Code No.: EC405PC

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CMR ENGINEERING COLLEGE:: HYDERABAD
UGC AUTONOMOUS
II–B.TECH–II–Semester End Examinations (Supply) - July 2024
CONTROL SYSTEMS
(ECE)

[Time: 3 Hours]   [Max. Marks: 70]

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A   (20 Marks)

1. a) Define transfer function.   [2M]
   b) What is a signal flow graph?   [2M]
   c) Define rise time and delay time.   [2M]
   d) State the initial value and final value theorems.   [2M]
   e) What are the effects of adding a Zero to the system?   [2M]
   f) What is centroid? How the centroid is calculated.   [2M]
   g) Define gain margin & phase cross over frequency.   [2M]
   h) What are the uses of lead compensator?   [2M]
   i) Define Controllability and Observability.   [2M]
   j) What are the advantages of state space representation?   [2M]
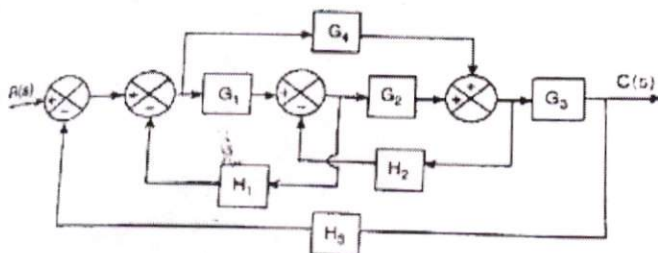
PART-B   (50 Marks)

2. Write the differential equations of the given mechanical system and obtain transfer function   [10M]
   $\Theta(S)/T(S)$.
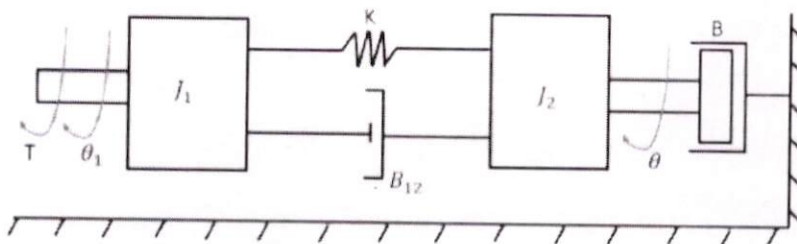
OR

3. Determine the transfer function for the given block diagram using block diagram reduction   [10M]
   technique and also draw the signal flow graph.

4. A certain unity negative feedback control system has the following open loop transfer [10M] function G(s) =10/s(s+2). Determine percentage overshoot, peak time and rise time?

OR

5. Using Routh criterion Determine the stability of the system represented by the characteristic [10M] equation $S^4+8S^3+18S^2+16S+5=0$. Comment on the roots of the characteristic equation.

6. Sketch the bode plot for the given transfer function $G(S) = \dfrac{2S^2}{[(1+0.2S)(1+0.02S)]}$. Determine the [10M] value of gain and phase margin for the gain cross over frequency of 5 rad/sec.

OR

7. Explain the design procedure of the Nyquist plot. [10M]

8. Explain and derive the frequency domain specifications. [10M]

OR

9. Explain the design procedure of lag compensator. [10M]

10. Determine whether the following system is completely state controllable and observable or [10M] not.

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -3 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} U$$

$$Y = [0 \quad 1 \quad -1] X$$

OR

11. Determine state model for a system characterized by the differential equation [10M]

$$\left(\frac{d^3y}{dt^3}\right) + 6\left(\frac{d^2y}{dt^2}\right) + 11\left(\frac{dy}{dt}\right) + 6y + u = 0$$

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