MMPC2001 INTRODUCTION TO MECHATRONICS (3-0-0)

Course Objective: This course aims at providing fundamental understanding about the basic elements of a mechatronics system, interfacing, and its practical applications

Module I (6 Hrs)
Introduction: Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronic approach, Integrated Product Design, Modeling, Analysis and Simulation, Man-Machine Interface.

Module II (6 Hrs)
Sensors and transducers: classification, Development in Transducer technology, Opto- Electronics-Shaft encoders, CD Sensors, Vision System, etc.

Module III (6 Hrs)
Drives and Actuators: Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control; Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems

Module IV (6 Hrs)
Smart materials: Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators: Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation, etc.

Module V (6 Hrs)
Micromechatronic systems: Microsensors, Microactuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.

Course Outcomes (COs)
Upon successful completion of this course, students will be able to:
1. Understand the foundational concepts of mechatronics systems, including integrated product design, modeling, and simulation.
2. Explain the classification, characteristics, and advancements in sensor and transducer technologies, including optoelectronics and vision systems.
3. Apply knowledge of hydraulic, pneumatic, and electrical actuation systems to design and analyze drive circuits in both open and closed-loop control configurations.
4. Analyze the behavior and applications of smart materials such as shape memory alloys and piezoelectric actuators in real-world scenarios like positioning and vibration isolation.
5. Evaluate the design and functionality of micromechatronic systems, including microsensors, microactuators, and micro-fabrication techniques, through case studies in various applications.
6. Create conceptual designs of mechatronic systems by integrating knowledge from multiple disciplines, such as robotics, machine diagnostics, and medical technologies.

Text/Reference Books:

1. Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.).
2. Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education
3. A Textbook of Mechatronics, R.K. Rajput, S. Chand & Company Private Limited
4. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.