QP Code: R252B082 | Reg. No | | | | | | | | | | | AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (Second Semester) Regular Examinations, July – 2025

24MMDPE12002–Instrumentation and Automatic Control System

(Machine Design)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. State the purpose of control system?	CO1	K1
b. Define the term transfer function	CO2	K1
c. Describe what do you mean by Root Contours.	CO3	K2
d. Define state of a system and state variable	CO4	K1
e. Sketch the constant gain loci for the unity feedback system whose feed forward transfer function is $G(s) = \frac{K}{S(s+1)}$	CO3	K3

PART – B **(10 x 5 = 50 Marks)**

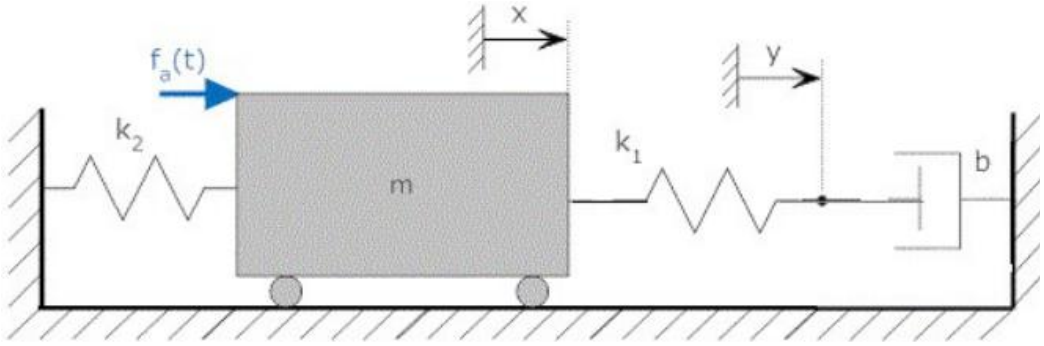
Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Explain the design of state observer	5	CO1	K1
b. Illustrate and explain pole placement by state feedback	5	CO1	K1
(OR)			
c. Explain Routh-Hurwitz's Stability Criterion. Mention its advantages and disadvantages.	6	CO3	K2
d. Sketch block diagram for pollution control in automobile engine	4	CO1	K3
3.a. Given the open loop frequency response G(jω) = U+ jV; Obtain the radii and center locations of constant M and N circles	7	CO3	K2
b. Define minimum phase, non-minimum phase and All pass system.	3	CO3	K1
(OR)			
c. A feedback system has a closed loop transfer function $\frac{Y(s)}{R(s)} = \frac{10s+40}{s^3+s^2+3s}$ Construct a state space representation of the system	10	CO4	K6
4.a. Sketch the Bode Plot of the open loop transfer function of a feedback system given by $\frac{G(s)}{H(s)} = \frac{10(s+3)}{s(s+2)(s^2+s+2)}$ Also determine the system Stability.	10	CO3	K3
(OR)			
c. Evaluate the stability of the following system given by $G(s) = \frac{K}{s(s+1)}$ *and* $H(s) = 1$ using Routh- Hurwitz's Stability Criterion.	10	CO3	K3

5.a.	Define state of a system, state variable, state space and state variable.	5	CO4	K1
b.	Enlist the properties of state transition matrix.	5	CO4	K1

(OR)

c.	A unity feedback system has open loop transfer function $$G(s) = \frac{(s+2)}{(s+1)(s-1)}$$ Use Nyquist criterion to determine if the system is stable in the closed loop configuration.	10	CO3	K3
6.a.	Evaluate the transfer function of the system with state space representation $$\dot{q} = Aq + Bu = \begin{bmatrix} 0 & 2 & 0 \\ 0 & 0 & 2 \\ -4 & -3 & -2 \end{bmatrix} q + \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix} u$$ $$y = Cq + Du = [4 \quad 2 \quad 0]q + 0.u$$	10	CO4	K3

(OR)

c.	Construct a state space model for the system shown. The input is f_a and the output is y. 	10	CO4	K6

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