UNIT DETAILS

Unit Title:	**Mechatronics 2**
Unit reference number:	DCL-2-210
Level:	2
Credit Value:	15 *CAT points (1 unit = 15 points)*
Subject Area:	Mechanical and Manufacturing Engineering
Student Study Hours:	150 hours
Class contact hours	48 hours
Student managed learning	102 hours
Pre-requisites:	None
Assessment Method:	100% Coursework
Unit Co-ordinator:	A V Terry
Teaching Team:	A V Terry and A C Roberts
Course:	BSc(Hons) Computer-Aided Engineering BSc(Hons) Computer-Aided Design BEng(Hons) Mechanical Engineering

INTRODUCTION

This unit provides an introduction to the emerging inter-disciplinary field of mechatronics. It is traced from its origins through the synergistic integration of fine mechanical engineering with electronics and computer control, to modern day products and processes. Particular attention is paid to sensors and actuators, smart instrumentation and embedded microprocessor control. Topics covered in microprocessors and programmable logic controllers range from the physical structure of PLCs and computer architecture through to applications and analysis of simple control programs. Robotics is also covered with particular emphasis on computer interfacing and the automation of mechanical devices.

AIMS OF THE UNIT

To introduce the field of mechatronics with specific reference to control systems, microprocessors and programmable logic controllers.

LEARNING OUTCOMES

The student will:

- Become aware of the emergence of mechatronics and its scope and significance.
- Identify the role of mechatronics in engineering and manufacturing systems.
- Be aware of state-of-the-art mechatronics through case studies.
- Be familiar with mechatronics in industrial robotics and automation.
- Identify design elements, internal operation and processing of microprocessors and PLCs.
- Understand the basic principles of computer interfacing in mechatronic devices and systems.

KEY AND CONGNITIVE SKILLS

The student will be able to:

- Use creativity and innovation in solving problems of a multi-disciplinary, integrative nature.
- Use IT and quantitative skills that are developed in investigating and analysing systems.
- Develop how to learn and research skills.
- Solve problems using science-based methods and design methodologies.
- Sort and present appropriate data in a suitable form.

SUMMARY OF INDICATIVE CONTENTS

- Historical perspective and development of mechatronics.
- Number systems. Logic systems. Digital and analogue devices. Synergy.
- Mechatronics in consumer and industrial products.
- Mechatronics in engineering and manufacturing systems.
- Microprocessors and programmable logic controllers.
- Interfacing, programming and control of mechatronic systems.
- Sensors, drives and actuators. Smart instrumentation.
- Mechatronics in industrial robotics.
- Automotive mechatronics.
- Design methodology and evaluation of mechatronic systems.
- Case studies and typical applications.

TEACHING AND LEARNING PATTERN

A series of lectures supported by handouts and audio-visual aids. Class contact time will amount to 48 hours. Students will be expected to engage in background study and produce their own portfolio of current information that is available in this emerging field. Case studies will be presented and analysed in a seminar fashion.

WEEKLY TEACHING AND LEARNING PROGRAMME

Mechatronics and Robotics

Week 1	What is Mechatronics? Historical perspective
.	
Week 2	Synergy. Number systems. Definition.
Week 3	Mechatronics in consumer products.
Week 4	Mechatronics in industrial products.
Week 5	Mechatronics in manufacturing/engineering systems.
Week 6	Mechanical and electrical elements and systems.
Week 7	Electro-mechanical systems.

Week 8	Programming and control of mechatronics systems.
Week 9	Mechatronics in industrial robotics.
Week 10	Sensors, drives and actuators. Smart instrumentation.
Week 11	Automotive mechatronics
Week 12	Design methodology for mechatronic systems.
Week 13	Case studies.
Week 14	Unit review.
Week 15	Examinations week.

Digital Systems and Computer Interfacing

Week 1	Basic logic concepts. Number codes. Arithmetic and conversion of number codes.
Week 2	Microprocessors and basic computer architecture. Logic states. Discrete mathematics. Combinational logic.
Week 3	Design of digital safety interlock systems for mechanical devices.
Week 4	Minimisation and De Morgan's theorem.
Week 5	Minimisation and Karnaugh maps.
Week 6	Sequential logic. Design of digital electronic combination locks.
Week 7	Design of digital control systems for operating mechanical lifts.
Week 8	Programmable logic controllers and their engineering applications.
Week 9	Interfacing of digital devices.
Week 10	Ladder logic programming. Introduction and applications.
Week 11	Microcomputer interfacing.
Week 12	Applications of the C programming language to digital interfacing and data acquisition principles.
Week 13	Case studies.
Week 14	Unit review.
Week 15	Examinations week.

ASSESSMENT PROGRAMME

The unit will be 100% coursework assessed and will comprise of two assignments and the submission of an individual portfolio. The first assignment will be an investigative study based on research and development and have a 25% weighting. The second assignment will include a design and evaluation element and have a weighting of 50%. An individual portfolio of mechatronics will contribute a weighting of 25%.

LEARNER SUPPORT MATERIALS

The University expects the students to take responsibility for their private study and anticipates that they will undertake the requisite amount of private study to support their learning. The approximate private study time expected is identified at the beginning of this unit guide.

Most of the learning support material related to the unit can be found in the Robotics, Mechatronics and Control laboratories, the University's Perry Library and in the Learning Resources Centre (LRC) in Borough Road. The LRC is a centralised University facility for computing and information technology where students may access electronic sources on the internet, on-line databases and CD-ROMs.

The Faculty of Engineering, Science and the Built Environment has a wide range of student computing facilities.

INDICATIVE SOURCES

Students should familiarise themselves thoroughly with the electronic resources for information that is available through the university web site www.lisa.sbu.ac.uk.

Supporting Texts:

- Sabri Cetinkunt, Mechatronics, Wiley, 2007, ISBN-10 0-471-47987-X
- Onwubolu G C, Mechatronics (Principles and Applications), Elsevier, 2005, ISBN 0-7506-6379-0
- Bolton W, Mechatronics 3rd edition, Addison Wesley Longman, 2003, ISBN 0 131 21633 3
- Braga C, Mechatronics Sourcebook, Thompson Delmar Learning, 2003, ISBN 1-40181-432-8
- Bradley D, Seward D, Dawson D, Burge S, Mechatronics (and the design of intelligent machines and systems), Stanley Thornes, 2000, ISBN 0-7487-5443-1
- Auslander D A, Dawson D, Kempf C J, Mechatronics, Mechanical System Interfacing, Prentice Hall, 1996, ISBN 0-13-120338-X
- Fraser C, Milne J, Integrated Electrical and Electronic Engineering for Mechanical Engineers, McGraw Hill, 1994, ISBN 0-07-707973-6
- Craig, J.J., Introduction to Robotics Mechanics and Control, Pearson Prentice Hall, 2005
- Niku, S,B, Introduction to Robotics: Analysis, Systems, Applications, Pearson Education, 2001
- Fuller, J.L.,Robotics - Introduction, Programming, and Projects, Prentice Hall 1998