

| 18ECPE808 | | PHYSICS OF SENSORS | | L | T | P | C | | |
|--|--|--|--|---|---|---|----------|----------|----------|
| | | | | 3 | 0 | 0 | 3 | | |
| Course Objectives: | | | | | | | | | |
| 1. | To have knowledge of the different types of sensors commonly used on mobile robotic platforms | | | | | | | | |
| 2. | understanding of the basic principles of operation of different types of sensors | | | | | | | | |
| 3. | To discuss common practices and algorithms for processing raw sensor information | | | | | | | | |
| Unit I | INTRODUCTION AND DISPLACEMENT MEASUREMENT | | | | | | 9 | + | 0 |
| Sensors - Basic requirements of a sensors- Classification of sensors - Static and Dynamic characteristics of sensors - Displacement Sensors - Linear and Rotary displacement sensors – Potentiometer - Capacitive and Inductive type displacement sensor - Position sensors - Optical encoder - Photoelectric sensor - Hall Effect Sensor. | | | | | | | | | |
| Unit II | MEASUREMENT OF PROXIMITY, FORCE AND PRESSURE | | | | | | 9 | + | 0 |
| Eddy current proximity sensor - Inductive Proximity sensor - Capacitive Proximity sensor - Pneumatic Proximity sensors - Proximity Switches - Contact and Noncontact type – Strain Gauge – Diaphragm Pressure Sensor- Capsule Pressure sensors - Bellows Pressure Sensor - Bourdon tube pressure sensor - Piezoelectric Sensor - Tactile sensor. | | | | | | | | | |
| Unit III | MEASUREMENT OF VELOCITY, FLOW AND LEVEL | | | | | | 9 | + | 0 |
| Tachogenerator - Pyroelectric sensors - Ultrasonic sensor – Resistive sensor - Pitot tube – Orificeplate - flow nozzle- Venturi tubes – Rotameter - Electromagnetic flow meter - Float level sensor- Pressure level sensor- Variable capacitance sensor. | | | | | | | | | |
| Unit IV | MEASUREMENT OF TEMPERATURE, MOTION AND LIGHT SENS | | | | | | 9 | + | 0 |
| Thermocouples - Thermistors - Thermodiodes – Thermotransistors – BimetallicStrip - Resistance Temperature Detector - Infrared Thermography - Vibrometer and accelerometer - Seismic accelerometer - Photoresistors - Photodiodes - Phototransistors - Photoconductors. | | | | | | | | | |
| Unit V | MICRO SENSORS AND ACTUATORS | | | | | | 9 | + | 0 |
| Micro Sensors: Principles and examples - Force and pressure micro sensors - Position and speed micro sensors - Acceleration micro sensors - Chemical sensors – Biosensors - Temperature micro sensors and flow micro sensors - Micro Actuators: Actuation principle - Shape memory effects - One way, two way and pseudo elasticity - Types of micro actuators – Electrostatic - Magnetic - Fluidic - Inverse piezo effect - Other principles. | | | | | | | | | |
| Total (L+T)=45 Periods | | | | | | | | | |
| Course Outcomes: | | | | | | | | | |
| Upon completion of this course, the students will be able to: | | | | | | | | | |
| CO1 | : | Understandthe basic principles of operation of different types of sensors | | | | | | | |
| CO2 | : | Discuss common practices and algorithms for processing raw sensor information | | | | | | | |
| CO3 | : | Configure, calibrate and use modern sensors in the context of mobile robots | | | | | | | |
| CO4 | : | List the reasons about limitations and advantages of different sensors in different application contexts | | | | | | | |
| Text Books: | | | | | | | | | |
| 1. | Clarence W De Silva, " Sensors and actuators-Control System Instrumentation" , CRC Press, 2007 | | | | | | | | |
| 2. | O. N. Pandey, "Sensors and Instrumentation ' , S.K. Kataria& Sons,2013 | | | | | | | | |
| Reference Books: | | | | | | | | | |
| 1. | Busch-Vishniac Ilene J, "Electromechanical Sensors and Actuators " Springer-Verlag New York Inc., New Edition | | | | | | | | |
| 2. | Andrzej M Pawlak,"Sensors and Actuators in Mechatronics: Design and Applications", 1 st Edition, Kindle Edition, 2006 | | | | | | | | |
| 3. | Rupitsch, Stefan Johann," Piezoelectric Sensors and Actuators Fundamentals and Applications", Springer,2019. | | | | | | | | |
| 4. | Minoru Taya, E. Van Volkenburgh , Makoto Mizunami , Shūhei Nomura, "Bioinspired Actuators and Sensors", 1 st Edition, Kindle Edition,2018 | | | | | | | | |
| E-References: | | | | | | | | | |
| 1. | https://nptel.ac.in/courses/112103174/3 | | | | | | | | |
| 2. | https://nptel.ac.in/courses/112101099/7 | | | | | | | | |
| 3. | https://nptel.ac.in/courses/112101099/7 | | | | | | | | |