# 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:2022 |
| Name of Course:Control System Engineering | Course Code: ELE223001 |
| 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

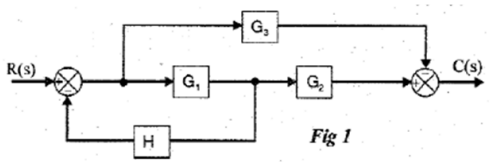



*Fig 1*

**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, CO2

**Question No. 3**

3a) Define all frequency domain specifications and write their formula (8) CO1, CO2

**OR**

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

$$G\left(s\right) = \frac{5}{s(s+1)(s+2)}$$

3c) State procedure to bode plot. Explain how you will find stability from the bode 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

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

**Question No. 4**

4a) Draw circuit for lag network, obtain transfer function and sketch pole-zero plot (8) CO1, CO2, CO5

**OR**

4b) Explain PID controller with proper equation and represent it in block diagram (8) CO1, CO2, CO5

4c) Draw circuit for lead network, obtain transfer function and sketch pole-zero plot (8) CO1, CO2, CO5

**OR**

4d) Explain purpose of controller in control system. Explain P and PI controller in detail with block diagram (8) CO1, CO2, CO5

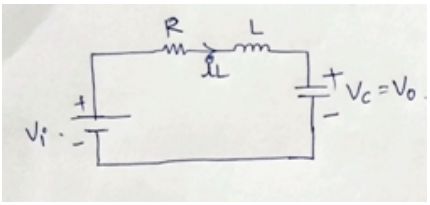
**Question No. 5**

5a) Determine the state transition matrix of given system using Laplace Transform Technique (8) CO1, CO2, CO4, CO5

$$A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$$

**OR**

5b) Develop a State model for electrical circuit given below (8) CO1, CO2, CO4, CO5




5c) Define the state transition matrix and Derive the expression for the state transition matrix Φ(t) and state its properties. (8) CO1, CO2, CO4, CO5

**OR**

5d) Explain Eigen Values and Eigen Vectors. Determine eigen values and stability of given system (8) CO1, CO2, CO4, CO5

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

**····· End of question paper·····**