



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:IV
Class:SY	Program:B.Tech
Branch Code:ETC	Pattern:2022
Name of Course:Control Systems	Course Code:ETC222014
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 02 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) What are the main advantages offered by closed-loop control systems? (6) CO1

Question No. 2

- 2a) Using the Routh–Hurwitz stability criterion, determine the stability of the given system from its characteristic equation. If the system is found to be unstable, also determine the number of roots lying in the right half of the s-plane. (6) CO2

$$S^5 + S^4 + 24S^3 + 48S^2 - 25S - 5 = 0$$

Question No. 3

- 3a) Determine the damping factor, undamped natural frequency, resonant frequency, resonant peak and resonant frequency for the system with closed loop transfer function (8) CO3

$$G(S) = \frac{100}{S^2 + 10S + 100}$$

OR

- 3b) Sketch Bode plot for following transfer function and determine GM, PM and corresponding frequencies. (8) CO3

$$G(s) = \frac{8}{s(s+2)(s+8)}$$

- 3c) For the system with closed loop transfer function (8) CO3

$$G(s)H(s) = \frac{10}{s^2 + 5s + 10}$$

Determine rise time, peak time, peak overshoot, settling time with 2% criterion.

OR

3d) Explain the standard test inputs used for analyzing control systems. (8) CO3

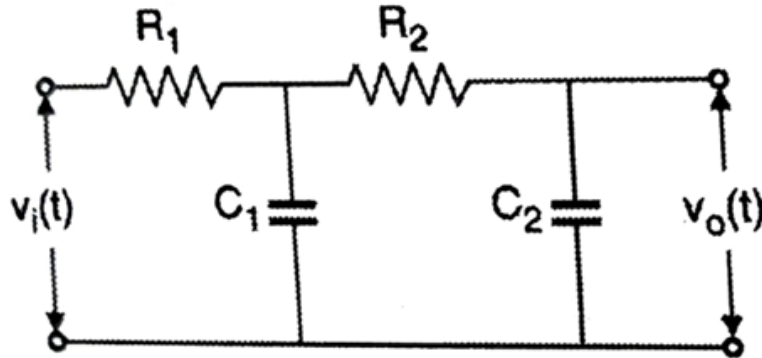
Question No. 4

4a) Determine transfer function if - (8) CO4

$$A = \begin{bmatrix} 0 & 1 \\ -3 & -8 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, C = [3 \quad 4] \text{ with } D=0$$

OR

4b) Find physical variable state model of following electrical network (8) CO4



4c) Obtain state transition matrix of (8) CO4

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -6 & -5 \end{bmatrix} x$$

OR

4d) Investigate the state controllability and observability if (8) CO4

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -5 & -2 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = [2 \quad 0 \quad 1]$$

Question No. 5

5a) What are the criteria for selecting a sensor for a particular application? (8) CO5

OR

5b) Explain the construction and working of relays and solenoids. (8) CO5

5c) Explain the Ziegler–Nichols tuning method for PID controllers. (8) CO5

OR

5d) Explain the advantages, disadvantages, and applications of (8) CO5

- (a) Pneumatic actuators
 - (b) Hydraulic actuators
 - (c) Electrical actuators
- in process control systems.

..... End of question paper.....