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Course code	Course Name	L-T-P-Credits	Year of Introduction
IC307	Industrial Instrumentation - I	3-0-0-3	2016

Prerequisite: Nil

Course Objectives:

- To familiarise various types of temperature, pressure, level, pH, viscosity, turbidity and conductivity measurement systems.

Syllabus

Different types of measuring instruments and principle of operation for temperature, pressure, level, pH, viscosity, turbidity and conductivity measurement systems.

Expected Outcome

Students successfully completing this course will

i. Become familiar with operating principles of instruments using for temperature, pressure, level, pH, viscosity, turbidity, conductivity measurement systems,
ii. Be able to select instruments for different industrial applications.

Text books

1. Jain.R.K,, Mechanical and industrial measurements, Khanna Publishers
2. Patranabis.D, Principles of industrial instrumentation,TMH

Reference

1. A.I.Sutko & Jerry D.Faulk, Industrial Instrumentation, Vikas Publishing Housing
2. Andrew and Williams, Applied instrumentation in process industries, Gulf pub.Vol- 1,2
3. Birdie G.S. & Birdie J.S., Water Supply and Sanitary Engineering, Dhanpat Rai & Sons
4. Doebelin.E.O, Measurement system- Application and design, McGraw hill
5. Dr. P. Jagatheeswari, Industrial Instrumentation I, Anuradha publications.
6. Fairgeyer & Okun, Water and Waste Water Technology, Prentice Hall of India.
7. Fribance, Industrial instrumentation fundamentals, McGraw hill.
8. Jones.E.B, Instrument technology, Scientific Pub.
9. Liptak.B.G , Instrument Engineers H/B Vol- 1, Chilton book.co.
10. Mark .J.Hammer& Mark.J.Hammer.jr, Water and Waste Water Technology, Prentice Hall of India.
11. Trade journals like I&C.S, Intech, Control and instrumentation etc.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Measurement of temperature- Definitions and units- Standards o temperature – Thermocouples- Peltier effect- Thomson effect Seebeck effect- Types of thermocouples - Cold junctio compensation- Thermowells-Lead compensation – Thermopiles Resistance thermometers- Principle of operation - Platinum RTD Construction of RTDs- *3wire method – 4 wire method*- Thermistors.	8	15%

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II	Expansion thermometers- Bimetallic thermometers – Liquid filled thermometers- Gas filled thermometers- Vapor pressure thermometers- Pyrometry- Stefan Boltzmann's law- *Black body radiation*- Optical radiation pyrometers- Disappearing filament photo electric pyrometer.	6	**15%**
FIRST INTERNAL EXAM			
III	Measurement of pressure – introduction – units and definitions – standards of pressure – Pressure and vacuum pressure measuring elements- Bourdon gauge- McLeod gauge - Ionization gauges – Knudsen gauge – Thermal conductivity gauges – Pirani gauge – *Pressure measuring strain gauges.*	6	**15%**
IV	Differential pressure elements – U tube manometer –Inclined manometer – Bellows - principle of operation' theory and constructions - Differential pressure transducers - Pressure switches - *Very high pressure measurements transducers.*	8	**15%**
SECOND INTERNAL EXAM			
V	Measurement of level- visual indicators- Float actuators- principles of operation-Level in open and closed tanks- Level switches- *Measurement of level in boundaries of two liquids* - Ultrasonic and capacitor type level measurement - *Measurement of level of solids* - Density measurements- various methods.	7	**20%**
VI	pH measurement- Digital pH meters- amplifiers for pH electrodes- problems in pH meters- *installations and maintenance*- need for pH measurement- Viscosity measurement- different methods of measuring viscosity – different viscometers, laboratory and industrial types - continuous measurement of viscosity - Rotameter for viscosity measurement-*Turbidity measurement- Conductivity measurement*.	7	**20%**
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2. Each question carries 15 marks and can have not more than four sub divisions. (15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4. Each question carries 15 marks and can have not more than four sub divisions. (15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6. Each question carries 20 marks and can have not more than four sub divisions. (20 x 2 = 40 marks)