

SENSORS AND ACTUATOR DEVICES SYLLABUS

Module 1: Overview of Sensors and Actuators

- The Five Senses: Vision, Hearing, Smell, Taste, and Touch
- Definitions: Sensors & Actuators
- Overview of Sensor and Actuator Classifications
- Performance Characteristics of Sensors & Actuators
 - Transfer Function
 - Range
 - Span
 - Input and Output Full Scale
 - Resolution
 - Dynamic Range
- Calibration & Reliability

Module 2: Temperature Sensors and Thermal Actuators

- Thermoresistive Sensors
 - Thermistors
 - Resistance Temperature Detectors (RTDs)
 - Silicon Resistive Sensors
- Thermoelectric Sensors
- Other Temperature Sensors
 - Optical
 - Acoustical
- Thermomechanical Sensors and Actuators
- Case Study: Breath Analyzer Using Temperature

Module 3: Optical Sensors and Actuators

- Principles of Optics
 - Optical Units
 - Quantum Effects
- Quantum-Based Optical Sensors
- Photoelectric Sensors
- Charge Coupled Device (CCD) Based Sensors
- Thermal-Based Optical Sensors
- Active Infrared (AFIR) Sensors
- Optical Actuators
- Case Study: Liquid Level Indicator Using Optical Sensors

Module 4: Electric and Magnetic Sensors and Actuators

- Principles of Electric and Magnetic Fields
 - Basic Units
- The Electric Field
 - Capacitive Sensors & Actuators
- Magnetic Sensors and Actuators
 - Magnetoresistance
 - Magnetostrictive Sensors and Actuators
 - Magnetometers
 - Magnetic Actuators
 - Voice Coil Actuators
 - Motors as Actuators
 - Magnetic Solenoid Actuators
 - Magnetic Valves
- Case Study: Speed Sensing and Odometer in a Car Using Smart Sensors

Module 5: Mechanical Sensors and Actuators

- Definitions and Units
- Force Sensors
 - Strain Gauges
 - Semiconductor Strain Gauges

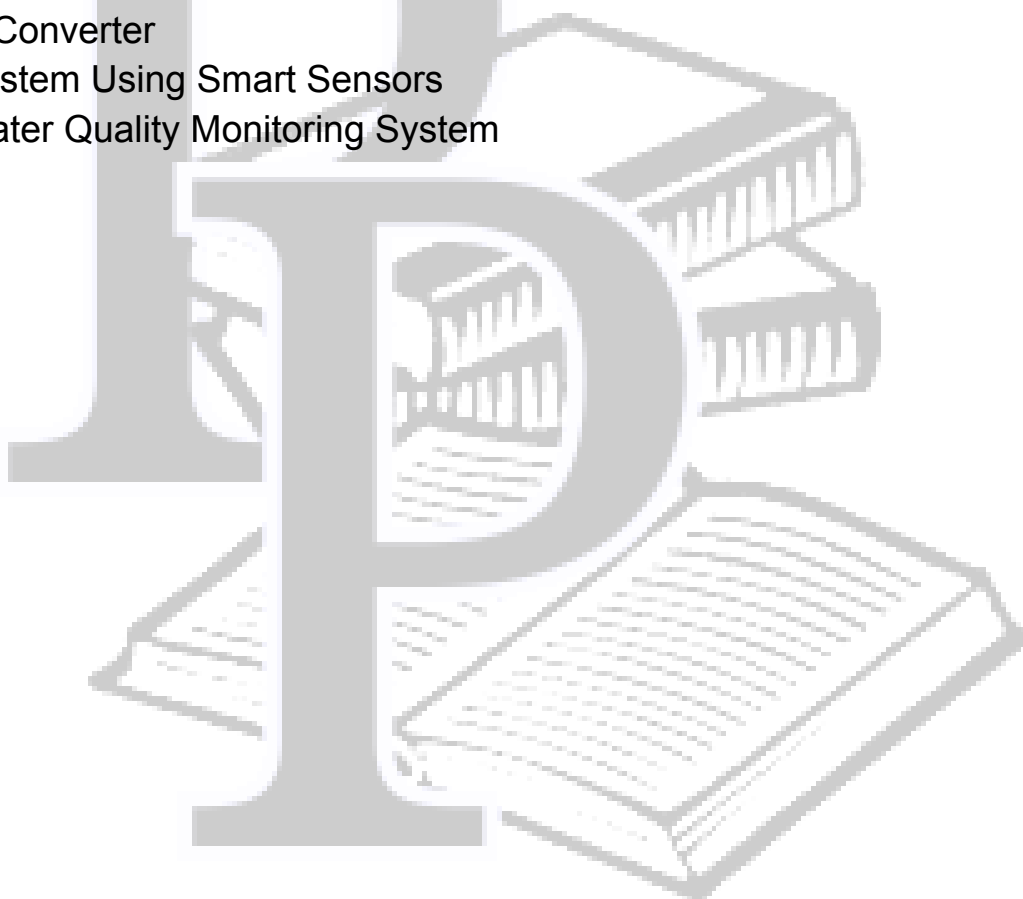
- Tactile Sensors
- Accelerometers
 - Capacitive Accelerometers
 - Strain Gauge Accelerometers
 - Magnetic Accelerometers
- Pressure Sensors
 - Mechanical
 - Piezoresistive
 - Capacitive
 - Magnetic
- Velocity Sensing
- Inertial Sensors and Actuators
 - Mechanical or Rotor
 - Optical Gyroscopes
- Case Study: Tire-Pressure Monitoring System Using Smart Sensors

Module 6: Acoustic Sensors and Actuators

- Definitions and Units
- Elastic Waves and Their Properties
- Microphones
 - Carbon
 - Magnetic
 - Ribbon
 - Capacitive
- Piezoelectric Effect
 - Piezoelectric Sensors
- Acoustic Actuators
 - Loudspeakers
 - Headphones
 - Buzzers
 - Magnetic and Piezoelectric
- Ultrasonic Sensors and Actuators
- Case Study: Ultrasonic Parking System

Module 7: Chemical Sensors and Actuators

- Chemical Units and Definitions
- Electrochemical Sensors
 - Metal Oxide Sensors
 - Solid Electrolyte Sensors
- Potentiometric Smart Sensors
 - Glass Membranes
 - Soluble Inorganic Salt Membranes
 - Polymer-Immobilized Ionophore Membranes
- Thermochemical, Optical, Mass, and Humidity Gas Sensors
- Chemical Actuators
 - Catalytic Converter
 - Airbag System Using Smart Sensors
- Case Study: Water Quality Monitoring System



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