Code: 9A02503

R09

B.Tech III Year I Semester (R09) Supplementary Examinations December 2015

CONTROL SYSTEMS

(Common to EEE, E.Con.E, EIE, ECE and MCT)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

(Polar graphs may be permitted in the examination hall)

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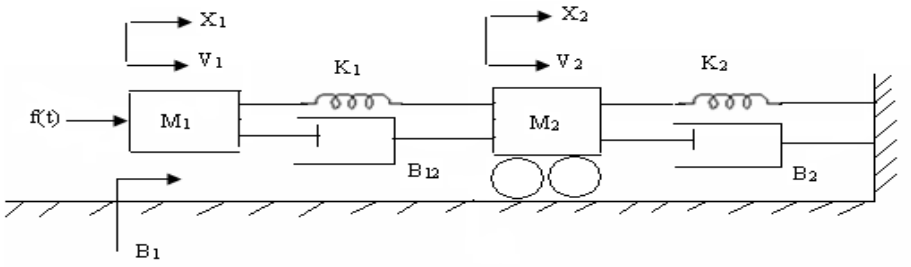
1 (a) Explain the feedback characteristics of a closed loop control system

(b) Write the differential equations governing the mechanical system shown in figure below.



2 Derive the transfer function for the field controlled D.C servomotor with neat sketch.

3 (a) What is meant by time response? Explain about: (i) Steady-state response. (ii) Transient response.

(b) Obtain the response of unity feedback system whose open loop transfer function is G(s) = 4/s(s+1) when the input is unit step.

4 Sketch the root locus of the following unity feedback system with:

$G(s) = K/(s(s+2)(s^2+2s+4))$

Find the value of K and the closed loop poles at which the damping factor is 0.6.

5 (a) What are the advantages of frequency response analysis?

(b) Draw the Magnitude Bode plot for the system having the following transfer function:

$G(s) = 5(1+2s)/[(1+4s)(1+0.25s)]$

6 Check the stability of the system by Nyquist criterion: $G(s) = 100/s(s+1)(s^2+2s+2)$.

7 Design a PID controller to satisfy the following specifications. For a unity feedback system with open loop transfer function G(s) = 10/(s+1)(s+20).

(i) $K_v \geq 4$.

(ii) Damping ratio = 0.7.

(iii) Natural frequency of oscillations = 2 rad/sec.

8 (a) State the properties of state transition matrix.

(b) Compute the state transition matrix for the following system.

$$\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} r(t)$$