

UCH506 PROCESS INSTRUMENTATION AND CONTROL

L	T	P	Cr
3	1	2	4.5

Instrumentation

Classification of measuring instruments, Elements of measuring instruments, Static and dynamic characteristics of instruments, Error analysis. Instruments for the measurement of temperature, Pressure, Liquid level, and moisture content, Instruments and sensors for online measurements.

Process Control

Introduction: General Principles of process control, Time domain, Laplace domain and frequency domain dynamic and control.

Linear Open loop Systems: Laplace domain analysis of first and second orders systems, linearization, Response to step, pulse, impulse and ramp inputs, Physical examples of first and second order systems such as thermocouple, level tank, U-tube manometer etc., Interacting and non-interacting systems distributed and lumped parameter systems, dead time.

Linear Closed-loop Systems: Controllers and final control elements, Different types of control valves and their characteristics, Development of block diagram, Transient response of simple control systems, Stability in Laplace domain, Root locus analysis.

Frequency Response: Frequency domain analysis, Control system design by frequency response, Bode stability criterion, Different methods of tuning of controllers.

Process Applications: Introduction to advanced control techniques as feed forward, feedback, cascade, ratio, Smith predictor, Internal model control, Digital computer control, Direct digital control and supervisory control and data acquisition, Multivariable control, Applications to equipments such as heat exchangers, distillation columns, reactors etc.

Laboratory work: Dynamics of first order and second order systems, valve characteristics, Interacting and non-interacting systems, Flow, level and temperature control using proportional, proportional-integral and proportional-integral-derivative control action, Manual and closed loop controls, Positive and negative feed back control, Tuning of controller, Step, pulse, impulse and frequency response.

Textbook:

1. Eckman, D.P., Industrial instrumentation, John Wiley & Sons (2004).
2. Coughanour, D.R., Process Systems analysis and Control, McGraw Hill (1991).

Reference books:

1. Stephanopoulous, G., Chemical Process Control: An Introduction to Theory and Practice, Prentice Hall of India (1984).
2. Harriott, P., Process Control, Tata McGraw Hill (1972).