

EC412 SENSORS AND ACTUATORS (Dept. Elective - V)

Course Description & Objectives:

The course introduces the student to the different types of sensors, signal conditioning circuits, and actuators for Automation in science, Engineering and medicine. The course objective is to understand the basic working principles of different sensors and Actuators and to introduce the operation of various electronic Instruments which are used to measure the basic parameters.

Course Outcome :

Upon successful completion of this course, students should be able to:

- understand the basic working principles Actuators.
- Identify various sensors, Transducers and their brief Performance specifications.
- Understand principle of working of various transducers used to measure Temperature, Displacement, Level, and various miscellaneous other sensors.
- Choose Suitable sensor/transducer for a given physical variable and understand its principle, characteristics.
- Design and fabricate sensors with desired physical and chemical properties.

UNIT I- Sensor -I :

Basic sensor technology, sensor systems, Characteristics, conditioning bridge circuits, amplifiers for signal conditioning, different ADCs. Temperature sensors: RTD, thermister, thermocouple, basic principles, resistance temperature, characteristics, material required, application comparison, Position sensor, LVDT. Displacement: capacitive sensors, potentiometer sensors. Speed: Hall Effect sensors.

UNIT II- Sensor –II :

IR sensors for distant measurement: basic principle and applications. Accelerometer: characteristic, shock, vibration, pressure sensors, Flow, level, force, weight, sensors. Bio sensors, humidity, optical and thermal infrared detectors.

Unit III- Electronic instrumentation :

Instrumentation and measurement systems, measurement system performance, static calibration, errors in measurement, true value, accuracy and precision, linearity, hysteresis, Errors in ammeters and voltmeters, permanent magnet moving coil, ohmmeters, measurement of self inductance, Schering bridge, measurement of frequency, sources of errors in bridge circuits,

Unit IV- Electronic Measurements :

CRO: Electro static deflection, post deflection acceleration of electron beam, observation of wave forms on CRO, measurements of voltages and currents, multi input oscilloscopes, Negative resistance oscillators, square wave and pulse generators, Function generator, Q meter.

UNIT V- Actuators :

The Electromechanical Relay working principle, Electrical Relay Contact Types. Working principle and applications of solenoid valves, Linear Solenoid Construction. Working of Brushed Motor, Brushless Motor. Working principle and block diagram of Servo Motor, stepper motor

TEXT BOOKS :

1. A.K. Sawhney, Puneeth sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai Publications, 2012.
2. Sensors and actuators: control systems instrumentation Clarence W. De Silva CRC Press, 2007

REFERENCES :

1. Ian Sinclair, "Sensor and Transducers", Elsevier India Pvt Ltd, 3rd Edition, 2011.
2. Patranabis D, "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., 2006.
3. Ernest O. Doebelin, "Measurement System, Application and Design", Tata McGraw Hill Publishing Company Ltd., 5th Edition, 2008.