marks)**

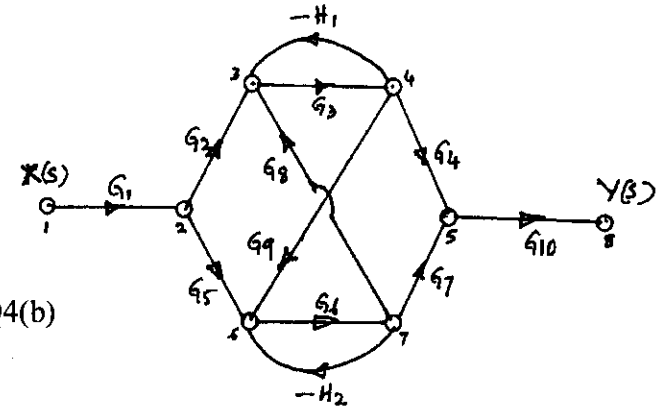


Fig.Q4(b)

PART - B

5 a. Draw the polar plot for the following system

$GH = \frac{20(s+5)}{(s+1)(s+2)(s+8)}$. **(06 Marks)**

b. Determine the stability of the system with

$GH = \frac{(s+6)}{(s+2)(s-1)}$, using Nyquist stability criterion. **(14 Marks)**

6 Construct Bode diagram for a feed back control system having its open loop transfer function. $GH \frac{100(10s+1)}{s(s+0.4)(s+1)(s+10)}$. Also determine gain margin and phase margin if the system is stable. **(20 Marks)**

7 The open loop transfer function of a feed back control system is given below :

$GH = \frac{K(s+1)}{S^2(s+10)}$. Construct the root locus plot and determine the range of 'K' for which the system is stable. **(20 Marks)**

8 a. What is system compensation? Briefly explain the i) Series compensation ii) Feed back compensation. **(08 Marks)**

b. Explain the following compensating systems by locating the respective poles and zeros on complex plane and also present their effect on rough bode plots.

i) Lag – compensation ii) Lead – compensation. **(12 Marks)**

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