



## **Module Specification**

### **Microcontrollers Applications Group Lab**

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## Part 1: Information

**Module title:** Microcontrollers Applications Group Lab

**Module code:** UFMFKA-30-2

**Level:** Level 5

**For implementation from:** 2024-25

**UWE credit rating:** 30

**ECTS credit rating:** 15

**College:** College of Arts, Technology and Environment

**School:** CATE School of Engineering

**Partner institutions:** None

**Field:** Engineering, Design and Mathematics

**Module type:** Module

**Pre-requisites:** Programming for Engineers 2023-24

**Excluded combinations:** None

**Co-requisites:** None

**Continuing professional development:** No

**Professional, statutory or regulatory body requirements:** None

## Part 2: Description

**Overview:** This module introduces concepts and practices related to microcontroller based systems. Students will be gain skills and knowledge in comparing, selecting, implementing, integrating and testing hardware and software components required for a microcontroller based robotic system.

This module aims to give students an in-depth, hands-on and teamwork experience of designing and building a microcontroller-based embedded system.

Microcontrollers are frequently used in the design and implementation of control interfaces for autonomous robots. An embedded system will often contain microcontrollers and can, for example, provide navigation capabilities without requiring human intervention. Such an embedded system will need to incorporate sensing, actuating, communicating, and controlling functionalities, all of which require hardware and software development.

**Features:** Not applicable

**Educational aims:** The aim of this module is to integrate topics and concepts from across engineering to facilitate the design of an autonomous mobile robot. The module also builds upon earlier modules and requires the students to demonstrate their project management skills.

**Outline syllabus:** The Syllabus is outlined as follows:

Embedded programming

Digital input/output

Interrupts and timers

Sensors and actuators

Controller design

Analogue to digital conversion

Serial communication

Path planning and maze solving algorithms

Use of robotic operating systems and simulation platforms

### **Part 3: Teaching and learning methods**

**Teaching and learning methods:** Scheduled Learning includes lectures, workshops and laboratory sessions. At the start of the course, students are divided into groups and are helped to develop an interesting and original mobile embedded system they could expect to complete within the time allotted for the course. In the first semester, there is an emphasis on students' individual work on completing laboratory exercises that are designed to help them gain knowledge of the principles and practical use of a microcontroller. This constitutes a major part of Assessment

B4 (individual assessment). Laboratory sessions in the second semester allow more time for students to work in a group on designing and implementing a microcontroller-based system. Students keep individual logbooks as documentary support. Groups make presentations to the rest of the class during and at the end of the project, demonstrate their mobile embedded system, and write a group report at the end of the course.

**Module Learning outcomes:** On successful completion of this module students will achieve the following learning outcomes.

**MO1** Design embedded software using a microcontroller and implementing a robot navigation algorithm. [AHEP D3b]

**MO2** Evaluate and test electronic components and circuits for electronics and robotics system design. [AHEP EA2b]

**MO3** Describe and explain the process of designing and constructing a mobile robot. [AHEP EA1b]

**MO4** Implement and integrate core functionalities (e.g. sensing, actuating, etc.) required for a microcontroller-based robotic system. [AHEP EA4b]

**MO5** Demonstrate capabilities in project planning, monitoring and reporting project progress. [AHEP D5, EL3i, P11m]

**Hours to be allocated:** 300

**Contact hours:**

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

**Reading list:** The reading list for this module can be accessed at [readinglists.uwe.ac.uk](https://uwe.rl.talis.com/modules/ufmfka-30-2.html) via the following link <https://uwe.rl.talis.com/modules/ufmfka-30-2.html>

## Part 4: Assessment

**Assessment strategy:** Students' achievements in the module will be assessed by the following strategy:

First Assessment Opportunity (Sit)

Description of each assessment task:

**Presentation (25%):** This is a group presentation which takes place at the end of the module. The presentation takes a maximum of 15 minutes, including questions. Relating this assessment to hands-on experience would be stimulating and is designed to motivate learners.

**Written Group Report (50%):** This is a 4000-word written group report based on the group project, namely design and implementation of a microcontroller-based system. This groupwork assessment uses peer assessment to reflect individual contribution to the project.

**Laboratory Logbook (25%):** Each student needs to use a logbook to record key procedures and findings of laboratory activities (primarily a few sets of laboratory exercises). In addition to the final logbook submission, students need to submit their interim logbooks regularly. Additionally, there will be opportunities for formative assessment (which does not contribute to the module mark). According to in-process evaluations of student comprehension, learning needs, and academic progress during lectures and labs, the tutors will regularly give students feedback on their laboratory exercises and progress with mobile robot design.

Second Assessment Opportunity (Resit) (further attendance at taught classes is not required)

Description of each assessment task:

**Presentation (25%):** This takes the form of a presentation followed by an oral examination. The student will describe the designs, experiments, and results based on the microcontroller system. Subsequently, the examiners will ask them a set of

questions to probe their knowledge and understanding of the work presented. Groups of more than one member will have 10 mins to present and 5 mins to answer question. Groups of one will have a maximum of 10 mins for the presentation (7 mins to present slides and 3 mins to answer questions). The oral examination gives the assessors an opportunity to extensively test student understanding and to help combat plagiarism.

**Written Group Report (50%):** Based on a groupwork context of designing and implementing a microcontroller-based system, similar to the first sit Report, students need to submit a written report (4,000 words). The word count limit is reduced to 2000 for a group of one student.

**Laboratory Logbook (25%):** Each student needs to use a logbook to record key procedures and findings of laboratory activities (primarily a few sets of laboratory exercises).

### **Assessment tasks:**

#### **Report (First Sit)**

Description: 4000-word written group report based on the group project, namely design and implementation of a microcontroller-based system.

This groupwork assessment uses peer assessment to reflect individual contribution to the project.

Weighting: 50 %

Final assessment: Yes

Group work: Yes

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5

#### **Presentation (First Sit)**

Description: This group presentation assessment takes place at the end of the module. Each presentation takes a maximum of 15 minutes, including questions.

Weighting: 25 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO2, MO5

### **Laboratory Report (First Sit)**

Description: Each student needs to use a logbook to record key procedures and findings of laboratory activities (primarily a few sets of laboratory exercises). In addition to the final logbook submission, students need to submit their interim logbooks regularly.

Weighting: 25 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO4, MO5

### **Laboratory Report (Resit)**

Description: Each student needs to use a logbook to record key procedures and findings of laboratory activities (primarily a few sets of laboratory exercises).

Weighting: 25 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO4, MO5

### **Presentation (Resit)**

Description: This takes the form of a presentation followed by an oral examination. The student will describe the designs, experiments, and results based on the microcontroller system. Subsequently, the examiners will ask them a set of questions to probe their knowledge and understanding of the work presented (20 mins).

Weighting: 25 %

Final assessment: Yes

Group work: Yes

Learning outcomes tested: MO2, MO5

### **Report (Resit)**

Description: Based on a groupwork context of designing and implementing a microcontroller-based system, similar to the first sit Report, students need to submit

a written report (4,000 words).

The word count limit is reduced to 2000 for a group of one student.

Weighting: 50 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5

## **Part 5: Contributes towards**

This module contributes towards the following programmes of study:

Mechatronics Engineering [Frenchay] MEng 2023-24

Electronic Engineering [Frenchay] BEng (Hons) 2023-24

Mechatronics Engineering [Frenchay] BEng (Hons) 2023-24

Robotics [Frenchay] BEng (Hons) 2023-24

Electronic Engineering {Foundation} [Frenchay] BEng (Hons) 2022-23

Instrumentation and Control Engineering {Foundation} [GCET] BEng (Hons) 2022-23

Electronics and Telecommunication Engineering {Foundation} [GCET] BEng (Hons)  
2022-23

Robotics {Foundation} [Frenchay] BEng (Hons) 2022-23

Automation and Robotics Engineering {Foundation} [GCET] BEng (Hons) 2022-23

Electronic Engineering [Sep][PT][Frenchay][6yrs] BEng (Hons) 2021-22

Instrumentation and Control Engineering {Foundation} [Feb][PT][GCET][8yrs] BEng  
(Hons) 2020-21

Instrumentation and Control Engineering {Foundation} [Oct][PT][GCET][8yrs] BEng  
(Hons) 2020-21