Course Number : AR503
Course Name : Mechatronics
Credit Distribution : 3-0-0-3
Intended for : UG, PG and PhD
Prerequisite : Consent of faculty advisor
Mutual Exclusion **:** None

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1. Preamble:

Students will be introduced to the main topics in the Mechatronics which blends the disciplines of mechanical engineering, computing, and electronics to create a huge range of electromechanical systems. It includes Introduction to the design of electromechanical systems. Interfacing sensors and actuators to a personal computer and a single-board computer. Electrical and mechanical design, prototyping, and construction. Dissection of a commercial mechatronic product. Students work in teams to produce final computer-controlled electromechanical projects of their own design.

2. Course Modules with quantitative lecture hours:

Introduction to Mechatronics: Introduction, Examples of Mechatronic systems, Electric circuits and components, Review of fundamentals of Electronics and its applications, Number systems: binary, hexadecimal and Review of C programming, CNC machines and Industrial Robots. **(4 hours)**

Mechatronics elements: Sensors and transducers, Displacement, Position & Proximity Sensors, Force, Fluid pressure, Liquid flow sensors, temperature, light sensor, Acceleration and, Vibration measurement, Performance terminology of sensors, Semiconductor sensors and micro-electromechanical systems (MEMS). **(8 hours)**

Microprocessors, microcontrollers, and Closed-loop controllers: Digital circuits, Microprocessors, Microcontrollers, Programming of Microcontrollers, P, I, PID Controllers, Digital Controllers, Program Logic Controllers, Input/output & Communication systems, Fault finding. **(4 hours)**

Signal conditioning: Introduction to signal processing, Op-Amp as a signal conditioner, Analog to Digital Converter, and Digital to Analog Converter. **(4 hours)**

Actuators, Drives, and mechanisms: Stepper motors, Actuators, Motor sizing, Power transmission: gears (rack and pinion, spur, planetary, worm, bevel, crown, harmonic) and belt drives; Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems. Torque, speed, and power equations, efficiency, and inertia. **(6 hours)**

Hydraulic and Pneumatic system: Flow, pressure, direction control valves, actuators, and supporting elements, hydraulic power packs, pumps, and design of hydraulic circuits. Pneumatic system production, distribution and conditioning of compressed air, system components and graphic representations, design of systems. **(6 hours)**

Modelling and system response: Mechanical, Electrical, Fluid system modelling, Dynamic response, Transfer function and frequency response. **(6 hours)**

Final project on mechatronics: Group project towards design and fabrication of functional Mechatronics systems. **(4 hours)**

Laboratory/practical/tutorial Modules:

Microprocessors, microcontrollers, and Closed-loop controllers, Signal conditioning, Actuators, Drives, and mechanisms, Hydraulic and Pneumatic system, Modelling and system response.

3. Textbooks:

1. Bolton, William. Mechatronics: electronic control systems in mechanical and electrical engineering. Pearson Education.
2. Mahalik, Nitaigour Premchand. Mechatronics. Tata McGraw-Hill.
3. Bishop, Robert H. Mechatronics: an introduction. CRC Press.
4. Mechatronics system design by Devdas Shetty and Richard A. Kolk, Cengage Learning.
5. Mechatronics by G. Hegde, Jones and Bartlett.

4. References:

1. G.W. Kurtz, J.K. Schueller, P.W. Claar . II, Machine design for mobile and industrial applications, SAE.
2. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi.
3. T.O. Boucher, Computer automation in manufacturing - an Introduction, Chappman and Hall.
4. Embedded Computing and Mechatronics with the PIC32 Microcontroller, Kevin Lynch, Nicholas Marchuk, Matthew Elwin, Newnes.
5. R. Iserman, Mechatronic Systems: Fundamentals, Springer.
6. Musa Jouaneh, Fundamentals of Mechatronics, Cengage Learning.

5. Similarity with the existing courses:

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.		None	None	None

6. Justification of new course proposal if cumulative similarity content is >30%: None