Code :R7311003

R7

III B.Tech I Semester(R07) Supplementary Examinations, May 2011
CONTROL SYSTEMS
(Electronics & Instrumentation Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE questions
All questions carry equal marks
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1. (a) Distinguish between open loop and closed loop systems. Explain merits and demerits of open loop and closed loop systems.
   (b) For the given lever systems in Fig P1, determine the equation relating f and x.

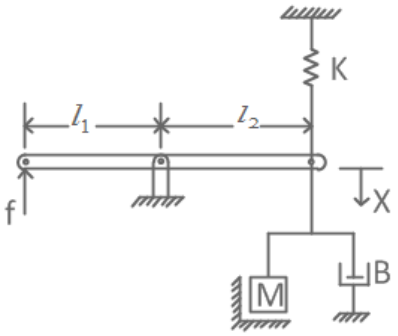

Fig.P1

2. (a) Find the transfer function of the system shown in Fig P2.

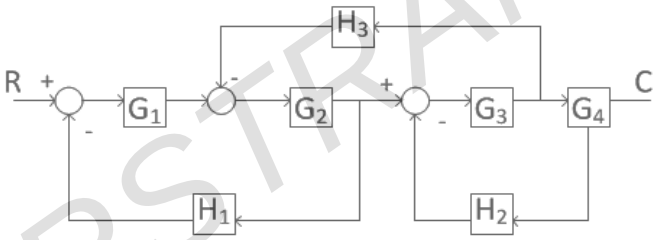

Fig P2

   (b) Find the transfer function of a field controlled d.c Servo Motor.

3. (a) Derive the time domain specification for a standard second ordered system.
   (b) A unit feedback system is characterized by an open-loop transfer function $G(s) = \frac{K}{s(s+10)}$. Determine the gain K so that the system will have a damping ratio of 0.6. For this value of K determine settling time, peak overshoot and times to peak overshoot for a unit-step input.

4. (a) The characteristic equation of a feedback control systems is $s^3 + (K + 0.5)s^2 + 4Ks + 50 = 0$. Using R-H criterion determine the value of K for which the systems is stable.
   (b) Determine (i) the number of root loci (ii) Number of asymptotes (iii) root loci on the real axis if any for the following: $GH(s) = \frac{K(s+1)}{s^3(s+2)(s+3)}$

5. Construct a Bode plot for the system whose open-loop transfer function is given by $G(s)H(s) = \frac{4}{s(1+0.5s)(1+0.08s)}$ and determine (a) the gain margin, (b) phase margin and, (c) the closed -loop stability.

6. (a) Explain the Nyquist criterion for assessing the stability of a closed loop system.
   (b) Sketch the Nyquist plot for the transfer function: $G(s)H(s) = \frac{52}{(s+2)(s^2+2s+5)}$ Discuss its stability.

7. (a) Explain the tuning sequences of PID controllers.
   (b) Explain the performance comparison between the Lead and Lag comparators.

8. Explain the properties of state transition matrix. A linear time invariant system is described by the state equation $\dot{X} = \begin{bmatrix} 0 & 6 \\ -1 & 5 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} [u]$ and $y = [\ 1 \quad 0\ ]\, X$, $X(0) = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ obtain the state transition matrix, hence obtain the output response $y(t), t \geq 0$ for a unit step input.

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