

# AMEI-22 INDUSTRIAL INSTRUMENTATION & PROCESS CONTROL

## UNIT-1 DESIGN ASPECTS OF A PROCESS CONTROL SYSTEM

- 1.1 Design Elements of a control system.
- 1.2 Control aspects of a complete chemical plant,
- 1.3 Development of a Mathematical model,
- 1.4 Modelling considerations for control purposes,
- 1.5 Dynamic Behavior of First order system, second order system and higher- order systems, introduction to Feedback control,
- 1.6 Dynamic Behaviour of feedback-controlled processes, stability Analysis of feedback systems

## UNIT-2 DESIGN OF FEEDBACK CONTROLLERS

- 2.1 Design problems of controllers,
- 2.2 Selection of type of feedback controller, time
- 2.3 Integral performance criterion, Process Reaction Curve and frequency response characteristic,
- 2.4 Ziegler-Nichol Rule, effect of dead time, dead time compensator and inverse response compensator

## UNIT-3 STUDY OF MULTIPLE LOOPS CONTROLLER

- 3.1 Cascade Control System, Selective control system,
- 3.2 Split Range Control, Feed forward and Ratio control,
- 3.3 Adaptive and Inferential control systems.

## UNIT-4 INTERACTION & DE-COUPLING OF CONTROL LOOP

- 4.1 Interaction of control loops, relative gain array and selection of the loops.
- 4.2 Design of non-interaction control loop, Multivariable model, Predictive control,
- 4.3 Simple and multivariable dynamic matrix control loop.

## UNIT-5 TEMPERATURE MEASUREMENTS:

- 5.1 Importance, advantage and limitation of different instruments,
- 5.2 Seeback effect, peltier effect used for temperature measurement, thermocouples,
- 5.3 Advantage and limitation of- Vapour filled, gas filled, Liquid filled, mercury in glass,
- 5.4 Bimetallic, Pressure spring thermometer, pyrometers, thermistors,
- 5.5 IC based metering, Low temperature and high temperature measurement schemes.
- 5.6 Level Measurements: Importance, advantage and limitation of different instruments, visual level indicators, float type, Purge method of measuring level,
- 5.7 Buoyancy method, Resistance and capacitance probes for level measurement,
- 5.8 Limit switches, level measurement in pressurized vessels,
- 5.9 Solid level measurement techniques, modern techniques for level measurements and their applications.

## UNIT-6 PRESSURE MEASUREMENTS

- 6.1 Principle of measurement of absolute/gauge/ Vacuum,
- 6.2 Different type of manometers, Pressure switches, pirani gauge.
- 6.3 Flow Measurements: Mechanical flow meter, Interferential type,
- 6.4 Rotating vane, propeller type, orifice plate, venturi tube, flow nozzle, pivot tube,
- 6.5 Variable area flow meters, rotameters,
- 6.6 Electromagnetic and ultrasonic flow meters, mass flow meters, and turbine flow meters, selection of flow meters and typical application scheme for very low flow and highly viscous fluid.
- 6.7 Force and Torque Measurement: Various measuring methods,
- 6.8 Mechanical weighing systems, Ballistic Weighing, Hydraulic and pneumatic system,
- 6.9 Torque Measurement, Transmission Dynamometers,
- 6.10 Combined Force and Moment Measurement.

### Reference Books:

1. B.G Liptak, "Instrumentation Engineers Handbook", BH Publication, 1999
2. D.R. Coughanour," Process system and analysis and control", TMH
3. W.H. Ray," Advanced Process Control", Tata McGraw Hill

