3PE43: MECHATRONICS
CREDITS - 4 (LTP: 3, 0, 1)

Course Objective:
Mechatronics is a rapidly growing interdisciplinary field of engineering with synergistic integration of mechanical engineering, electronics engineering, computer technology & control engineering in development of electromechanical products through a unified design approach. Students with sound & fundamental knowledge and understanding of this broad & multi-disciplinary course are today's need of industries. The basic objective of this course is to prepare the students of Production Engineering Program to fulfill the said need.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Mechatronics Systems:** Introduction to mechatronics, Elements of Mechatronics System, Mechatronics Design Process, Measurement & Control Systems, Real-time Mechatronics Systems & Other Applications	05
2	**Sensors & Transducers:** Introduction, Types of Transducers, Characteristic Parameters used in Transducers, Working Principles of sensors used for Displacement, Position, Proximity, Velocity, Motion, Force, Acceleration, Torque, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, and Light Measurements/Sensing.	11
3	**Analog Signal Conditioning:** Signal conditioners, Operational amplifiers, Noise Reduction, Bridge Circuits.	05
4	**Actuators in Mechatronics:** Introduction, Working, construction & applications of hydraulic, pneumatic, mechanical and electrical actuators, Selection Criteria for actuators.	08
5	**Digital Electronics & Systems:** Digital Logic Control including Logic Gates, Boolean Expression from Truth Table, Applications of Logic Gates, Sequential Logic, Microprocessors & Microcontrollers including their structures, applications & basic programming, Data Acquisition Systems, Input/Output Hardware, Analog-to-Digital & Digital-to-Analog Conversions	06
6	**Programmable Logic Controllers:** Introduction, Basic Structure of a Programmable Logic Controller (PLC), Principles of Operation, Internal Architecture & Hardware Components, PLC Programming & Use of Ladder Diagrams, Applications of PLCs for Control, Case Studies of Mechatronics System's Design.	07
	Total	**42**

List of References:

1. K. P. Ramchandran, G. K. Vijayaragravan & M. S. Balasundram, "*Mechatronics: Integrated Mechanical Electronic Systems*", Wiley India Pvt. Ltd., 2008.
2. W. Bolton, "*Mechatronics*", Pearson Education (India), 2003.
3. Histand B.H. & Alciatore D.G., "*Introduction to Mechatronics and Measurement Systems*", Tata McGraw Hill Publishing Company Ltd, 3rd Edition, 2007.
4. Shetty D., Kolk R. A., "*Mechatronic System Design*", PWS Publicity Boston, 2002.
5. R.K. Rajput, "*A Text Book of Mechatronics*", S. Chand & Company Ltd., 1st Edition, 2007.
6. Sabri Cetinkunt, "*Mechatronics with Experiments*", John Wiley & Sons Ltd,This edition first published 2015.
7. Godfrey C. Onwubolu, "*Mechatronics Principles and Applications*", Elsevier Butterworth-Heinemann, First published 2005.
8. R. S. Gaokar, "*Microprocessor Architecture, Programming and Applications with the 808*", Penram International Publishing, 5/e.
9. Edited by Clarence W. de Silva, Farbod Khoshnoud, Maoqing Li & Saman K. Halgamuge,"*Mechatronics - Fundamentals and Applications*", CRC Press - Taylor & Francis Group, 2016.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand & explain key elements of mechatronics system, core technology necessary for the design & development of the mechatronics products as well as provide examples of mechatronics systems.
2. Learn about performance parameters of sensors & transducers used in the measurements of various parameters & quantities as well as understand construction, working & selection criteria of various types of sensors & transducers.
3. Explain the purpose & importance of signal conditioning, the use of operational amplifiers, and noise reduction & filtering.
4. Understand working, construction & applications of hydraulic, pneumatic, mechanical and electrical actuators.
5. Understand the fundamentals of digital logic control, logic gates, microprocessors, microcontrollers & data acquisition systems including interfacing requirements, analog-to-digital & digital-to analog conversions, and design simple logic circuits.
6. Explain the operations of hardware & input/output devices found in programmable logic controllers, and develop PLC programming using ladder diagram as well as understand case studies related to various mechatronics systems.