ROBOTICS (GE)

Credits:Theory-03 **Theory Lectures: 45h**

Course Learning Objectives

This course helps student to understand the fundamentals of robotics and their applications. They should be able to use various sensors and design an automated system which works depending on the various external environmental conditions. Student would be in a position to make rudimentary robot which is capable of moving along a predetermined path, follow a drawn line and other more equivalent applications.

Course Learning Outcomes

At the end of this course, Students will be able to

CO1 Familiarize with concept of robotics and its applications to various industries.
CO2 Familiarization with the programming environments used in robotics applications.
CO3 Understand the working of sensors, actuators and other components used in design and implementation of robot.
CO4 Designing timer/counter circuits and displays their out puts using LCD and other indicator devices.
CO5 Understand the communication standards and their uses in interfacing.

Prerequisite: Basic knowledge of analog and digital circuits, any programming language

L-T-P: 3-0-1

Syllabus Contents

Unit I: Introduction (11 Lectures)

Robots, Robotics (Definition only) ; types of Robots , components of robot , Robot degrees of freedom, Robot joints , Robot coordinates, Robot reference frames, Robot characteristics : payload, reach, precision, repeatability; Laws of Robotics, Introduction to Computer Vision and Pattern Recognition , Signal conditioning and Industrial Applications of robots.

Unit II : Robot programming and Programming Environments (11 Lectures)

Robot Programming modes: physical set up, Teach mode, Continuous Walk through mode and software mode, Integrated Development Environment (IDE) for AVR microcontrollers, free IDEs like AVR Studio, WIN AVR. Installing and configuring for Robot programming, In System Programmer (ISP),loading programmes on Robot

Unit III: Actuators and Sensors (12 Lectures)

Actuators: Characteristics of actuating systems**,** comparison of actuating systems (Hydraulic, Electric and Pneumatic), DC Motors ,Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations, Grippers (types only)

Sensors: White line sensors , IR range sensor of different range, Analog IR proximity sensors, Analog directional light intensity sensors, Position encoders, Servo mounted sensor pod/Camera

Pod, Wireless colour camera, Ultrasound scanner, Gyroscope and Accelerometer, Magnetometer, GPS receiver, Battery voltage sensing, Current Sensing
Indicators : LEDs and Buzzer

Unit IV: Robot control and Communication Technology (11 Lectures)
PWM generation and its applications in motor velocity control, servo control ,motor position control and event scheduling
Communication Technology : Wired RS232 (serial) Communication, Wireless Zigbee Communication, USB Communication, Simplex infrared Communication (IR remote to robot), LCD interfacing .

References/Suggested Readings:

1. Saha,S.K., Introduction to Robotics,2nd Edition, McGraw-Hill Education, New Delhi, 2014
2. R.K. Mittal,I.J. Nagrath,–Robotics&Control‖,Tata McGraw&Hills, 2005.
3. Robotic Engineering – An Integrated Approach by Richard D Klafter, Thomas A. Chmielewski and Michael Negin, Prentice Hall India (1989)
4. Saeed B. Niku, Introduction to Robotics , Analysis , systems and Applications , PHI(2007)

Robotics Lab

Credits: 01 **Lectures: 30h**

Course Learning Outcomes

At the end of this course, Students will be able to

CO1 Understand the fundamentals of Robotics and its components
CO2 Design the software and Hardware for day to day / long term applications.
CO3 Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications.

Syllabus Contents

1. Interfacing experiment using available hardware like LCD, LED, Buzzer, Motors.
2. Read IR proximity sensor to determine if there is some object nearby and thus Control the motion of robot using IR sensors.
3. Control a robot using LDR/ laser
4. Simple Motion Control(programming the robot to move forward, backward, left and right)
5. Line following Robot (programming the robot to move along a define path, white line or black line)
6. Obstacle Detection (programming the robot for obstacle detection)
7. Project work