

## Process Instrumentation

1.1 Course Number: CH301

1.2 Contact Hours: 2-0-0 Credits: 6

1.4 Semester -Offered: 3<sup>rd</sup> Year-Odd

1.5 Prerequisite: NA

1.6 Syllabus Committee Member: Dr Vivek Kumar, Dr V S Sistla

2. **Objective:** The course covers the key features of industrial process instrumentation. The course introduces the principles behind measurement of various chemical process variables like temperature, pressure, flow, level, etc. for undergraduate students.

### 3. Course Content

(Unit wise distribution of content and number of lectures)

Unit	Topics	Sub-topic	Lectures
1	Introduction to industrial instrumentation	Elements of instrumentation systems and their functions, Characteristics of instruments and their classifications	6
2	Principle and construction of other instruments and their applications	Indicators, Recorders, Process switches, Alarms, Sensors, Transducers, Converters	7
	Instrumentation Diagrams	Process and Instrument diagrams, Loop Diagrams, Functional Diagrams	
3	Measurement of Pressure and Vacuum	Methods of pressure measurement, Mechanical pressure elements, Measurement of vacuum, Electrical pressure elements, Force-balance pressure transmitters, and Differential pressure transmitters	4
4	Measurement of Temperature	Temperature scales, Methods of temperature measurement, Thermocouples, Bimetallic thermometers, Liquid-in-glass, Pressure thermometer, Semiconductor sensors, Digital thermometers, Pyrometers	4
5	Measurement of Fluid Flow	Methods of flow measurement, Variable area: Weirs and flumes, Velocity based: Electromagnetic flow meter, Anemometers, Laser Doppler anemometer, Positive displacement flow meters, Mass flow meter	4

6	Measurement of Head and Level	Level Gauges, Hydrostatic pressure based, Displacement based, Echo based, Weight based, Capacitive based, Radiation based	3
<b>Total</b>			<b>28</b>

#### 4. Readings

##### 4.1 Text Books:

1. D.P. Eckman, Industrial Instrumentation, CBS Publishers & Distributors Pvt. Ltd., 2004
2. R.K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, 2005

##### 4.2 Reference Books:

1. Tony R. Kuphaldt , Lessons in Industrial Instrumentation, *Creative Commons Attribution 4.0 International Public License* (2015).
2. William C. Dunn, Fundamentals of Industrial Instrumentation and Process Control, Tata McGraw-Hill Education Private Limited, 2009.
3. D. Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Company, New Delhi, 2010
4. E.O. Doebelin, Measurement systems, Applications and Design, *McGraw-Hill* (1982).

#### 5. Outcome of the Course:

After the successful completion of the course the students will be able to:

1. Acquire knowledge about various industrial instrumentation, instrument connection possibilities to process industry.
2. Will be able to understand the principles of various pressure, temperature, flow, and level measurement techniques
3. Improve ability to select suitable industrial instrument for pressure, temperature, and flow and level measurement