Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pr/ Oral.	Total
ILOT5014	Mechatronics	3	-	-	3	-	-	3

Course Code	Course Name	Examination Scheme								
		Theory						TW	Pr/ Oral.	Total
		Internal Assessment				End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg.	Mid Sem Exam					
ILOT5014	Mechatronics	20	20	20	20	60	2	-	-	100

Course Prerequisite

1. None

Course Objectives

The aim of this course is to provide in-depth treatment on methods and techniques in

1. To learn the architecture of the mechatronics system design
2. To introduce broad spectrum characteristics of the mechanical
3. and electrical actuators and their selection for mechatronic systems.
4. To familiarize development of process plan and templates for design of mechatronic systems.

Course Outcomes After successful completion of the course student will be able to …

1. Develop the mechatronic system.
2. Analyze the concept of system modeling.
3. Identify the suitable sensor and actuator for a mechatronic system.
4. Design feedback and intelligent controllers.
5. Implement mechatronic system validation.
6. Integrate the components in mechatronics system.

Module	Detailed Content	Hours	CO
1	**Introduction to mechatronics systems:** Definition and evolution levels of mechatronics, integrated design issues in mechatronics, key elements of mechatronics, mechatronics design process- modeling and simulation, prototyping, deployment /life cycle, advanced approaches in mechatronics.	06	CO1
2	**Modeling and Simulation of physical systems:** Simulation and block diagrams, Analogies and impedance diagrams, electrical system-bridge circuit system, transformer, mechanical translational and rotational systems-sliding block with friction, elevator cable system, mass-damper system, automobile suspension system, mechanical lever system, geared elevator system, electromechanical coupling- DC motor, fluid systems-three tank liquid system, hydraulic actuator and hydraulic pressure regulator.	09	CO2
3	**Hardware components:** Sensors: motion and position measurement, force, torque and tactile sensors, ultrasonic and range sensors, fiber optic sensors, micro sensors. Actuators: Pneumatic and hydraulic-directional and pressure control valves, cylinders, servo proportional control valves, rotary actuators, Electrical actuation: A.C and DC motors, stepper motors, mechanical switches and solid state switches. Mechanical Actuation: types of motion, kinematic chain, cams, gears, ratchets and pawl, belt and chain drives, bearings, mechanical aspects of motor selection, piezoelectric actuators, magnetostrictive actuators, memory metal actuators, Programmable Logic Controller	09	CO3
4	**Intelligent control:** Automatic control methods, Artificial Neural Network(ANN) – Modeling, basic model of neuron, characteristics of ANN, perceptron, learning algorithms, fuzzy logic – propositional logic, membership function, fuzzy logic and fuzzy rule generation, defuzzification, time dependent and temporal fuzzy logic.	07	CO4
5	**Components based modular design and system validation:** Components based modular design view, system validation, validation methodology- integrated and design dependence, distributed local level, validation schemes, fusion technique	04	CO5
6	**Integration:** Advanced actuators, consumer mechatronic products, hydraulic fingers, surgical equipment, industrial robot, autonomous guided vehicle, drilling machine	04	CO6
	Total	**39**	

Evaluation Scheme:

1. **In-Semester Assessment:**
   a. Assessment consists of two Internal Assessments (IA1, IA2) out of which; one should be compulsory class test (on minimum 02 Modules) and the other is a class test / assignment on case studies / course project.
   b. Mid Semester Examination (MSE) will be based on 40-50% of the syllabus.

2. **End-Semester Examination:**
   - Question paper will comprise of full syllabus.
   - In the question paper, weightage of marks will be proportional to the total number of lecture hours as mentioned in the syllabus.

Text books:

1. Devdas Shetty and Richard Kolk, “Mechatronics System Design”, Thomson Learning, 2nd reprint, 2010.
2. W. Bolton, “Mechatronics - Electronic Control Systems in Mechanical and Electrical Engineering”, Pearson Education Ltd, 6th edition, 2018.
3. Nitaigour Mahalik, “Mechatronics- Principles, Concepts and Applications”, Tata McGraw Hill, 2004.

Reference Books:

1. Stamatios V. Kartalopoulos, “Understanding Neural Networks and fuzzy Logic”, PHI,3rd reprint, 2013.
2. Zhijun Li, Shuzhi Sam Ge, “Fundamentals in Modeling and Control of Mobile Manipulators", March 30, 2017, by CRC Press.
3. Sergey Edward Lyshevski, “Mechatronics and Control of Electromechanical Systems", May 30, 2017, by CRC Press.
4. Bodgan Wilamowski, J. David Irwin, “Control and Mechatronics", October 12, 2017, by CRC Press.
5. Takashi Yamaguchi, Mitsuo Hirata, Justin Chee Khiang Pang, "High-Speed Precision Motion Control", March 29, 2017, by CRC Press.
6. David Allan Bradley, Derek Seward, David Dawson, Stuart Burge, “Mechatronics and the Design of Intelligent Machines and Systems", November 17, 2000, by CRC Press.
7. Clarence W. de Silva, Farbod Khoshnoud, Maoqing Li, Saman K. Halgamuge, “Mechatronics: Fundamentals and Applications", December 12, 2018, by CRC Press.
8. Clarence W. de Silva, “Mechatronics: A Foundation Course", June 4, 2010 by CRC Press.