20ES008 - Smart sensors and Actuators

UNIT – I

Sensors / Transducers

Principles – Classification – Parameters – Characteristics - Environmental Parameters (EP) – Characterization.

Mechanical and Electromechanical Sensors

Introduction – Resistive Potentiometer – Strain Gauge – Resistance Strain Gauge – Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors:– Electrostatic Transducer– Force/Stress Sensors Using Quartz Resonators – Ultrasonic Sensors.

UNIT – II

Thermal and Magnetic Sensors

Introduction–GasthermometricSensors–ThermalExpansionTypeThermometricSensors – AcousticTemperatureSensor–DielectricConstantandRefractiveIndexthermosensors– HeliumLowTemperatureThermometer–NuclearThermometer–MagneticThermometer– Resistance Change Type Thermometric Sensors –Thermoemf Sensors– Junction SemiconductorTypes–ThermalRadiationSensors–QuartzCrystalThermoelectricSensors – NQR Thermometry – Spectroscopic Thermometry – Noise Thermometry – Heat Flux Sensors.

Introduction to magnetic sensors–SensorsandthePrinciplesBehind–Magneto-resistiveSensors–Anisotropic Magnetoresistive Sensing – Semiconductor Magnetoresistors– Hall Effect and Sensors – Inductance and Eddy Current Sensors– Angular/Rotary Movement Transducers –Synchros – Synchro-resolvers - Eddy Current Sensors – Electromagnetic Flowmeter – Switching Magnetic Sensors SQUID Sensors.

UNIT – III

Radiation and Electro analytical Sensors

Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors. , The Electrochemical Cell – The Cell Potential - Standard HydrogenElectrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes - Sensor Electrodes – Electro ceramics in GasMedia.

UNIT – IV

Smart Sensors and Applications

Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation.

Applications

Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing –Sensors for environmental Monitoring.

UNIT – V

Actuators

Pneumatic and Hydraulic Actuation Systems- Actuation systems – Pneumatic andhydraulic systems - Directional Control valves – Presure control valves – Cylinders - Servo and proportional control valves – Process control valves – Rotaryactuators.

Mechanical Actuation Systems- Types of motion – Kinematic chains – Cams – Gears – Ratchet and pawl – Belt and chain drives – Bearings – Mechanical aspects of motor selection.

ElectricalActuationSystems-Electricalsystems-Mechanicalswitches–Solid-stateswitches Solenoids – D.C. Motors – A.C. motors – Steppermotors.

TEXT BOOKS:

1. D. Patranabis – "Sensors and Transducers" –PHI Learning PrivateLimited.
2. W. Bolton – "Mechatronics" –Pearson EducationLimited.