TEC-501 13 Printed Pages : 3

Roll No. to be filled in your Answer Book

Roll No. | | | | | | | | | | | |

Semester: V

B. Tech End Semester Examination Dec 2014

AUTOMATIC CONTROL SYSTEMS

Time: 3 Hours **MM. 100**

Q.1 Attempt any *four parts* (5x4=20)

(1) Define analogous systems. Out of two electrical analogies for mechanical system. Discuss force voltage analogy.

(2) What do you understand by observer system? Explain in brief.

(3) The characteristic equation of given system is

$$S^4 + 6S^3 + 11S^2 + 6S + K = 0$$

Using the Routh stability criterion, determine the range of 'K' for which the system will be stable.

(4) Determine the solution of state equation

$\square = AX + Bu$, if $X(0) = X_0$

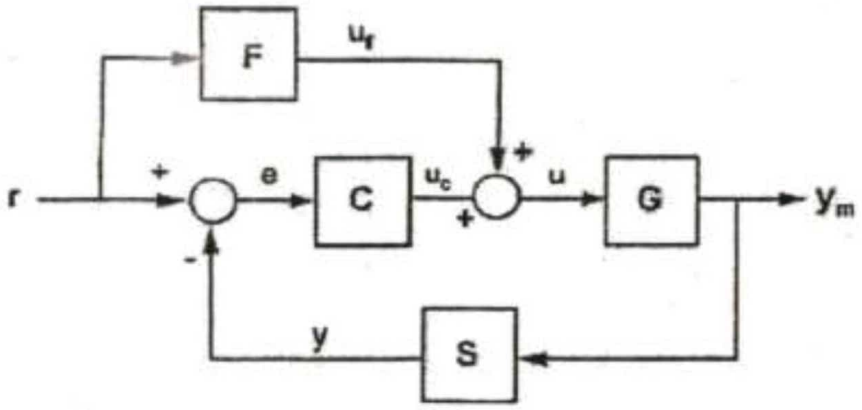
In the time interval $t \square [t_o\ t_f]$.

(5) Derive the formula for peak overshoot, rise time and peak time.

(6) Explain the effect of feedback on sensitivity, gain, and system stability.

Q.2 Attempt any *four parts* (5x4=20)

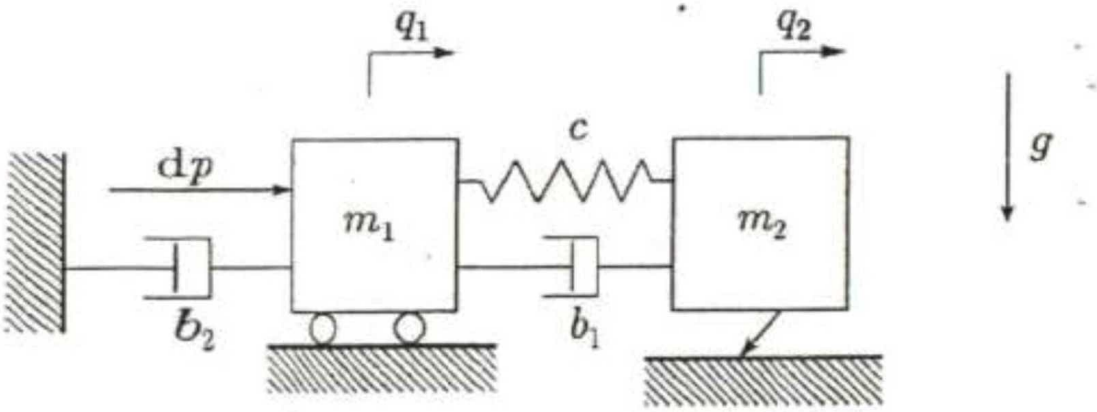
(1)Using block diagram reduction technique .Determine the ratio y_m/r, for the system representation in given figure.



(2)Discuss the functioning of hydraulic proportional controller

(3)Write short notes on rules of root locus.

(4)Determine the value of force applied from left side of the given figure



(5)Write short note on polar and inverse polar plots.

(6) Determine error coefficient for the system having.

$$G(S)/H(S) = (S+2)/S\,(1+0.5S)\,(1+0.2S)$$

Q.3 Attempt any *two parts* (10x2=20)

(1) Establish the correlation between the time response and frequency response analysis & suitably explain with diagrams.

(2) Consider a type -1 unity feedback system with an open loop transfer function: $G(s) = K/s(s+1)$
It is desired to have the velocity error constant K=10 and the phase margin of the system be at least 45^0. Design a suitable lead compensator.

(3) Using nyquist criterion investigate the stability of a closed loop control system whose open loop transfer.

$$G(s)\,H(s) = K/s\,(sT_1+1)\,(sT_2+1)$$

Q.4 Attempt any *two parts* (10x2=20)

(1) What are controllability & observability of control system? Give the methods of their testing? What is the importance of controllability and observability in the design of control system?

(2) Sketch the asymptotic Bode plot for the transfer function given below.

$$G(s)/H(s) = 2(s+0.25)/s^2(s+1)\,(s+0.5)$$

From the bode plot determine

(i) the phase cross over frequency
(ii) the gain cross over frequency
(iii) the gain margin
(iv) the phase margin

Is the system stable?

(3) Discuss the working of the lag lead compensator. Sketch the bode plot of lag lead compensator. Give design steps of a lag compensator.

Q.5 Attempt any *two parts* (10x2=20)

(1) Construct the signal flow graph & obtain the state model for

$$C(s)/R(s) = 3/s^4+2s^3+3s+2$$

(2) For the open loop transfer function draw the root locus and determine the value of K

At s= -2 and comment as the stability & time response of the system.

$$G(s)\,H(s) = K(s+1)/(s^2+0.4s+0.4)$$

(3)Discuss the PD, PI &PID controllers with their application &their error constant