Mechatronics (404212)

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To provide multidisciplinary knowledge
- Expose Role of Controls in Mechatronics.
- Aims to develop understanding of Mechatronics Components.
- To make students aware about Logic system, Software & Data acquisition.
- Apply Mechatronics Engineering technical expertise to industry-related fields.
- Get awareness on advance technologies like MEMS.

Course Outcomes:
After successfully completing the course students will be able to

- Work in interdisciplinary field.
- Describe how to optimize Mechatronics system.
- Implement software for control of Mechatronics systems.
- Interpret and apply current or emerging knowledge from inside and outside Mechatronics Engineering.
- Use relevant mathematics and computer science concepts as tools.

Unit I : Overview of Mechatronics 6L

Key Elements, Mechatronics Design Approach, Functions of Mechatronics system, Division of functions between Mechanics and Electronics, Stepwise Design Procedure, Modeling Procedure. Mechanical Components and systems: Bearings and Bushings, Belts and Pulleys, Brakes and clutches, Chains and Sprockets, Couplings and joints, gears, Pulleys and Belts, Solenoids, springs, Switches.

Unit II : Self-Optimizing Mechatronic Systems 6L

Introduction ,Self-Optimization, Challenges during the development of self-optimizing systems, Specification of the principle solution, Partial models, Interrelations between the partial models, Particularities within the specification of self-optimizing systems,. Conceptual design of self-optimizing systems, The role of the principle solution during the concretization

Unit III : Systems and Control 6L

Role of controls in Mechatronics, Key elements of controlled Mechatronics system, Integrated Modeling, design and control implementation, Case study: Design of a mobile Robot, Modern examples of Mechatronics systems in action, Special Requirements of Mechatronics that

Differentiate from Classic Systems and Control Design, State space analysis controller examples.

Unit IV :Computers and Logic Systems 6L

The Mechatronics use of computers, concept of real time, System interfaces, Terminology and Definitions (Serial vs. Parallel, Bit Rate vs. Baud Rate, Synchronous 16 vs. Asynchronous, Data Flow-Control, Handshaking, Communication Protocol, Error Handling, Simplex, Half- Duplex, Full-Duplex, Unbalanced vs. Balanced Transmission, Point-to-Point vs. Multi-Point, Serial Asynchronous Communications, the Universal Asynchronous Receiver Transmitter (UART)), TIA/EIA Serial Interface Standards RS- 232 Serial Interface, Functional Description of Selected Interchange Circuits, IEEE 488- The General Purpose Interface Bus (GPIB) CNC machines, PLC.

Unit V: Software and Data Acquisition 6L

Data logging functional requirement: Acquisition, Sensors, Signal Connectivity, Signal Conditioning, Conversion, Online Analysis, Logging and Storage, Offline Analysis, Display, Report Generation, Data Sharing and Publishing; Data-Logging Systems Different applications of Mechatronics as Case study

Unit VI: Introduction to MEMS 6L

MEMS: Introduction and Fundamentals , mechanical properties of MEMS materials, modeling and simulation of MEMS, materials involved in designing and fabricating MEMS devices, various fabrication and manufacturing methods, including LIGA and macromolding, X-ray based fabrication.

Applications:-inertial sensors, micromachined pressure sensors, surface micromachined devices, microscale vacuum pumps, reactive control for skin-friction reduction, and microchannel heat sinks.

Text Books

1. Robert H. Bishop, 'The Mechatronics Handbook'_ CRC Press

2. D.G.Alciatore, M.B.Histand, 'Mechatronics'_2nd edition, TMH

3. Jurgen Gausemeier, Sascha Kahl, 'Architecture and Design of self –optimization Mechatronics System' InTech publication

Reference Books

1. Mohamed Gad-el-Hak, "The MEMS Handbook, Second Edition" - 3 Volume Set _CRC Press.