

University of Pune

Centre for Sensor Studies

Syllabus for Basics of Measurement and Measuring Instruments (An interdisciplinary course for 6 credits)

- **The course is introduced for M. Sc. Students / Ph.D. Students doing experimental science of any subject.**
- **The course is of interdisciplinary nature. It can be taken by students from physics, chemistry, biological Science, Electronic Science and Instrumentation Science.**
- **Course duration is 6 months and will be conducted in both the semesters.**
- **Each course is of one credit and the course has total 6 credits. 4 credits are for theory course and 2 credits for laboratory.**
- **The student can opt from these 6 credits any number of credits at any of the semesters to understand the basics of measurements.**
- **It is run by the Centre of Sensor Studies, University of Pune, which has representation of physical, chemical and biological Sciences.**
- **The grades for course will be based on 50:50 weightage of Continuous Internal Assessment (CIA) and Semester End Examination (SEE).**

CSS- 101

Introduction to measurements: 1Credit

Significant figures, units of physical constants, Averages, RMS values, Decibels, Categories of Measurements, Factors in making the measurements-accuracy, precision, resolution, repeatability, reproducibility, hysteresis, sensitivity, range, Errors in Measurements-theoretical, static, dynamic, instrument insertion. Multimeter, CRO- Principle of Operation, Block Diagram, Specifications, Controls, Making Measurements with the Instruments -15L

CSS-102

Test and Measuring instruments: 1Credit

UV-Vis, FTIR Spectrometers, optical Multichannel Analyzer, optical Fiber Receiver- Transmitters, Lock-in Amplifier, Cyclic Voltmeter. Optical Microscope, SEM, FESEM, TEM, AFM, interpretation of results. (Block diagram and working) -15L 1Credit

CSS-103

Transducers and Sensor Parameters/ classification: 1Credit

Types, Specifications, Chemical, Physical, Mechanical, Thermal, Optical, Electrical, Magnetic and Bio-Sensors-Two sensors of each type, Applications of Sensors in clinical diagnosis, environment, Requirements, Basic Science, Design Considerations. -15L

CSS-104: 1Credit

II Overview of the living world

Introduction to molecules, Basic Ecology. Prokaryotes and eukaryotic cells and different levels of organization in the living world, overview of Bio-molecules and biochemical machinery of metabolism, Basic ecological concepts, Biotic and abiotic factors influencing ecosystem ecology. -15L

CSS-105 (Practical) : 1 Credit

Suggested List of Experiments and or Experiments of Similar Nature

Temperature Transducers:

- a. Characteristics of IC Temperature Sensor.
- b. Characteristics of Platinum RTD.
- c. Characteristics of NTC Thermistor.

Characteristic of J type thermocouple.

- b. Characteristic of K type thermocouple.
- c. Bimetallic relay as a temperature dependent control device.
- d. Temperature controlled alarm system (INTC)
- e. Temperature controlled alarm system (Bridge NTC)

Displacement Sensor:

- a. Study of Input Output characteristics of LVDT.
- b. To determine linear Range of operation of LVDT.
- c. To determine Sensitivity of LVDT.

Optical fiber sensors

- a. Characteristic of optical fibers
- b. Humidity Sensor
- c. Force Sensor
- d. Flow Sensor

Ultrasonic sensor

- a. Distance measurement using ultrasonic sensor.
- b. Sound sensitive switch

Estimation of Proteins by Biuret Method.

Estimation of Vitamin C

Familiarization with basic microbiological techniques, study of bacterial growth.

Biotic components of an (terrestrial / aquatic) ecosystem.

CSS-106 (Practical): 1 Credit

Suggested List of Experiments and or Experiments of Similar Nature

Pressure Sensor:

- a. Study of strain measurement using strain gauges and cantilever assembly.
- b. To determine linear range of operations of strain measurement.
- c. To determine sensitivity of trainer.

Strain / Pressure / Force / Piezo electric sensor

- a. Strain gauge as displacement sensor.
- b. Strain measurement and gauge factor determination.
- c. Test piezo electric transducer.

Speed measurement sensor

- a. Using magnetic pick up for motor speed sensor.
- b. Photo reflector for speed measurement.
- c. Photo interrupter method for speed measurement.

Stroboscopic method for speed measurement.

- b. Inductance used for speed measurement.
- c. Hall effect used for speed measurement.

Displacement sensor

- a. Linear displacement measurement using capacitance.
- b. Angular displacement measurement using capacitance.
- c. Displacement measurement using linear potentiometer.

Estimation of reducing sugars by DNSA method/ Nelson method.

Microscopic studies of prokaryotic and eukaryotic cells, plants and animals (including microbes), tissue organization of plants and animals.

Isolation of DNA from Plant/ Animal/ Microbial samples.