

APPC3004 Process Control & Instrumentation (3-0-0)

Course Objectives:

1. Introduce the fundamental concepts of automatic control and instrumentation in process plants.
2. Describe commonly used sensing, transmission, and final control elements using Piping and Instrumentation Diagrams (P&IDs).
3. Enable students to characterize and tune simple processes while understanding the importance of control for safety and profitability.
4. Provide updated knowledge for designing process equipment, such as heat and mass transfer units used in process plants.
5. Develop knowledge of various process measurement and instrumentation devices.

Module I: Process dynamics: Introduction to process control, objective of modelling, models of industrial process, hydraulic tanks, fluid flow systems, mixing process, chemical reactions, thermal systems, heat exchangers and distillation column. (7 Hours)

Module-II: Control actions and controller tuning: Basic control actions-on/off, P, P+I, P+I+D, floating control, pneumatic and electronic controllers- controller tuning-time response and frequency response methods-non-linear controllers. (8 Hours)

Module-III: Complex control techniques: Feed forward-ratio-cascade-split range-inferential-predictive adaptive and multivariable control. (5 Hours)

Module-IV: Programmable logic controllers: Evolution of PLC, Sequential and Programmable controllers, Architecture, Programming of PLC, Relay logic and Ladder logic, Functional blocks, Communication Networks for PLC. (7 Hours)

Module V: Computer control of processes: PLC-based control of processes, Computer control of liquid level system, heat exchanger, Smart sensors and Field bus. (3 Hours)

Course Outcomes:

By the end of this course, students will be able to:

- CO1 Explain process dynamics and develop mathematical models for various industrial systems.
- CO2 Analyze control actions and apply suitable controller tuning methods.
- CO3 Apply advanced control strategies to enhance process performance.
- CO4 Interpret PLC architecture and design, basic relay and ladder logic programs.
- CO5 Implement PLC and computer-based control for industrial process applications.

Text Books:

1. George Stephanopolus, Chemical Process Control, Prentice Hall India
2. Harriot P., Process Control, Tata McGraw-Hill, New Delhi, 1991.

References:

1. Norman A Anderson, Instrumentation for Process Measurement and Control, CRC Press LLC, Florida, 1998.
2. Marlin T.E., Process Control, Second Edition McGraw hill, New York, 2000.
3. Balchan J.G. and Mumme G., Process Control Structures and Applications, Van Nostrand Renhold Co., New York, 1988.