Code No: RT31043 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, October/November- 2018

CONTROL SYSTEMS

(Common to Electronics and Communication Engineering and Electronics and Instrumentation Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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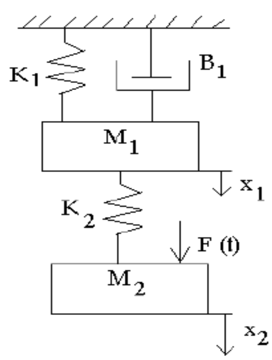
PART –A

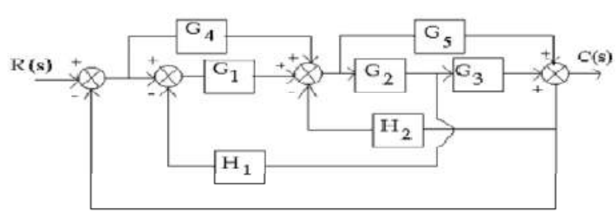
1. a) Explain advantages and disadvantages of positive and negative feedback in control system. [3M]
b) What are the advantages and disadvantages of Block diagram Reduction technique. [4M]
c) Explain PI and PD controller in time response of the system. [4M]
d) By adding a poles and zeros to the system, How the stability will be affected in root loci. [4M]
e) Explain Polar Plot for stability analysis. [3M]
f) What are the advantages of state space analysis and define state space model. [4M]

PART -B

2. a) Explain the differences between open loop and closed loop control system and write the effects of Feedback in control systems. [8M]
b) Write the dynamic equation in respect of the mechanical system given in Fig. Then using force-voltage analogy obtain the equivalent electrical network. [8M]



3. a) Derive the Transfer Function of DC Servo motor. [8M]
b) Determine the transfer function C(S)/R(S) for the block diagram shown in Fig below. [8M]



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4. a) Derive the expressions for rise time, peak over shoot, settling time of Second order system of unit step input. [8M]

   b) A unit feedback system is characterized by an open-loop transfer function G(s) = K/s(s+5). Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine settling time, peak overshoot and times to peak overshoot for a unit-step input. [8M]

5. a) Explain different conditions for stability using RH criteria. [4M]

   b) Sketch the root locus diagram for a unity feedback system with its open loop function as $G(S) = \frac{K(S+3)}{S(S^2+2S+2)(S+5)(S+9)}$ Thus find the value of K at a point where the complex poles provide a damping factor of 0.5. [12M]

6. a) Sketch the Bode plot for the open loop transfer function [10M]

$$G(s) = \frac{10(S+3)}{S(S+2)(S^2+4S+100)}$$

   b) Explain how Polar plot is used to fine out the stability of the system. [6M]

7. a) What do you mean by state transition matrix? And give its properties [8M]

   b) The state equation of a linear time-invariant system is given below [8M]

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} -2 & 0 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Determine the following:

i) State transition matrix ii) Controllability and observability of the system

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