# Module Proforma

**Approved, 2022.01**

## Summary Information

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|---|---|
| **Module Code** | 5522USST |
| **Formal Module Title** | Embedded Systems Programming and Applications in the Environment |
| **Owning School** | Engineering |
| **Career** | Undergraduate |
| **Credits** | 20 |
| **Academic level** | FHEQ Level 5 |
| **Grading Schema** | 40 |

## Module Contacts

### Module Leader

| Contact Name | Applies to all offerings | Offerings |
|---|---|---|
| Dante Matellini | Yes | N/A |

### Module Team Member

| Contact Name | Applies to all offerings | Offerings |
|---|---|---|

### Partner Module Team

| Contact Name | Applies to all offerings | Offerings |
|---|---|---|

## Teaching Responsibility

| LJMU Schools involved in Delivery |
|---|
| LJMU Partner Taught |

## Partner Teaching Institution

| Institution Name |
|---|
| University of Shanghai For Science and Technology |

## Learning Methods

| Learning Method Type | Hours |
|---|---|
| Lecture | 22 |
| Practical | 22 |

## Module Offering(s)

| Offering Code | Location | Start Month | Duration |
|---|---|---|---|
| SEP-PAR | PAR | September | 12 Weeks |

## Aims and Outcomes

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|---|---|
| **Aims** | The module aims to broaden the students' knowledge and understanding of digital circuit design, and examines modern microcontroller architectures and the interface requirements to external systems. It also aims to provide students with practical skills necessary to design, analyse and implement electronic circuits controlled by microcontrollers and finite state machines for real life applications in environment. |

## Learning Outcomes

**After completing the module the student should be able to:**

| Code | Description |
|---|---|
| MLO1 | Define electronic circuit operations and design |
| MLO2 | Design, analyse and implement finite state machine based digital circuits |
| MLO3 | Describe and identify suitable interfaces for modern microcontroller/embedded systems |
| MLO4 | Select appropriate hardware, software platforms and interface considering power, cost and capability requirements |
| MLO5 | Produce integrated embedded systems with external sensors and actuators |

## Module Content

| Outline Syllabus |
| --- |
| Review of Boolean algebra and Karnaugh maps. Counter Design Synchronous sequential state machine design and analysis, including Mealy, Moore and mixed type circuits. Asynchronous sequential design. Identify the advantages and disadvantages of various processors available on the market. Research the costs of mass production identifying the power and capability of the devices. Plan for the power requirements of embedded systems, considering different use case requirements in real-life applications. Create embedded systems that interface with various sensors, both analogue and digital, ensuring that inputs are buffered to protect the processor from hazardous conditions. Integrate processors with control devices e.g. Arduinos, Servos, DC Motors, etc. |

**Module Overview**

**Additional Information**

This module introduces the students to digital electronics, embedded systems, microcontrollers for applications the Environment.

General Notes

UNESCO Sustainable Development Goals

Quality Education
Gender Equality
Affordable and Clean Energy
Industry, Innovation and Infrastructure
Sustainable Cities and Communities
Responsible Consumption and Production
Peace, Justice and Strong Institutions
Partnerships for the Goals

UK SPEC AHEP 4

CEng.
M3 Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed.
M4 Select and critically evaluate technical literature and other sources of information to solve complex problems.
M5 Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health and safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards
M6 Apply an integrated or systems approach to the solution of complex problems.
M7 Evaluate the environmental and societal impact of solutions to complex problems (to include the entire lifecycle of a product or process) and minimise adverse impacts.
M8 Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.
M10 Adopt a holistic and proportionate approach to the mitigation of security risks.
M11 Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.
M12 Use practical laboratory and workshop skills to investigate complex problems.
M13 Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.
M14 Discuss the role of quality management systems and continuous improvement in the context of complex problems.
M16 Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance.

IEng.
B1 Apply knowledge of mathematics, statistics, natural science and engineering
principles to broadly-defined problems. Some of the knowledge will be informed by current developments in the subject of study.

B2 Analyse broadly-defined problems reaching substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles.
B3 Select and apply appropriate computational and analytical techniques to model broadly-defined problems, recognising the limitations of the techniques employed.
B4 Select and evaluate technical literature and other sources of information to address broadly-defined problems.
B5 Design solutions for broadly-defined problems that meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health and safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards.
B6 Apply an integrated or systems approach to the solution of broadly-defined problems.
B7 Evaluate the environmental and societal impact of solutions to broadly-defined problems.
B8 Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.
B10 Adopt a holistic and proportionate approach to the mitigation of security risks
B11 Recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.
B12 Use practical laboratory and workshop skills to investigate broadly-defined problems.
B13 Select and apply appropriate materials, equipment, engineering technologies and processes.
B14 Recognise the need for quality management systems and continuous improvement in the context of broadly-defined problems.
B16 Function effectively as an individual, and as a member or leader of a team.

## Assessments

| Assignment Category | Assessment Name | Weight | Exam/Test Length (hours) | Learning Outcome Mapping |
|---|---|---|---|---|
| Exam | Exam | 70 | 2 | MLO1, MLO2, MLO3, MLO4, MLO5 |
| Report | Assignment | 30 | 0 | MLO1, MLO2, MLO3, MLO4 |