



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:IV
Class:SY B. Tech ETC	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.

Question No. 1 Attempt following Question

- 1a) Compare open loop and closed loop control system. (6) CO1

Question No. 2 Attempt following Question

- 2a) Find the transfer function of a system with poles at $s=-1$ and $s=-3$ and zeros at $s=-2$ and $s=2$. (6) CO2

Draw its pole zero plot.

Discuss the stability of the system based on the pole locations.

Question No. 3 Attempt following Question

- 3a) The open loop transfer function of a unity feedback system is $G(s) = \frac{25}{s(s+5)}$. (8) CO3

Determine the rise time, Peak time, Peak overshoot and settling time.

OR

- 3b) Sketch Bode plot for a system having $G(s) = \frac{100}{s(1+0.5s)(1+0.1s)}$ and $H(s) = 1$. Also determine GM, PM, and corresponding frequencies. (8) CO3

- 3c) From a unity feedback system $G(s) = \frac{20(s+2)}{s^2(s+1)(s+5)}$. (8) CO3

Determine-

1. Type of system
2. Error coefficients
3. Steady state error for the input $r(t) = 1 + 3t + \frac{t^2}{2}$

OR

- 3d) Find frequency domain specifications with a unity feedback system having $G(s) = \frac{36}{s(s+8)}$. (8) CO3

Question No. 4 Attempt following Question

- 4a) Obtain a state space representation in controllable and observable canonical form for a system with $G(s) = \frac{s+3}{s^2+3s+2}$. (8) CO4

OR

- 4b) Find the transition matrix $\phi(t)$ if (8) CO4

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

- 4c) Determine the 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

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

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -6 & -8 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = [1 \quad 2 \quad 1]$$

Question No. 5 Attempt following Question

- 5a) For the given system design a PID controller using Zeigler Nichols tuning method. Assume system with unity feedback. $G(s) = \frac{1}{s(s+1)(s+2)}$ (8) CO5

OR

- 5b) What is a sensor and how does it differ from an actuator? Explain briefly about the dynamic characteristics of sensors. (8) CO5

- 5c) Explain the operation of a hydraulic rotary actuator. What are its advantages over linear actuators? (8) CO5

OR

- 5d) Explain the Zeigler Nichols tuning method of a PID controller. (8) CO5

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