[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2066)

16125(J) June-16

B. Tech 6th Semester Examination

Control Engineering (NS)

EE-322

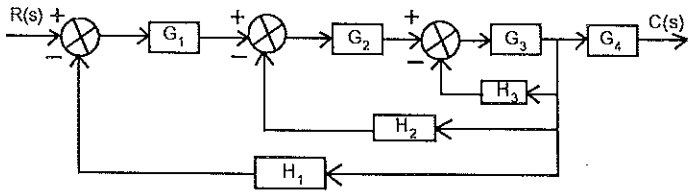
Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Answer one question from each section A, B, C and D. Answer all question from section-E.

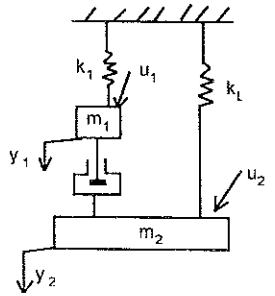
SECTION - A

1. Simplify the block diagram shown in the figure below and determine C(s)/R(s).



Draw the signal flow graph of the above system. (20)

2. Obtain a state space representation of the mechanical system shown below. u_1 and u_2 are input and y_1 and y_2 are the output. (20)

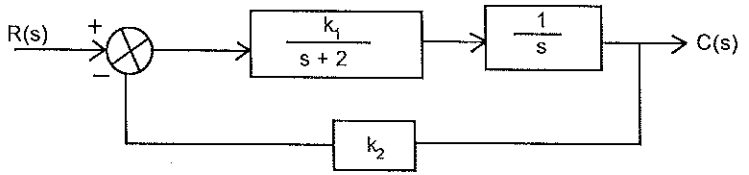


[P.T.O.]

SECTION - B

3. The characteristic equation of a control system is $s^4 + ks^3 + 2s^2 + s + 3=0$. Determine the stability of the system using Routh Hurwitz criteria. Find the range of k for stability. (20)

4. For the system below determine k_1 and k_2 such that the system has damping ratio of 0.7 and undamped natural frequency w_n of 4 rad/sec. (20)



SECTION - C

5. A unity feedback control system has the following open loop transfer function $G(s) = \frac{s^2 + 2s + 1}{s^3 + 0.2s^2 + s + 1}$. Draw a Nyquist plot of G(s) and examine the stability of the system. (20)

6. Draw the Bode plot of the system whose open loop transfer function is $G(s) = \frac{100(s+2)}{s(s^2 + 10s + 100)}$. Obtain phase margin, gain margin, gain cross over frequency and phase cross over frequency. (20)

SECTION - D

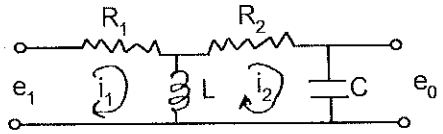
7. A unity feedback system has an open loop transfer function $G(s) = \frac{(k)}{s(s+1)(0.2s+1)}$. Design phase lag compensation for the system to achieve velocity error constant k_v=8 and phase margin of 45°. (20)

8. Explain the action of a field controlled dc servomotor. (20)

SECTION - E

9. (a) Compare linear and nonlinear control system.

(b) Obtain the transfer function of the circuit below.



(c) Define absolute stability and relative stability.

(d) Draw control block diagram of a servo system with velocity feedback and explain the operation.

(e) Write down the general rules for construction of root loci.

(f) Define gain margin and phase margin.

(g) State Nyquist criterion of stability.

(h) Draw Nyquist plot for a unity feedback system having open loop transfer function.

$$G(s) = \frac{1}{s^2 + 0.5s + 1}$$

(i) Why compensation is required for a system? What are the advantages of lag compensation?

(j) What is difference between PI and PD controller?

(2×10=20)