Industrial Instrumentation		Semester	IV
Course Code	BAG405B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

### Course objectives:

The course will enable the students to

- To introduce the measurement techniques of force, torque and speed.
- To introduce the measurement techniques of acceleration, Vibration and density
- To introduce the measurement Viscosity, Humidity and moisture.
- To introduce the temperature measurement techniques
- To introduce the pressure measurement techniques

# **Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- 1. Adopt different type of teaching methods to develop the outcomes through Power-Point Presentation and Video demonstration or Simulations.
- 2. Chalk and Talk method for Problem Solving.
- 3. Arrange visits to show the live working models other than laboratory topics.
- 4. Adopt collaborative (Group Learning) Learning in the class.
- 5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information.
- 6. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

#### Module-1

**MEASUREMENT OF FORCE, TORQUE AND SPEED** - Different types of load cells: Hydraulic, Pneumatic, Strain gauge, Magneto-elastic and Piezoelectric load cells – Different methods of torque measurement: Strain gauge, Relative angular twist. Sped measurement: Capacitive tacho, Drag cup type tacho, D.C and A.C tacho generators – Stroboscope.

### Module-2

MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY - Accelerometers: LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instruments as accelerometer – Vibration sensor – Calibration of vibration pickups – Units of density and specific gravity – Baume scale and API scale – Densitometers: Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer. Power station, Calculation of energy through photovoltaic power generation and cost economics.

### Module-3

MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE -Viscosity: Saybolt viscometer – Rotameter type and Torque type viscometers – Consistency Meters – Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type dew meter. Moisture: Different methods of moisture measurements –Thermal Conductivity and Capacitive sensors, Microwave, IR and NMR sensors, Application of moisture measurement – Moisture measurement in solids.

### Module-4

**TEMPERATURE MEASUREMENT** - Definitions and standards – Primary and secondary fixed points – Different types of filed in system thermometers – Sources of errors in filed in systems and their compensation – Bimetallic thermometers – IC sensors – Thermocouples: Laws of thermocouple, Fabrication of industrial thermocouples, Reference junctions compensation, Signal conditioning for thermocouple, Commercial circuits for cold junction compensation, Response of thermocouple, Special techniques for measuring high temperature using thermocouple – Radiation fundamentals – Radiation methods of temperature measurement – Total radiation pyrometers – Optical pyrometers – Two colour radiation pyrometers – Fiber optic sensor for temperature measurement – Thermograph, Temperature switches and thermostats – Temperature sensor selection, Installation and Calibration.

### Module-5

PRESSURE MEASUREMENT - Units of pressure - Manometers: Different types, Elastic type pressure gauges: Bourdon tube, Bellows, Diaphragms and Capsules - Electrical methods: Elastic elements with LVDT and strain gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor -Measurement of vacuum: McLeod gauge, Thermal conductivity gauge, lionization gauges, Cold cathode type and hot cathode type - Pressure gauge selection, installation and calibration using dead weight ester.

## Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

- 1. Understand Principles and working of Viscosity, Humidity, Moisture, temperature, pressure, flow and level measuring Instruments.
- 2. Calibrate temperature, flow , level and Pressure measuring devices
- 3. Apply measurement of Viscosity, Humidity, Moisture, temperature, pressure, flow and level in Industrial **Applications**
- 4. Select and install Industrial instruments for various applications
- 5. Understand various Electrical type Industrial Instruments

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

## **Continuous Internal Evaluation:**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 220B2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

#### Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

- 1. The question paper will have ten questions. Each question is set for 20 marks.
- 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

## Marks scored shall be proportionally reduced to 50 marks

### Suggested Learning Resources:

### Books.

- 1. Doebelin, E.O. and Manik, D.N., "Measurement systems Application and Design", 6thMcGraw-Hill Education Pvt. Ltd, 2011.
- 2. A.K. Sawhney and PuneetSawhney, "Mechanical Measurements and Instrumentation and Control", DhanpatRai & Co. (P) Limited, 2015

## Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Quizzes

Assignments

Seminars

H.O.D.

Dept. of Agricultural Engineering

Alva's Institute of Engg. & Technology