Unit 40: Commercial Programming Software

Unit code	**K/615/1508**
Unit level	**5**
Credit value	**15**

Introduction

The use of Computer Aided Design (CAD) and simulation in the electronic and electrical engineering industry is ever growing. Commercial software packages enable an engineer to design, simulate, model and predict the outcome of a design before a product has been made. This enables time and cost savings in the development of a product whilst enabling the engineer to further develop their design.

The aim of this unit is to introduce students to the availability and use of commercial software packages within electronics engineering, including design, simulation, simple microprocessor programming and evaluation of the tools available.

On successful completion of this unit students will be able to research a range of software tools or applications to support engineering functions related to electronics, consider how a software package can be used to simulate the behaviour of an electronic circuits function, explain how to programme a microprocessor-based device to achieve a specified outcome/task, evaluate a specific electronics software tool/application, describe the types of commercial software available, compare the differences between a software simulation and a real-world circuit, and write simple commands to a microcontroller.

Learning Outcomes

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

1. Research a range of software application tools to determine how they can support electronic engineering functions effectively.
2. Explain how a software package can be used to simulate the behaviour of an electronic circuit function and compare the results to real components and circuits.
3. Programme a microprocessor-based device to achieve a specified outcome or task using commercially available software.
4. Evaluate an electronics software application tool to report on its ability to replicate the real world and the resource savings this can bring to an organisation.

Essential Content

LO1 **Research a range of software application tools to determine how they can support electronic engineering functions effectively**

Exposition of computer packages or applications:

Circuit design, simulation, testing and analysis

Printed circuit board layouts

Electronic design automation (EDA or ECAD)

Microcontroller programming, such as Programmable Intelligent Computers (PICs). Microcontroller function simulation, monitoring and testing

LO2 **Explain how a software package can be used to simulate the behaviour of an electronic circuit function and compare the results to real components or circuits**

Application of an industrial computer-aided design package:

Simulation and analysis of electronic circuits

PCB design:

Creation of schematic netlists of a given design and transfer to a PCB layout to make design created using computer-based tools

Build:

Component identification and handling

Develop soldering skills to be able to populate a printed circuit board

Test and comparison:

Application of test equipment to measure voltage, current and resistance Systematic test, commission and fault finding methods

Compare simulated values with tested values, comparison criteria to include; function, behaviour, accuracy, response times and errors

LO3 **Programme a microprocessor-based device to achieve a specified outcome or task using commercially available software**

Introduction to microprocessors:

Introduction to: common languages, compilers and simulators in-circuit debugging

simple programming for exercises:

Digital inputs, simple user feedback

Simulation and debugging

Motor, relay and sound outputs

Communication

LO4 **Review an electronics software application tool to report on its ability to replicate the real world and the resource savings this can bring to an organisation**

Software application:

Software applications with specific industry examples incorporating ease of use, functions available, performance, reliability, quality and costs

Possible limiting factors in software systems, based on previous work undertaken in the unit

Current trends in simulation, testing and microprocessor development

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Research a range of software application tools to determine how they can support electronic engineering functions effectively</td><td rowspan="2">D1 Evaluate the functions and benefits of a range of commercial software used in developing electrical engineering</td></tr>
<tr><td>P1 Examine the functions of commercial programming software

P2 Discuss the categories of commercial electrical and electronic software</td><td>M1 Analyse the effectiveness of a range of commercial software in supporting electronic engineering functions</td></tr>
<tr><td colspan="2">LO2 Explain how a software package can be used to simulate the behaviour of an electronic circuit function and compare the results to real components or circuits</td><td rowspan="2">D2 Critically evaluate the functionality of simulation in comparison to real components using a complex PCB layout</td></tr>
<tr><td>P3 Design a simple PCB layout using a software package

P4 Investigate and compare results produced in simulation to develop an analysis with the physical build</td><td>M2 Design a complex PCB layout with a good level of optimisation using a software package

M3 Evaluate functionality of simulation to show considered comparisons between testing and simulation</td></tr>
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Pass	Merit	Distinction
LO3 Programme a microprocessor-based device to achieve a specified outcome or task using commercially available software		**D3** Critically evaluate the functionality of simulation by noting variations between testing and simulation
P5 Programme a microprocessor-based device to produce working code using appropriate software **P6** Test and review code used through simulation and in the hardware	**M4** Make improvements to given examples to produce complex working code **M5** Evaluate code through simulation and in the hardware, demonstrating good competence of the software	
LO4 Review an electronics software application tool to report on its ability to replicate the real world and the resource savings this can bring to an organisation		**D4** Critically analyse current and emerging applications of commercial software with clear application to industry examples, identifying trends and recognising technical and economic factors which influence developments
P7 Evaluate an electronics software application and its ability to replicate the real world, supported by industry specific examples and illustrating the resource savings implications offered by this approach	**M6** Analyse an electronics software application and its ability to replicate the real world, supported by specific industry examples and illustrating the resource savings implications this has	

Recommended Resources

Textbooks

BLUM, J. (2013) *Exploring Arduino*. Wiley.

PETRUZZELLIS, T. (2005) *Build your own electronics workshop*. McGraw-Hill.

ROBBINS, A. and MILLER, W.C. (2013) *Circuit analysis: theory and practice*. 5th Ed. International Ed. Clifton Park, N.Y.: Delmar.

RICHARDSON, M. and WALLACE, S. (2013) *Getting started with Raspberry Pi*. 1st Ed. Maker Media Inc.

Websites

https://www.circuitlab.com/	Circuit Lab Online schematic editor and circuit simulator (Training)

Links

This unit links to the following related units:

Unit 23: Computer Aided Design and Manufacture (CAD/CAM)

Unit 37: Virtual Engineering

Unit 41: Distributed Control Systems