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	Program:B.Tech
Branch Code: SY BTECH 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)	Investigate the stability of the system having characteristic equation $q(s) = s^4 + 9s^3 + 7s^2 + 4s + 3 = 0$ using Routh's stability criteria. Also determine number of poles in right half of s-plane.	(6)	CO2

Question No. 3 Attempt following Question

3a)	For the system shown in Fig.1 determine the type of system, error coefficient and the steady state error for the input $r(t) = 10 + 4t + \frac{3}{2}t^2$	(8)	CO3

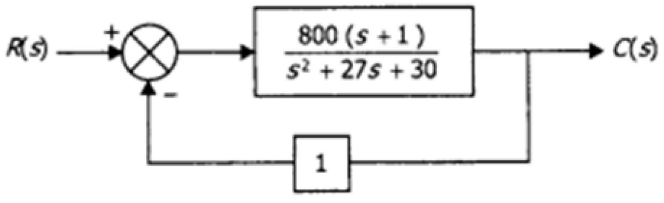

Fig. 1

OR

3b)	Draw Bode plot of the system with open loop transfer function $G(s) = \frac{8}{s(s+2)(s+4)}$ Determine stability margins and corresponding frequencies. Comment on stability.	(8)	CO3

3c) For the unity feedback control system shown in Fig. 2 calculate Resonance peak and resonance frequency. (8) CO3

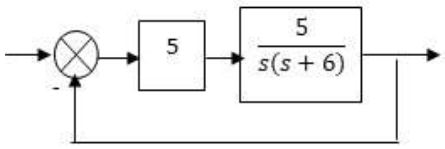

Fig. 2

OR

3d) Define the following terms: (8) CO3

1. Delay time
2. Rise time
3. Peak overshoot
4. Settling time

Question No. 4 Attempt following Question

4a) Obtain the transition matrix using Laplace transform if $A = \begin{matrix} 0 & 1 \\ -11 & -12 \end{matrix}$ (8) CO4

OR

4b) What are the advantages of state variable approach? Also state properties of state transition matrix. (8) CO4

4c) Determine transfer function if $A = \begin{matrix} -2 & 1 \\ 0 & -3 \end{matrix}$, $B = \begin{matrix} 0 \\ 1 \end{matrix}$, $C = \begin{matrix} 1 & 1 \end{matrix}$ with $D = 0$. (8) CO4

OR

4d) Investigate the state controllability and observability if $A = \begin{matrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{matrix}$, $B = \begin{matrix} 1 \\ 1 \\ 1 \end{matrix}$, $C = \begin{matrix} 1 & 1 & 1 \end{matrix}$ (8) CO4

Question No. 5 Attempt following Question

5a) What are the key factors to consider when selecting a sensor for a specific application? (8) CO5

OR

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

5c) Differentiate between Pneumatic and Hydraulic actuators. In what applications each of them are commonly used? (8) CO5

OR

5d) Compare and contrast between analog and Digital controllers. (8) CO5

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