Unit 6: Mechatronics

Unit code T/615/1480

Unit level 4

Credit value 15

Introduction

Auto-focus cameras, car cruise control and automated airport baggage handling systems are examples of mechatronic systems. Mechatronics is the combination of mechanical, electrical and computer/controlled engineering working together in automated systems and 'smart' product design.

Among the topics included in this unit are: consideration of component compatibility, constraints on size and cost, control devices used, British and/or European standards relevant to application, sensor types and interfacing, simulation and modelling software functions, system function and operation, advantages and disadvantages of software simulation, component data sheets, systems drawings, flowcharts, wiring and schematic diagrams.

On successful completion of this unit students will be able to explain the basic mechatronic system components and functions, design a simple mechatronic system specification for a given application, use appropriate simulation and modelling software to examine its operation and function, and solve faults on mechatronic systems using a range of techniques and methods.

Learning Outcomes

By the end of this unit students will be able to:

1. Explain the design and operational characteristics of a mechatronic system.
2. Design a mechatronic system specification for a given application.
3. Examine the operation and function of a mechatronics system using simulation and modelling software.
4. Identify and correct faults in a mechatronic system.

Essential Content

LO1 **Examine the design and operational characteristics of a mechatronic system**

Origins and evolution:

History and early development, evolution.

Practical examples and extent of use.

Current operational abilities and anticipated improvements.

Systems characteristics:

Design of systems in an integrated way.

Sensor and transducer types used.

Consideration of component compatibility.

Constraints on size and cost.

Control device requirements and examples of applications.

LO2 **Design a mechatronic system specification for a given application**

Systems specifications:

British and/or European standards relevant to application.

Sensor types and interfacing.

Actuator technology availability and selection.

Selection and use of appropriate control software/devices.

Consideration of the interaction of system variables.

System commissioning parameters.

LO3 **Examine the operation and function of a mechatronics system using simulation and modelling software**

Operation and functions:

Simulation and modelling software functions.

System function and operation.

Modes of operation simulation, loading and surges.

Advantages and disadvantage of software simulation.

LO4 **Identify and correct faults in a mechatronic system**

Locating and correcting system faults:

Component data sheets, systems drawings, flowcharts, wiring and schematic diagrams.

Original system correct function and operation.

Inspection and testing using methodical fault location techniques and methods, use of control software to aid fault location.

Identification, evaluation and verification of faults and their causes, rectification, final system testing and return to service.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Examine the design and operational characteristics of a mechatronic system		**D1** Investigate an actual mechatronics system specification to propose alternative solutions.
P1 Describe the key components of a given mechatronics system. **P2** Identify the types of actuators, sensors and transducers used in the mechatronics system.	**M1** Explore how the mechatronics components operate as part of an integrated system. **M2** Investigate the methods of control used by mechatronics systems.	
LO2 Design a mechatronic system specification for a given application		**D2** Evaluate the operational capabilities and limitations of the mechatronics system design specification produced.
P3 Select the relevant sensor and the appropriate actuator technologies and produce a design specification suitable for these selections.	**M3** Justify the sensor and actuator technologies selected with reference to available alternatives.	
LO3 Examine the operation and function of a mechatronics system using simulation and modelling software		**D3** Explain the function and operation of a simulated mechatronics system.
P4 Demonstrate industry standard mechatronics simulation/modelling software.	**M4** Describe the advantages and disadvantages of the software simulation.	
LO4 Identify and correct faults in a mechatronic system		**D4** Investigate the causes of faults on a mechatronics system and suggest alternatives to the design specification to improve reliability.
P5 Explain the safe use of fault finding test equipment. **P6** Locate and rectify faults on a mechatronic system.	**M5** Apply and document the correct use of fault finding techniques/methods.	

Recommended Resources

Textbooks

BOLTON, W. (2015) *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering*. 5th Ed. Essex: Pearson Education Limited.

MAHALIK, N.P. (2010) *Mechatronics: Principles, Concepts and Applications*. New Delhi: McGraw-Hill.

ONWUBOLU, G.C. (2005) *Mechatronics: Principles and Applications*. Oxford: Elsevier.

RAMACHANDRAN, K.P., VIJAYARAGHAVAN, G.K. and BALASUNDARAM, M.S. (2008) *Mechatronics: Integrated Mechanical Electronic Systems*. India: Wiley.

Journals

International Journal of Advanced Mechatronic Systems.

Links

This unit links to the following related units:

Unit 15: Automation, Robotics and Programmable Logic Controllers (PLCs)

Unit 54: Fundamentals of Control Systems