B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
Fifth Semester
Instrumentation and Control Engineering
(Common to Electronics and Instrumentation Engineering)
20ICPC501 - PROCESS CONTROL
Regulations - 2020

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

|		Marks	K-Level	CO
1.	Degrees of freedom defines (a) Number of dependent variables of a process (b) Number of independent variables of a process (c) Number of interacting variables (d) Both the independent and dependent variables	1	K1	CO1
2.	Mention the importance of process control (a) Increase system throughput (b) Number Eliminate inefficiencies (c) Boost energy efficiency (d) All the above	1	K1	CO1
3.	The main purpose of a control valve positioner is to (a) Alter the fail status of the valve (b) Improve the precision of the valve (c) Increase transmitter accuracy (d) Eliminate cavitation in the valve	1	K1	CO2
4.	Cavitation in a control valve is caused by (a) process noise (b) Improve the precision of the valve (c) Increase transmitter accuracy (d) Eliminate cavitation in the valve	1	K1	CO2
5.	The effect of PD controller (a) to reduce the steady state (b) to reduce damping ratio (c) to increase the steady state (d) to increase the damping ratio	1	K1	CO3
6.	The proportional controller output depends on: (a) Integral of error (b) Derivative of error (c) Magnitude of error (d) Past errors	1	K1	CO3
7.	Continuous cycling method determines (a) Ultimate gain and period (b) Frequency response (c) Transfer function (d) Disturbance amplitude	1	K1	CO4
8.	To suppress large errors the which Time integral performance is recommended? (a) ITAE (b) ISE (c) IAE (d) none of the above	1	K1	CO4
9.	Smith Predictor is used to : (a) Compensate time delay (b) Increase gain (c) Add disturbance (d) Linearize system	1	K1	CO5
10.	Three-element boiler drum level control measures: (a) Drum level, steam flow and feed water flow (b) Pressure , temperature and flow (c) Only level (d) Only pressure	1	K1	CO5

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

		Marks	K-Level	CO
11.	Define Degrees of Freedom.	2	K1	CO1
12.	Express the mathematical model representation of a pressure process.	2	K2	CO1
13.	Give the functions of an actuator and list different types of actuators.	2	K1	CO2
14.	Recall the term Control Valve sizing.	2	K1	CO2
15.	Derivative controls cannot be used alone. Justify your answer.	2	K2	CO3
16.	Illustrate auto/manual transfer in controller.	2	K2	CO3
17.	Formulate the tuning criteria for continuous cycling method.	2	K2	CO4

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **13921**

18. Discuss the advantages and disadvantages of feedback and feed forward controllers.	2	K2	CO4
19. Smith Predictor Control scheme is recommended for dead time process. Justify it.	2	K2	CO5
20. Differentiate between IMC control and multivariable control.	2	K2	CO5
21. Outline the term ISE.	2	K2	CO4
22. List the advantages and disadvantages of three-element boiler drum level control.	2	K1	CO5

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23. a) (i) Obtain the mathematical model of a first order thermal process.	5	K2	CO1
(ii) Describe how the mathematical model represents the behavior of the given process.	6	K2	CO1
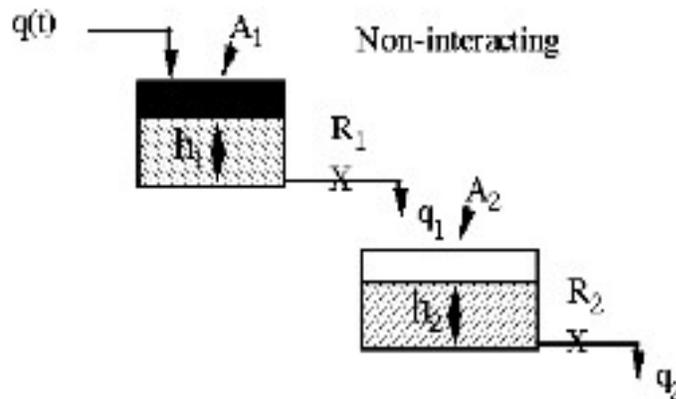
OR

b) Differentiate between the servo and regulatory operation with the help of a suitable example.	11	K2	CO1

24. a) Illustrate the inherent and installed characteristics of valves with necessary diagram.	11	K2	CO2

OR

b) Discuss in detail about the following			
(i) Cavitation and Flashing	6	K2	CO2
(ii) I/P converter	5	K2	CO2

25. a) (i) Explain about the characteristics of two position control.	6	K2	CO3
(ii) With a neat schematic diagram, describe the single speed floating control.	5	K2	CO3

OR

b) Compare and contrast the features of P, I, D and composite control modes P+I, P+D and P+I+D and draw their characteristics.	11	K2	CO3

26. a) A first-order process with delay has a transfer function $G(s)= \dfrac{2e^{-3s}}{5s+1}$ Use Cohen–Coon tuning formulas to calculate K_c, T_i, and T_d for a PID controller.	11	K3	CO4

OR

b) With block diagram, Determine the superior performance of cascade control over single loop feedback control. Justify how cascade control exhibits superior performance in a distillation column.	11	K3	CO4

27. a) Discuss briefly about the Smith algorithm for dead time compensation of a process.	11	K2	CO5

OR

b) Enumerate the two elements and three element drum level control with suitable diagrams.	11	K2	CO5

28. a) (i) Summarize about the distributed system with an example.   *5*   *K2*   *CO1*

      (ii) Explain how feed forward control in implemented in CSTR process.   *6*   *K2*   *CO5*

OR

    b) (i) Describe the functions of Internal Model Control with block diagram and explain in detail.   *6*   *K2*   *CO5*

      (ii) Derive the mathematical model for a first order flow process.   *5*   *K2*   *CO1*