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

III B. Tech I Semester Supplementary Examinations, May- 2019

CONTROL SYSTEMS

(Common to Electronics and Communication Engineering, 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**

~~~~~~

PART –A

1. a) Discuss the effects of feedback on system dynamics by unit feedback and regenerative feedback. Give suitable examples. [3M]
   b) Explain about Torque – Speed characteristics of a.c Servo motor. [4M]
   c) What are the different time domain specifications of a dynamical system? [4M]
   d) State the advantages and limitations of Routh's criterion. [4M]
   e) Explain how Polar plot is used to find out the stability of the system. [3M]
   f) What are the advantages and limitations of state space analysis over conventional methods? [4M]

PART -B

2. a) By means of relevant diagrams explain the working principles of a practical closed loop system. [8M]
   b) Obtain the transfer function of the mechanical system shown in figure 1 and draw the force-voltage analogy & force- current analogy circuit. [8M]

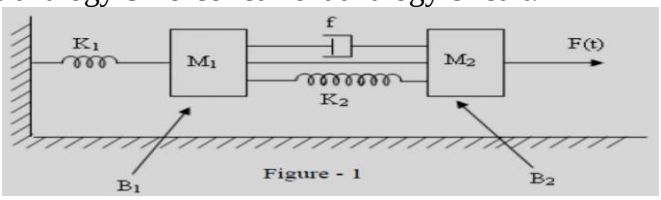
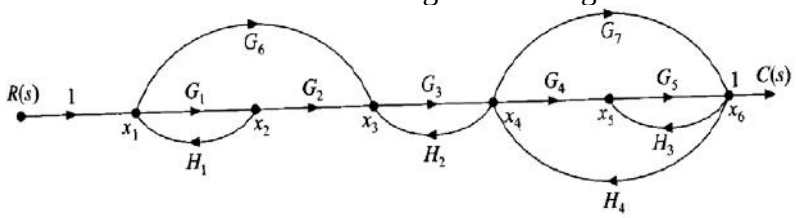


Figure - 1

3. a) Explain Synchro transmitter and receiver pair and obtain its transfer function. [8M]
   b) What are differences between block diagram reduction and signal flow graph reduction and obtain transfer function through Mason's gain formula. [8M]



4. a) Derive the expressions for rise time, peak over shoot, settling time of 2nd order system of unit step input. [8M]
   b) A unity feedback system is characterized by an open loop transfer function [8M]
   $G(S) = \frac{K}{S(S+3)}$ then Determine the gain 'K' so that it will have a damping ratio 0.4. For this value of 'K' determine the settling time, peak overshoot and for a unit step input.
~~~~~~

5. a) Check the stability of the given characteristic equation using Routh's method [8M]

$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$

b) Sketch the root locus diagram for a unity feedback system with its open loop function as, [8M]

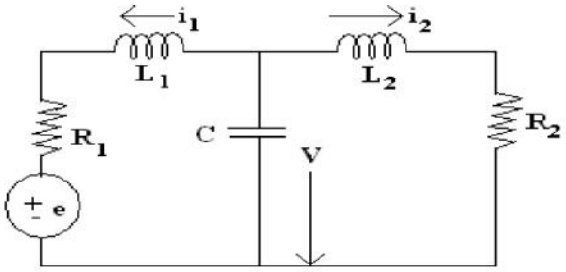
$G(S) = \frac{K(S+3)}{S(S^2+2S+2)(S+5)(S+9)}$ Thus find the value of K at a point where the complex poles provide a damping factor of 0.5.

6. a) Sketch the Bode Plot for a unity feedback system characterized by the open loop transfer function G(s) = $\frac{K(1+0.2s)(1+0.025s)}{s^3(1+0.001s)(1+0.005s)}$. Show that the system is conditionally stable. Find the range of values of K for which the system is stable [8M]

b) A certain unity negative feedback system has the $G(s)=1/s^2+4$. By applying Nyquist stability criterion, determine the stability of the closed loop system. [8M]

7. a) Define the following terms: [8M]
i)State variable
ii)State transition matrix
iii) State model
iv) Controllability

b) Obtain the state model of the system for the figure shown below. Consider the state variables as i_1, i_2, v. [8M]



*****