EG-151 Microcontrollers

Assessment and Feedback Brief

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Introduction

EG-151 Microcontrollers is a 10-credit module running in the first semester. It introduces the structure and operation of a basic 8-bit microcontroller. It is intended to give you a grounding in the use of microcontrollers by taking you from some simple C-language programmes to a mini-project which addresses a real engineering task. Assessment is by means of laboratory exercises, a class test, and a mini-project.

This document is also available in PDF form.

Module Aims

EG-151 aims to introduce students to the fundamentals of microcontroller structure and operation and to help them to develop skills in low-level programming language and laboratory work. There will be an introduction to programming in the embedded C-language and an appreciation of low-level programming with assembly code.

Covid-19 Statement

As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Summary of assessment

Module assessment components: Laboratory Introduction (5%) + Laboratory work (20%) + Class test (40%) + Mini-project (35%)

Access to the Digital Learning Platform

Access to course resources, on-demand activities, timetabled classes, formative quizzes, discussions and full instructions for the practical exercises for each component are provided in the **Course Content** **(Modules)** section of the Canvas site for **2021_EG-151 Microcontrollers**.
Practice test questions will be made available in the **Assessment and Feedback** section of the Canvas site.

Module Delivery Method

EG-151 will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Laboratory Introduction

Laboratory sessions during the first two weeks of term will be used for a laboratory introduction exercise.
The laboratory introduction is COMPULSORY and must be passed if a student is to work in the laboratory.
Components of the laboratory introduction are as follows:

- Health and safety and safe working during the COVID pandemic
- Breadboard construction exercise

The following compulsory activities may need to be deferred until Semester 2

- Circuit Simulation using National Instruments Multisim
- Soldering exercise

Each component will be assessed individually on a pass-fail basis, and the laboratory introduction is worth 5% of the whole module.

On-demand learning activities

There will be the equivalent of one lecture a week on the architecture of the target microcontroller.

Knowledge and understanding will be increased via retrieval practice based on weekly formative tests delivered in Canvas.

Live on-line activities: there will be one hour a week online examples class for group activities in support of the lecture course and designed to address the areas of particular difficulty that have been identified by the formative tests.

On-campus laboratories

There will be one three-hour lab session per week supplemented by a two-hour on-line on-demand support session.

The lab exercises have been designed to be taken home and can be done completely off-campus if preferred.

The laboratory work will be assessed by means of a lab diary worth 20%
of the module marks. The lab diary is to be submitted via TurnitIn in November.

Class test

The lecture course and the laboratory work will be assessed by an online class test worth 40%.

Mini-project

There will be a mini-project which will be assessed by a demonstration of the completed project and a short report.## Delivery Method

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Intended Learning Outcomes

The following AHEP 3 Programme Learning outcomes [1] at Partial CEng (p) are partially addressed at a threshold level by this module:

- EA2p – Identity, classify and describe the performance of systems and components: operation of a microcontroller; computer instructions their execution. (Assessed by Class Test)
- EA3p – Practical and laboratory skills: safe-working; social distancing; use of electronic instrumentation; simulation, implementation and commissioning of an embedded system. (Assessed by the Lab Introduction (Practical))
- D2p – Investigate and define the problem: health and safety; design simple programs in both assembly language and C; design the hardware and software for a simple application. (Assessed by the Lab Introduction (Practical), Lab Exercises and Project)
- S1 – Apply your skills in problem-solving, communication, working with others, information

retrieval and the effective use of general IT facilities via the use of a development environment to simulate, implement and commission an embedded system; demonstrate the application of the skills developed in the module to design the hardware and software for a simple application. (Assessed by the Mini-Project)

Transferable skills

1. Keyboard skills
2. Use of IT tools
3. Problem solving
4. Programming of a microcontroller

Assessment details

Laboratory introduction

The laboratory introduction is assessed on a pass/fail basis according to the following:

- Health and safety and safe working during the COVID pandemic.
- Breadboard construction exercise.
- Answers to questions at the end of the laboratory introduction script.

Additional components may be deferred to the second semester

- Testing of circuit using plug-in breadboard and National Multisim.
- Construction of Tic-Tac box continuity tester.

Marking is done and feedback is given by the chief Electronics technician.

Laboratory exercises

There are four laboratory exercises and the assessment will be based on the lab diary submitted by each student.
The lab diary will be marked on the five criteria listed below using the grading rubric. Only non-submissions will score zero.

Criteria

- **Content** – A complete record of the experiment or exercise is recorded in the lab diary. The material that is present is complete, accurate and reproducible.

- **Tools and Equipment** – A detailed description of the tools and equipment needed to complete the laboratory experiment or exercises provided.
- **Analysis and Discussion** – Adequate analysis and discussion are given for all recorded results. There are no errors in the conclusions drawn. You have demonstrated a clear understanding of all the aspects of the tasks carried out.
- **Reflection** – A detailed and thorough reflection is given. The reflection identifies both good and bad experiences in all tasks as well as how improvements can be made for next time where appropriate.
- **Presentation** – The lab diary is very well structured and flows logically. The content is easily readable and experiments could easily be reconstructed by reference to the lab diary.

Grading rubric

Exceeds Standard	Meets Standard	Needs Work	Poor
4 .	3 .	2	1 .

Early feedback on the standards should be sought and facilities will be provided inside Canvas for you to submit up to a maximum of two early lab diary entries for informal assessment and feedback.

Mini-project

Assessment criteria for the mini-project (lab assessment, out of 10):

Marks	Criteria
4	Project specifications achieved.
5-7	Project specifications achieved and you are able to explain the program.
8-10	Project specifications achieved and you are able to explain the program and successfully answer detailed questions related to the project.

Assessment for the mini-project (report, out of 15)

Marks	Criteria
6	Report contains minimum details. It is difficult to repeat the project with the report.
7-11	Report is clear and concise. Some details are missing.
12-15	Report is clear and concise. It contains all details that are required to successfully repeat the project.

Timeline for EG-151

Weeks 2-3: Laboratory introduction. Students enrolling on the Electrical and Electronic degree programmes come from a wide range of backgrounds. Some students will have taken a technology based course in their previous education, and in consequence they will have some familiarity with electronic components and embedded microcontrollers. Other students will have little or no experience of practical electronics. The laboratory introduction gives everybody an experience of using electronic components in a practical circuit, use of laboratory instruments, and an introduction to simulation software. The laboratory introduction starts in week 2 and will continue for the first two weeks of teaching. It will make use of the on-campus timetabled lab slots. Assessment of the laboratory introduction is partly “on the spot” in the case of the Tic-Tac construction. The lab diary will be assessed at the end of the exercise. The laboratory introduction is worth 5% of the module.

Weeks 2 to 12: On-demand materials and live timetabled on-line sessions. **There is one lecture per week, starting at 12 noon on Monday afternoons. This lecture includes the architecture of a typical 8-bit microcontroller, and how the internal registers permit different programming structures. Initially examples will be in C-language, but examples in assembly language, needed to understand the detailed working of the microcontroller hardware, will be given as the module progresses. Review and preparation for the class test will be given in Week 10; feedback on the class test will be given in Week 12.

Weeks 5 to 7: Following the laboratory introduction, students will embark on a series of experiments designed to build experience in programming the target microcontroller, and the use of an Integrated Development Environment to debug their programmes. Detailed records of progress will be recorded in a lab diary which will be assessed at the end of the module. There will be opportunities for feedback to be given on lab diaries before they are submitted for final assessment. As social-distancing rules limit access to the electronics laboratory, the lab exercises have been designed to be taken home. Additional support will be available on-line via a scheduled weekly support session attended by module lecturers and demonstrators. This part of the module is worth 20% of the total.

Week 8: has been reserved for the **EG-126 Engineering for People** activity. There will be no teaching or labs on EG-151 in week 8.

Week 9: Briefing about the Mini-Project.

Weeks 9 to 12: Mini-Project. All mini-projects will be based on the same core components. This approach has been very successful in Micromouse, where the starting point is the same for all the teams. This year, each student will be given … ???

Each Mini Project participant … ???

Week 11: The **class test** carries 40% of the module mark. It will be based on the taught material from the lecture course and experience from the laboratory exercises. Many of the questions will be of the form, “what bits will be set on Port X if the following lines of code are executed” and will require detailed understanding of the operation of the microcontroller. The class test will be delivered electronically via a Canvas Quiz and feedback will therefore be immediate aside from any text or essay questions that will have to be manually marked.

Week 12: Assessment of mini-project. … How done???

Specific rules for passing this module:

This module is assessed by a combination of Class Test and practical assessment. In order for the practical assessment marks to count, you must achieve at least 30% in the Class Test. You will have one attempt to redeem a failure in the class test before the end of semester 1. If you achieve less than 30% in the Class Test, then the module mark will be just the Class Test mark and you will be required to take another test in August.

Note

1. For a detailed explanation of AHEP 3 learning outcomes, see the references mentioned on page 5 of the Undergraduate Student Handbook for the BEng/MEng in Electronic and Electrical Engineering, 2020-2021.