Code: 15A02303 **R15**

B.Tech II Year I Semester (R15) Supplementary Examinations June 2017

CONTROL SYSTEMS ENGINEERING

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

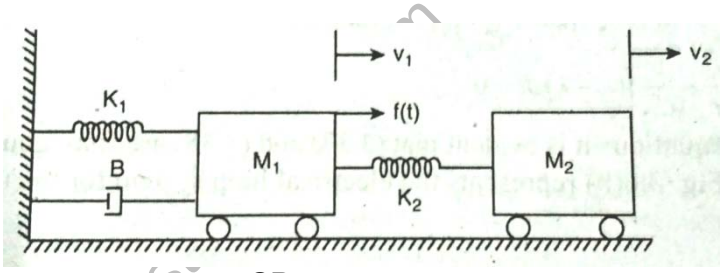
(a) What are the characteristics of negative feedback?
(b) What is the advantage of block diagram?
(c) Distinguish between Order and Type of system.
(d) What is steady state error?
(e) What are the necessary conditions for the stability of the system?
(f) Define the Root Locus.
(g) Define phase margin.
(h) When is compensation required?
(i) What is state model?
(j) State the Cayley-Hamilton theorem.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

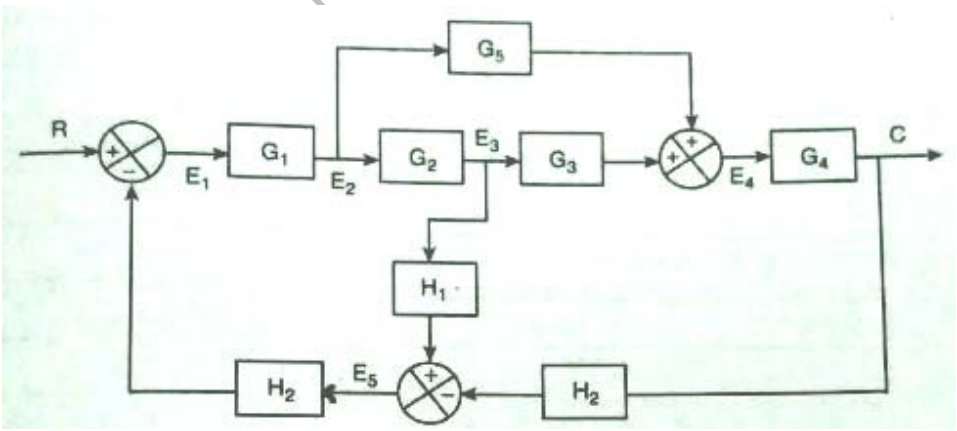
UNIT – I

2 For the given mechanical system, obtain the analogous electrical circuit based on Force-Voltage and Force-Current analogies.



OR

3 For the block diagram shown below, draw the signal flow graph and determine transfer function C/R.



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UNIT – II

4 A unity feedback system has G(s) = 1/s((1+s). The input to the system is described by r(t) = 4 + 6t + $2t^3$. Find the generalized error coefficients and hence steady state error.

OR

5 A unity feedback system has an open loop transfer function G(s) = 10/s(s+2). Find the rise time, percentage overshoot, peak time, timedelay and settling time for a unit input of 12 units.

UNIT – III

6 The forward path transfer function of a certain unity negative feedback system is given by GH(s)= k/s(s^2 +2s+2). Draw the root locus for 0≤ k ≤ ∞. Show how the value of K is determined at any point Q on the root locus.

OR

7 Determine the range of K for which the unity feedback system whose open loop transfer function G(s) = K/s(s^2 +s+1)(s+4) is stable and determine the frequency of sustained oscillations.

UNIT – IV

8 Sketch the Bode plot for the following transfer function and determine the system gain K for the crossover frequency ω_g to be: (i) 10 rad/s. (ii) 0.5 rad/s.

G(s)H(s) = K s^2 / (1+0.25s)(1+0.025s)

OR

9 Write the procedure for the Design of Lag compensator.

UNIT – V

10 Test the controllability and observability of the system described by:

$$\begin{bmatrix}\dot{x}1\\ \dot{x}2\end{bmatrix} = \begin{bmatrix}1 & 1\\ -3 & 1-2\end{bmatrix}\begin{bmatrix}x1\\ x2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$$

$$y = \begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x1\\ x2\end{bmatrix}$$

OR

11 Find the transfer function for the system which is represented in state space representation as:

$$\begin{bmatrix}\dot{x}1\\ \dot{x}2\\ \dot{x}3\end{bmatrix} = \begin{bmatrix}-2 & 1 & 0\\ 0 & -3 & 1\\ -3 & -4 & -5\end{bmatrix}\begin{bmatrix}x1\\ x2\\ x3\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u$$

$$y = \begin{bmatrix}0 & 1 & 0\end{bmatrix}\begin{bmatrix}x1\\ x2\\ x3\end{bmatrix}$$

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