Code: R7 311003

R7

B.Tech III Year I Semester (R07) Supplementary Examinations, May 2012

CONTROL SYSTEMS

(Electronics and Instrumentation Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE questions

All questions carry equal marks

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1 (a) List the differences between open loop and closed loop control systems.

(b) For the mechanical translational system shown below in figure (1). Find transfer function $\frac{X_2(S)}{F(S)}$.

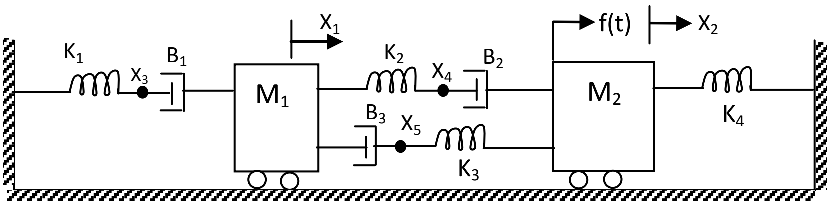

Figure 1

2 Find the overall transfer function of the system whose signal flow graph shown in figure (2).

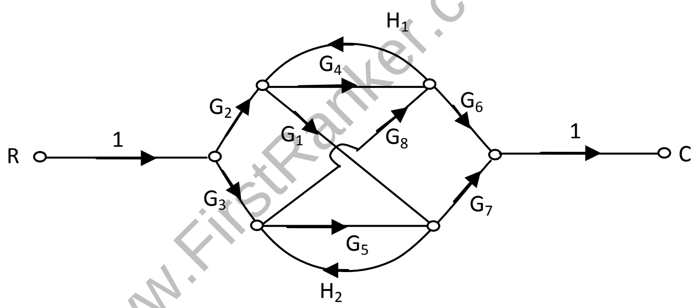

Figure 2

3 (a) What are the standard test signals? Give their representations mathematically and graphically.

(b) Find the steady state error for unit step, unit ramp and unit parabolic inputs for the system: G(S)= $\frac{1000(S+1)}{(s+10)(S+50)}$

4 (a) State and explain Routh-Hurwitz stability criterion.

(b) Consider the characteristic equation: $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$, comment on its stability.

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5 (a) Draw the Bode magnitude plot for the system having transfer function:

$$G(S)=\frac{2000(S+1)}{S(S+10)(S+40)}$$

(b) Explain the significance of Bode plots in stability studies of linear control systems.

6 Sketch the Nyquist plot and determine there from the stability of the following open loop transfer function of unity feedback control system: G(S) H(S) = $\frac{K\,(S+2)}{S^2\,(S+1)}$.

7 Design a lead compensator for a unity feedback system with openloop transfer function G(S) = $\frac{K}{S(S+1)(S+5)}$,to satisfy the following specifications.

(a) Velocity error constant, $K_v \geq 50$.

(b) Phase margin $\geq 20^0$.

8 The state model of a system is given by

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}1 & 0 & 2\\ -1 & 1 & 1\\ 0 & 3 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}1\\ 1\\ 0\end{bmatrix}u \text{ and } y=\begin{bmatrix}1 & 0 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}.$$

Transform this state model into a canonical state model, also compute the state transition matrix.

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