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

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

| WINTER-2025 | |
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| Exam Seat No.: | |
| Academic Year:2025-2026 | Semester:V |
| Class:TY | Program:B.Tech |
| Branch Code:ROB | Pattern:2022 |
| Name of Course:Control System Engineering | Course Code:ROB223001 |
| 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 _____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) | Discuss the transfer function of positive and negative feedback control system and explain the effect of feedback on overall gain | (6) | CO1 |
| **Question No. 2** | | | |
| 2a) | Explain the step response of the second order system for the underdamped case with diagram. | (6) | CO2 |
| **Question No. 3** | | | |
| 3a) | Find the stability of the control system having characteristic equation $s^5 + 3s^4 + s^3 + 3s^2 + s + 3 = 0$ | (8) | CO3 |
| | **OR** | | |
| 3b) | State and prove with suitable example that if any row of the Routh's array contains all elements as zero, then the control system is marginally stable or unstable. | (8) | CO3 |
| 3c) | Explain basics of root locus with Angle and Magnitude Conditions | (8) | CO3 |
| | **OR** | | |
| 3d) | Draw the root locus plot for the system whose open loop transfer function is given by $G(s) = K/s(s+4)(s^2+4s+13)$ | (8) | CO4 |
| **Question No. 4** | | | |

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| 4a) | Sketch the polar plot and determine the gain and phase margin. The open loop transfer function of a unity feedback system is given by $G(s) = 1/s(1+s)(1+2s)$ | (8) | CO4 |
| | **OR** | | |
| 4b) | Determine the Resonant peak and Bandwidth of frequency response. | (8) | CO4 |
| 4c) | Explain Stability Analysis of LTI system using Bode Plots. | (8) | CO5 |
| | **OR** | | |
| 4d) | Explain Rules for Drawing Nyquist Plots for stability analysis of LTI system. | (8) | CO5 |
| **Question No. 5** | | | |
| 5a) | Define positive definite, negative definite, and indefinite functions. Provide examples | (8) | CO5 |
| | **OR** | | |
| 5b) | How does vision-based control compare to traditional control systems? What are the main challenges of implementing vision-based control? | (8) | CO5 |
| 5c) | Explain Key Features and types of Adaptive Control System. | (8) | CO5 |
| | **OR** | | |
| 5d) | Explain Self-Tuning Regulators (STR) with example | (8) | CO5 |

**····· End of question paper·····**