MECHATRONICS

Course Code: ME7T1   **Credits: 3**
Lecture: 3 Periods/week   **Internal assessment: 30 Marks**
Tutorial: 1 Period/week   **Semester end examination: 70 Marks**

COURSE OUTCOMES:
At the end of course the students will be able to:
1. Demonstrate the mechatronic systems and sensors used in building mechatronic systems
2. Illustrate various types of actuation systems .
3. Discuss the modeling of basic systems and their dynamic response.
4. Describe the basic structure and functions of closed loop controllers, Microprocessor and micro controllers.
5. Discuss the basics of digital logic, PLC programming and applications of Fuzzy logic.

Pre-Requisites:
Basic electrical and electronics

UNIT I
INTRODUCTION: Definition of Mechatronics, evolution of mechatronics, systems, measurement systems, control systems, mechatronic design process, traditional design and mechatronic design, applications of mechatronic systems, advantages and disadvantages of mechatronic systems.

SENSORS : classification of sensors, basic working principles, Velocity sensors – Proximity and Range sensors, ultrasonic sensor, laser interferometer transducer, Hall Effect sensor, inductive proximity switch. Light sensors – Photodiodes, phototransistors, tactile sensors – PVDF tactile sensor, micro-switch and reed switch Piezoelectric sensors, vision sensor

UNIT II
PNEUMATIC AND HYDRAULIC ACTUATION SYSTEMS: Actuation systems, Pneumatic and Hydraulic systems- constructional details of filter, lubricator, regulator, direction control valves, pressure control valves, flow control valves, actuators-linear and rotary.
ELECTRICAL ACTUATION SYSTEMS: Electrical systems, Mechanical switches, solid state switches, solenoids, DC motors, AC motors, stepper motors. Characteristics of pneumatic, hydraulic, electrical actuators and their limitations.

UNIT III
BASIC SYSTEM MODELS: Mathematical models, mechanical system building blocks, electric system building blocks, fluid system building blocks, thermal system building blocks, **DYNAMIC RESPONSES OF SYSTEMS:** Transfer function, Modelling dynamic systems, first order and second order systems.

UNIT IV
CLOSED LOOP CONTROLLERS: Classification of control systems, feedback, closed loop and open loop systems, continuous and discrete processes, control modes, two step mode, proportional mode, derivative control, integral control, PID controller.

MICROPROCESSOR AND MICRO CONTROLLER: Introduction, Architecture of a microprocessor (8085), Architecture of a Micro controller, Difference between microprocessor and a micro controller.

UNIT V
DIGITAL LOGIC: Digital logic, number systems, logic gates, Boolean algebra, Karnaugh maps, application of logic gates, sequential logic, transducer Signal Conditioning and devices for data conversion.
PROGRAMMABLE LOGIC CONTROLLERS: Introduction, basic structure, input/output processing, programming, mnemonics, timers, internal relays and counters, shift register, master and jump controls. Data handling, Analog input/output, selection of a PLC.
FUZZY LOGIC APPLICATIONS IN MECHATRONICS: Fuzzy logic systems, Fuzzy control, Uses of Fuzzy expert systems.

Learning Resources

Text books:

1. Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering, (3rd edition), by W Bolton, Pearson Education Press, 2005.
2. Mechatronics System Design, 5th Indian reprint, 2009, by Devdas shetty, Richard A. kolk, PWS Publishing Company

Reference books:

1. Mechatronics Source Book, by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics, by N. Shanmugam, Anuradha Agencies Publishers.
3. Control sensors and actuators, by C.W.Desilva, Prentice Hall.
4. Design with Microprocessors for Mechanical Engineers, by Stiffler, A.K.McGraw- Hill (1992).