

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIFTH SEMESTER B. TECH DEGREE EXAMINATION (S), FEBRUARY 2023
CHEMICAL ENGINEERING****(2020 SCHEME)****Course Code : 20CHT307****Course Name: Instrumentation and Process Control****Max. Marks : 100****Duration: 3 Hours***Normal / semi log graph sheet shall be provided on request***PART A***(Answer all questions. Each question carries 3 marks)*

1. Explain the principle of working of a rotameter.
2. List any two temperature measuring instruments. Mention their advantages and disadvantages.
3. Describe a unit pulse function.
4. Derive the Laplace transform of $A \sin(\omega t)$.
5. Define the terms (i) Overshoot (ii) Decay Ratio.
6. Write short notes on selection of control valves.
7. Distinguish between servo and regulator problems.
8. Describe the development of a block diagram.
9. What is frequency response?
10. Explain Gain margin and Phase margin.

PART B*(Answer one full question from each module, each question carries 14 marks)***MODULE I**

11. a) Explain the static characteristics of measuring instrument. (7)
- b) Give two examples for pressure measuring instruments. (7)
Explain the principle and operation of any one of them.

OR

12. a) What are thermistors? Explain the working principle. Mention any two applications. (7)
- b) Explain the construction and operation of a piezoelectric manometer. (7)

MODULE II

13. a) State the final value theorem. Find the final value of $y(t)$ for the transfer function $\frac{1}{s(s^3+3s^2+3s+1)}$. (7)
- b) Derive the solution of a second order differential equation using Laplace transforms. (7)

OR

14. a) Derive the transfer function for a liquid level system. State valid assumptions. (8)
- b) Invert the following transfer function: (6)
- $$\frac{1}{s(s^2 - 2s + 5)}$$

MODULE III

15. a) What are the relative advantages and disadvantages of the proportional, integral and proportional-integral-derivative controllers? (7)
- b) Derive the transfer function of a non-interacting liquid level system. (7)

OR

16. Derive the transfer function between h and Δp for a simple U-tube manometer. (14)

MODULE IV

17. a) Construct the root loci for the following equation (10)
- $$1 + \frac{K}{s(s+1)(2s+1)} = 0$$
- b) How does the pole location determine the stability of an uncontrolled or controlled process? (4)

OR

18. a) Explain analysis of stability using Routh-Hurwitz criterion. (10)
- b) What are the main advantages of Routh-Hurwitz criterion for examining the stability of a system. (4)

MODULE V

19. a) Define the terms (i) amplitude ratio (ii) phase lag (iii) corner frequency. (6)
- b) Construct the Bode diagram for a first order system having the transfer function $G(s) = \frac{Kp}{\tau s + 1}$ (8)

OR

20. a) Describe the Ziegler Nichols controller tuning method. (4)
- b) Construct the Bode plot for the following open loop transfer function $G(s) = \frac{100}{(10s+1)(s+1)}$. Obtain the gain margin and phase margin. (10)
