

# AMSF-17 PROCESS INSTRUMENTATION AND CONTROL ENGINEERING

## UNIT-1 ELEMENTS OF MEASUREMENT

- 1.1 Fundamental standards, Quality of measurement, Meaning of measurement, Errors in measuring instruments, Precision and accuracy,
- 1.2 Calibration principle, Static and dynamic characteristics of measuring instruments.
- 1.3 Measurement of temperature – Bimetallic and pressure thermometers, Thermocouples, Resistance thermo meters, Pyrometer, Calibration. Pressure and vacuum measurement – Manometers, Measuring element, Absolute pressure measurement, Static accuracy of pressure gauges.

## UNIT-2 FLOW MEASUREMENT

- 2.1 Orifice installation, Pitot tube, Area flow meters, Open channel meters.
- 2.2 Level measurement – Direct method, Measurement of level in open and pressure vessels.
- 2.3 Measurement of pH and humidity. Recording Instruments,
- 2.4 Indicating and signaling instruments, Signal transmission, and codes.

## UNIT-3 OPEN LOOP AND CLOSE LOOP SYSTEMS

- 3.1 Transfer function modeling- block diagram representation of mechanical, thermal and liquid level systems.
- 3.2 Transient response analysis- Time response of first and second order system for impulse and step inputs
- 3.3 Effect of damping factors on transient response
- 3.4 Characteristics of proportional, integral, derivative, PI, PD and PID controllers.
- 3.5 Frequency response method of analysis- polar plot- Bode Plot.

## UNIT-4 INTRODUCTION TO STABILITY

- 4.1 Definition via impulse response function- Routh-Hurwitz stability criterion- Nyquist stability criterion.
- 4.2 Control system components- error detectors- modulators and demodulators- Hydraulic controllers- Pneumatic controllers- PLC.
- 4.3 Introduction to computer control in chemical process industry.
- 4.4 Comparison between discrete data, digital and analogue control systems. Introduction to digital signal processing.

### References Books:

1. D Patranabis, Principles of Industrial Instrumentation, Second Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1996.
2. George Stephanopoulos, Chemical Process Control: An Introduction to Theory and Practice, Prentice Hall of India Pvt. Ltd, 1990.