

## CH453: PROCESS INSTRUMENTATION AND CONTROL

CREDITS = 6 (L = 4, T=0, P = 2)

1. **INSTRUMENTATION:** principle of measurement; static and dynamic characteristic of instrument; error analysis and its calibration, temperature, pressure, flow, liquid level and composition measurement, measurement of humidity, pH; recording, indicating and signaling instrument, transmission of instrument reading, instrument diagram, control valves. 8 Hours
2. **DESIGN ASPECTS OF A PROCESS CONTROL SYSTEM:** classification of the variables, design elements of a control system, Process control hardware. 4 Hours
3. **DYNAMICS OF PROCESSES:** Modeling of simple chemical processes; Simple system analysis; Dynamic behavior of simple process; Laplace transform; Block diagram & its reduction algebra; Transfer function; Transient response of first; second and higher order system; transportation lag; Dynamic behavior of systems with dead time and inverse response. 10 Hours
4. **FEEDBACK CONTROL:** control loop and its components; Types of feedback controllers; Dynamic behavior of feedback controlled control processes; Stability analysis- notion of stability, characteristic equation; Routh-Hurwitz stability criterion, Root locus analysis. 8 Hours
5. **FREQUENCY RESPONSE ANALYSIS:** frequency response characteristic of general linear system; Bode diagram and Nyquist plots and stability analysis. 4 Hours
6. **SELECTION OF CONTROLLER SETTINGS:** Design of feedback controllers; Controller tuning; Process Identification. 3 Hours
7. **ADVANCE CONTROL SYSTEMS:** feed-forward, cascade, ratio, inferential, adaptive control, DCS, PLC and safety interlock system. 3 Hours

### REFERENCE BOOKS:

- Title: Chemical Process Control - An Introduction to Theory and Practice  
Author: George Stephanopoulos  
Publisher: PHI
- Title: Process System Analysis and Control  
Author: Donald R Coughanowr  
Publisher: McGraw-Hill Inc.

Title: Process Instrumentation  
Author: Patranobish  
Publisher: Tata McGraw-Hill

## ***LIST OF EXPERIMENTS***

1. To determine the time constant of a first order system.
2. To determine the time constant of a pseudo first order system.
3. To study the dynamic response of second order under damped system.
4. To find out the response of second order over damped system.
5. To find out the response of second order over damped system.
6. To determine the % opening vs. % flow rate characteristic of the given pneumatic control valve.
7. To study the working of pneumatic controller and its tuning.
8. To study the PID tuning and stability of level control system.
9. To study the PID tuning and stability of flow control system.
10. To study the PID tuning and stability of temperature control system.
11. To study the PID tuning and stability of pressure control system.