Code No.: EC405PC | R20 | H.T.No. | | | 8 | R | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–B.TECH–II–Semester End Examinations (Regular) - August- 2023
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) Write the Manson's gain formula. [2M]
   b) Define sensitivity. [2M]
   c) Write the equations for error constants (K_p, K_v, K_a). [2M]
   d) Write the effects of proportional derivative systems on second order response. [2M]
   e) What are the limitations of Routh's stability. [2M]
   f) The damping ratio for the characteristic equation $s^2 + 2s + 1 = 0$ is. [2M]
   g) Draw the pole-zero plot of Lag compensator. [2M]
   h) What is the difference between polar plot and Nyquist plot. [2M]
   i) Define State and State variable. [2M]
   j) Define Gain margin and Phase margin. [2M]

PART-B **(50 Marks)**

2. What is control system? Explain with real time examples of a control system. [10M]

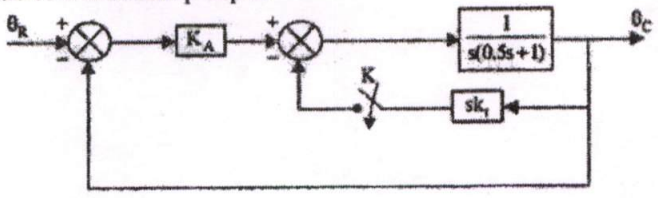
OR

3. Difference between open loop and closed loop control system. [10M]

4. Write the equations for time domain specifications of a standard second order system with unit step input (t_p, t_s, t_d, t_r, M_p). [10M]

OR

5. Consider the system shown in the Figure 3. With switch K open, determine the damping factor and the natural frequency of the system. If a unit ramp input is applied to the system, find the steady state output. Take KA =5. The damping factor is to be increased to 0.7 by including derivative output compensation. Find the value of kt to achieve this. Find the value of undamped natural frequency and the steady state error due to a unit ramp input. [10M]



6. A unity feed-back control system has its open-loop transfer function given by [10M]
   $G(s) = (4s+1)/4s^2$
   Determine an expression for the time response when the system is subjected to
   i. Unit impulse function ii. Unit step input function.

OR

7. Sketch the Bode plot for the following transfer function and determine the system gain K for which the magnitude plot crosses the 0 db line at $\omega = 15$ rad/sec. [10M]
   $G(s) = K/[\, s\,(1+s)\,(1+0.1s)(1+0.01s)]$.

8. A unity feedback control system has an open loop transfer function given by G(s) H(s) =1/[(s)(1+s)(1+2s)]. Draw the polar plot and find Gain margin and Phase Margin. [10M]

OR

9. What is PID controller and write its merits and demerits. [10M]

10. Obtain the transfer function for linear time invariant system and also draw the state model. [10M]

OR

11. The state equation of a linear-time invariant system is given as, [10M]

$$\dot{X} = \begin{bmatrix} 0 & 5 \\ -1 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 1 \end{bmatrix} r \text{ and } y = \begin{bmatrix} 1 & 1 \end{bmatrix} X,$$

Find the observability and controllability of the state equation.

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