Design Innovation Centre, IUST

Course Title	Mechatronics
Course Code	DICE03T
Course Type	Open Elective Course
Total Credits	3 (L-T-P: 3-0-0)
Pre-requisites (if any)	Basic Electric and Electronic Circuits, Basic Programming knowledge
Co-Requisites	Signals & Systems
Preferred Semester	5th (ECE, EE, ME, CSE,)
Course Synopsis	Mechatronics integrates mechanical, electronics, software and control engineering in the design, development and control of diverse systems used on a range of industries including manufacturing, medicine, service industries etc. Examples of Mechatronics systems include aircrafts, dishwashers, motor vehicles, automated manufacturing plants, medical and surgical devices and systems, robots, artificial organs, car anti-lock braking systems (ABS) and many others. The purpose of this interdisciplinary course will be to study the basics of mechatronics systems, to understand the fundamentals of the mechatronics design paradigm, to get familiar with the design and application of advanced hybrid systems (electromechanical systems).
Course Objectives	This course aims at: 1. Creating a firm base for mechatronics design and development at the basic level. 2. Familiarising students with the fundamentals of design and development of mechatronics systems. 3. Reinforcing the knowledge/skills gained, through practice and reflection in an action-oriented setting.

Course Outcome	By the end of this course the student will be able to: Develop a firm understanding of Mechatronics as a discipline. Use the techniques, skills, and modern mechatronics engineering tools necessary for engineering practice. Design mechatronics component, system or process to meet desired needs.

UNIT	Topic
1	**INTRODUCTION TO MECHATRONICS** Definition, Disciplinary foundations , Mechatronics design process, evolution of Mechatronics as a design paradigm, Mechatronics systems - Basic concept of mechatronic system, reverse engineering of real world examples of mechatronics systems (disassembly and analysis of commercially available mechatronics system).
2	**SENSORS & ACTUATORS** Sensors: Overview of sensors, Fundamental Sensor Concepts: Sensor characteristics: transfer function, range and sensitivity, errors and calibration, accuracy and precision, linearity, hysteresis. Sensors for position, displacement, level and flow, occupancy. Sensors for velocity, acceleration, force and strain. Sensors for radiation: sources, detectors, optical circuit components. Sensors for temperature: reference points, thermo-resistive and thermoelectric sensors. Actuators: Hydraulic, Pneumatic, Electric.
3	**SYSTEM MODELLING AND CONTROL** Principles for modelling of physical systems. Models of mechanical system, electrical system, thermal system, fluid system. Model representations using differential equations, transfer functions, and difference equations. Simulation of dynamics systems. System analysis: transient response, sensitivity and stability. Controller design and simulation using MATLAB.
4	**MECHATRONICS SYSTEM DESIGN** Integrated system design, selections and interfacing of mechatronics components and prototyping, design project in mechatronics system development. Special lectures on contemporary topics.

Note: Practical/Lab Sessions will form a part of the lectures.

Recommended Readings:

1. Mechatronics, Principles, Concepts and Applications. Nitaigour Mahalik, 2003, Tata McGraw Hill.
2. Introduction to Mechatronic Design. J.Edward Carryer, R.Matthew Online, Thomas William Kenny, 2011, Prentice Hall.
3. Mechatronics: An Introduction. Robert bISHOP, 2006, Taylor and Francis, CRC Press, FL