K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:V
Class:TY	Program:B.Tech
Branch Code: ELE	Pattern:2023
Name of Course:Control System Engineering	Course Code:2306301
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Marks CO

Question No. 1

1a) Convert the block diagram to signal flow graph and determine the transfer function with Mason's Gain Formula (6) CO1

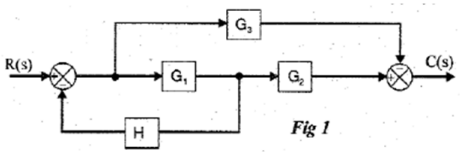


Fig 1

Question No. 2

2a) State the standard test signals used in control system. Write their expression in time domain, laplace domain and draw their graphs (6) CO1

Question No. 3

3a) Define and write their formula**.** (8) CO1, CO2

a. Phase Margin and gain margin with respect to bode plot.

b. Gain cross over frequency with respect to bode plot

c. Resonant frequency

d. Bandwidth

OR

3b) Sketch the polar plot for the following transfer function and comment on stability (8) CO1, CO2

$G\left(s\right) = \frac{1}{(1+s)\,(1+2s)}$

3c) State Procedure to sketch polar plot .Explain how you will find stability from the polar plot. (8) CO1, CO2

OR

3d) Draw the magnitude plot and the phase plot (bode plot) for unity feedback system having open loop transfer function. Comment on stability (8) CO1, CO2

$$G\left(s\right) = \frac{200}{s\left(s+2\right)\left(s+20\right)}$$

Question No. 4

4a) Draw circuit diagram for lead network, obtain transfer function and sketch pole-zero plot (8) CO1, CO2, CO3, CO4

OR

4b) Describe PID controller with proper equation and represent it in block diagram (8) CO1, CO2, CO3, CO4

4c) Describe the construction and working of a separately excited DC servo motor (Armature Control). Derive its transfer function (8) CO1, CO2, CO3, CO4

OR

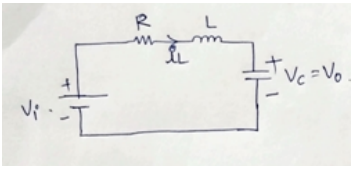
4d) Describe P, Pl controller with block diagram and transfer function. Write advantages of same. (8) CO1, CO2, CO3, CO4

Question No. 5

5a) Define: State, State Vector, State Variable, State Equation and State model. Draw state model diagram considering MIMO system. (8) CO1, CO3, CO4

OR

5b) Develop a State model for electrical circuit given below (8) CO1, CO3, CO4



5c) Define controllability and observability. State Kalman's test steps for controllability and observability. Consider the system represented by: (8) CO1, CO3, CO4

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

Determine the Controllability of the system

OR

5d) Obtain the phase variable form of the given equation $G\left(s\right) = \frac{10\left(s+4\right)}{s\left(s+1\right)\left(s+3\right)}$ (8) CO1, CO3, CO4

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