
# Course Handbook

## BEng(Hons) Robotic Engineering
## MEng(Hons) Robotic Engineering

2019-2020

Dr Stephen Sigurnjak
School of Engineering

Please read this Handbook in conjunction with the University's Student Handbook.

## Contents

## 1. Welcome to the course

Welcome to Robotic Engineering at UCLan. We hope to provide you with an interesting and challenging education, and to develop competences appropriate to Robotic Engineering.

Please read the handbook carefully as it is a source of information on the academic, administrative and operational aspects of your course and it is intended to explain what is required of you. Feel free to discuss any aspects with myself or any member of the course team.

Enjoy your time studying with us!

Stephen Sigurnjak – Course Leader for MEng/BEng(Hons) Robotic Engineering

### 1.1 Rationale, aims and learning outcomes of the course

The MEng/BEng (Hons) Robotic Engineering course aim is to develop graduates with a broad understanding of current technology and practice in Robotic engineering, covering the relevant aspects of analogue and digital electronic systems and additional specialist areas according to the option modules studied.

The course is three years (BEng) or four years (MEng) in duration, plus an extra year if an industrial placement is included.

- To provide a focused education at an academic level appropriate for the target awards: MEng/BEng(Hons) Robotic Engineering as well as the exit awards
- To meet the requirements for accreditation of the programme by the Institution of Engineering and Technology (IET).
- To provide an extended, enhanced, and industrially relevant Integrated Master's programme of study in preparation for professional practice. (MEng only)
- To produce resourceful, competent, clear-thinking professional engineers with a range of skills and experience relevant to modern industry.
- To equip graduates of the programme with knowledge, skills, experience, and understanding which underpin a professional career in engineering.

Specifically, the Robotic Engineering courses aim to provide graduates with a broad understanding of current technology and practice in electronic engineering, covering the relevant aspects of analogue and digital electronic engineering and robotic systems, plus additional specialist areas according to the option modules studied.

The discipline of robotic engineering encompasses a wide skills base and the emphasis of this course is placed on electronic system design rather than that of individual component devices. By concentrating on the principles fundamental to system level design, the course equips graduates with the knowledge, skills and confidence to thrive in the rapidly evolving field of electronic engineering, produce designs suitable for a variety of applications and the transferrable skills to find employment in a diverse set of industrial and commercial sectors.

The full program specifications, including learning outcomes, are provided as appendices.

### 1.2 Course Team

Names and contact details of the key members of the team.

Academic Lead for Engineering
Martin Varley
Computing & Technology Building, room CM149

☎ 01772 893272 (ext. 3272), ✉ mrvarley@uclan.ac.uk

Robotic Engineering Programme Course Leader
Stephen Sigurnjak
Computing & Technology Building, room CM132
☎ 01772 893305 (ext. 3305), ✉ ssigurnjak@uclan.ac.uk

Retention Co-ordinator
Patrick Ryan
Computing & Technology Building, room CM024
☎ 01772 893273 (ext. 3273), ✉ pryan1@uclan.ac.uk

Industrial Placements Tutor
Joel Allison
Computing & Technology Building, room CM131
☎ 01772 893251 (ext.3251), ✉ jallison@uclan.ac.uk

ERE Joint Course Leader (China)
Wei Quan
Computing & Technology Building, room CM124
☎ 01772 895168 (ext. 5168), ✉ wquan@uclan.ac.uk

ERE Projects Co-ordinator (undergraduate)
Javad Yazdani
Computing & Technology Building, room CM138
☎ 01772 892685 (ext. 2685), ✉ jyazdani@uclan.ac.uk

### 1.3 Expertise of staff

Each member of staff that will be teaching you has had many years' experience of the subject, this may have been gathered via research and scholarly activities or by experience in industry. Many members of staff are actively involved in research and enterprise activities which enrich the curriculum that you will be studying.

### 1.4 Academic Advisor

You will be assigned an Academic Advisor who will provide additional academic support during the year. They will be the first point of call for many of the questions that you might have during the year. Your Academic Advisor will be able to help you with personal development, including developing skills in self-awareness, reflection and action planning.

### 1.5 Administration details

Campus Admin Services provides academic administration support for students and staff and are located in the following hubs which open from 8.45am until 5.15pm Monday to Thursday and until 4.00pm on Fridays. The hub can provide general assistance and advice regarding specific processes such as extenuating circumstances, extensions and appeals.

**Allen Building**
Medicine
Dentistry
telephone: 01772 895566

email: AllenHub@uclan.ac.uk

### Harris Building

Lancashire Law School
Humanities and the Social Sciences
Centre for Excellence in Learning and Teaching
telephone: 01772 891996/891997
email: HarrisHub@uclan.ac.uk

### Foster Building

Forensic and Applied Sciences
Pharmacy and Biomedical Sciences
Psychology
Physical Sciences
telephone: 01772 891990/891991
email: FosterHub@uclan.ac.uk

### Computing and Technology Building

Art, Design and Fashion
Computing
Journalism, Media and Performance
Engineering
telephone: 01772 891994/891995
email: CandTHub@uclan.ac.uk

### Greenbank Building

Sport and Wellbeing
Management
Business
telephone: 01772 891992/891993
email: GreenbankHub@uclan.ac.uk

### Brook Building

Community, Health and Midwifery
Nursing
Health Sciences
Social Work, Care and Community
telephone: 01772 891992/891993
email: BrookHub@uclan.ac.uk

### 1.6 Communication

The University expects you to use your UCLan email address and check regularly for messages from staff. If you send us email messages from other addresses they risk being filtered out as potential spam and discarded unread.

### 1.7 External Examiner

The External Examiners for the ERE courses are:

Professor Osman Tokhi
Head of Division of Electrical and Electronic Engineering, London South Bank University

Dr Andrew Tickle
Senior Lecturer in Electrical and Electronic Engineering, University of Coventry

External Examiner reports for the Engineering courses can be accessed electronically via the Engineering@UCLan Blackboard pages.

## 2. Structure of the course

### 2.1 Overall structure

Figures 1 and 2 overleaf illustrate the programme structure for BEng (Hons) and MEng (Hons) Robotic Engineering courses respectively. These courses exist as part of the Modular Credit Accumulation and Transfer Scheme (MODCATS). The award requires that a student pass 360 credits total for BEng (Hons), or 480 credits for MEng (Hons).

Each full-time year of study requires you to pass modules to the value of 120 credits. Most modules on the programmes are standard sized and worth 20 credits, although there are examples of modules worth 10, 30 and 40 credits. Students wishing to follow part time study are counselled by a member of staff and a suitable programme of study developed

**Specific credit requirements for the target awards:**

*MEng (Hons) Robotic Engineering* requires 480 credits with a minimum of 360 at level 5 or above, 200 at level 6 or above, 100 at level 7 and a minimum of 360 credits studied at this University.

*MEng (Hons) Robotic Engineering with Industrial Placement* requires 480 credits with a minimum of 360 at level 5 or above, 200 at level 6 or above, 100 at level 7 and a minimum of 360 credits studied at this University, plus satisfactory completion of the Placement module MP2899.

*BEng (Hons) Robotic Engineering* requires 360 credits including a minimum of 220 at level 5 or above and a minimum of 100 at level 6.

*BEng (Hons) Robotic Engineering with Industrial Placement* requires 360 credits including a minimum of 220 at level 5 or above and a minimum of 100 at level 6, plus satisfactory completion of the Placement module MP2899.

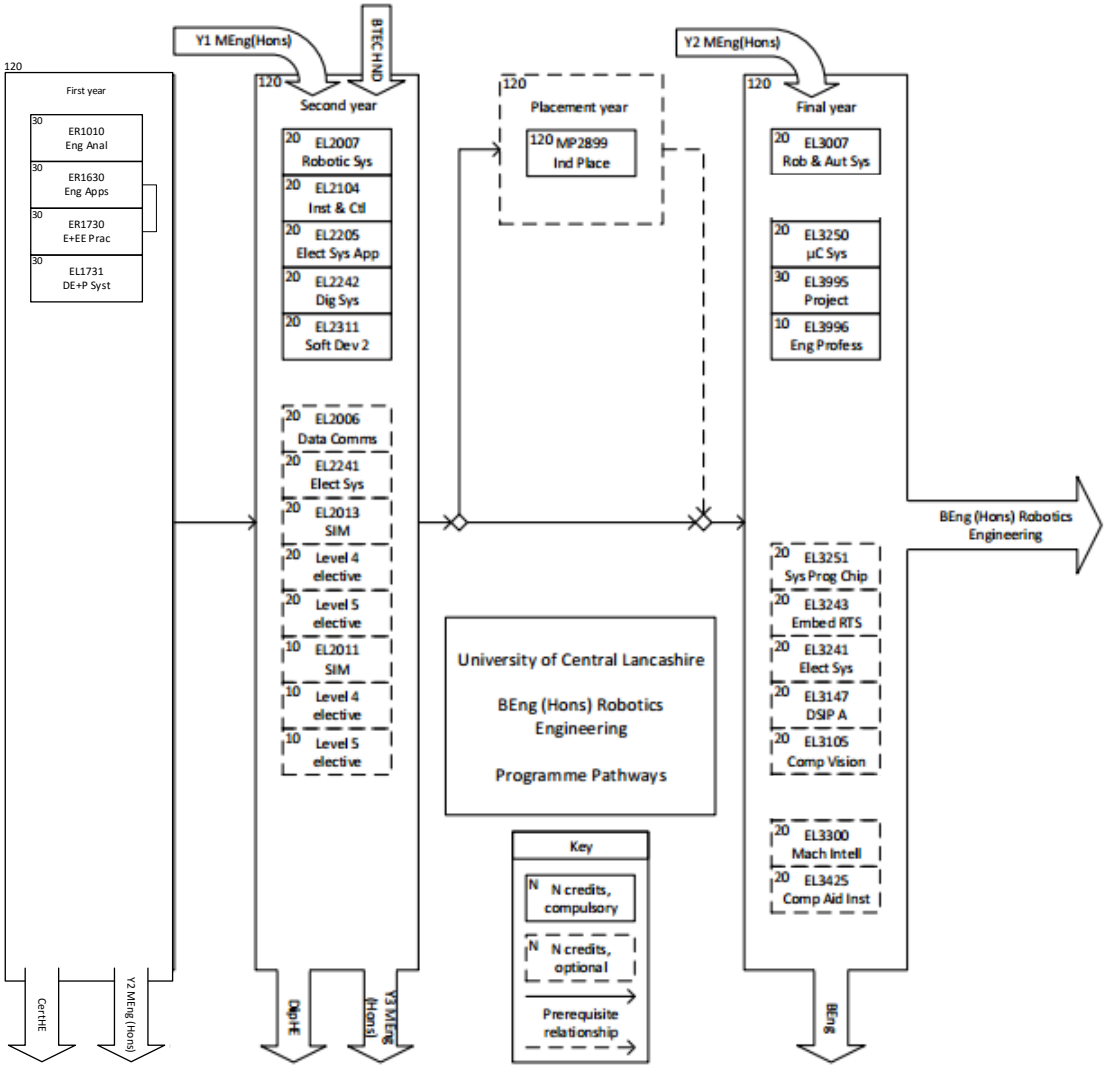



**Figure 1 BEng RE Programme Structure**

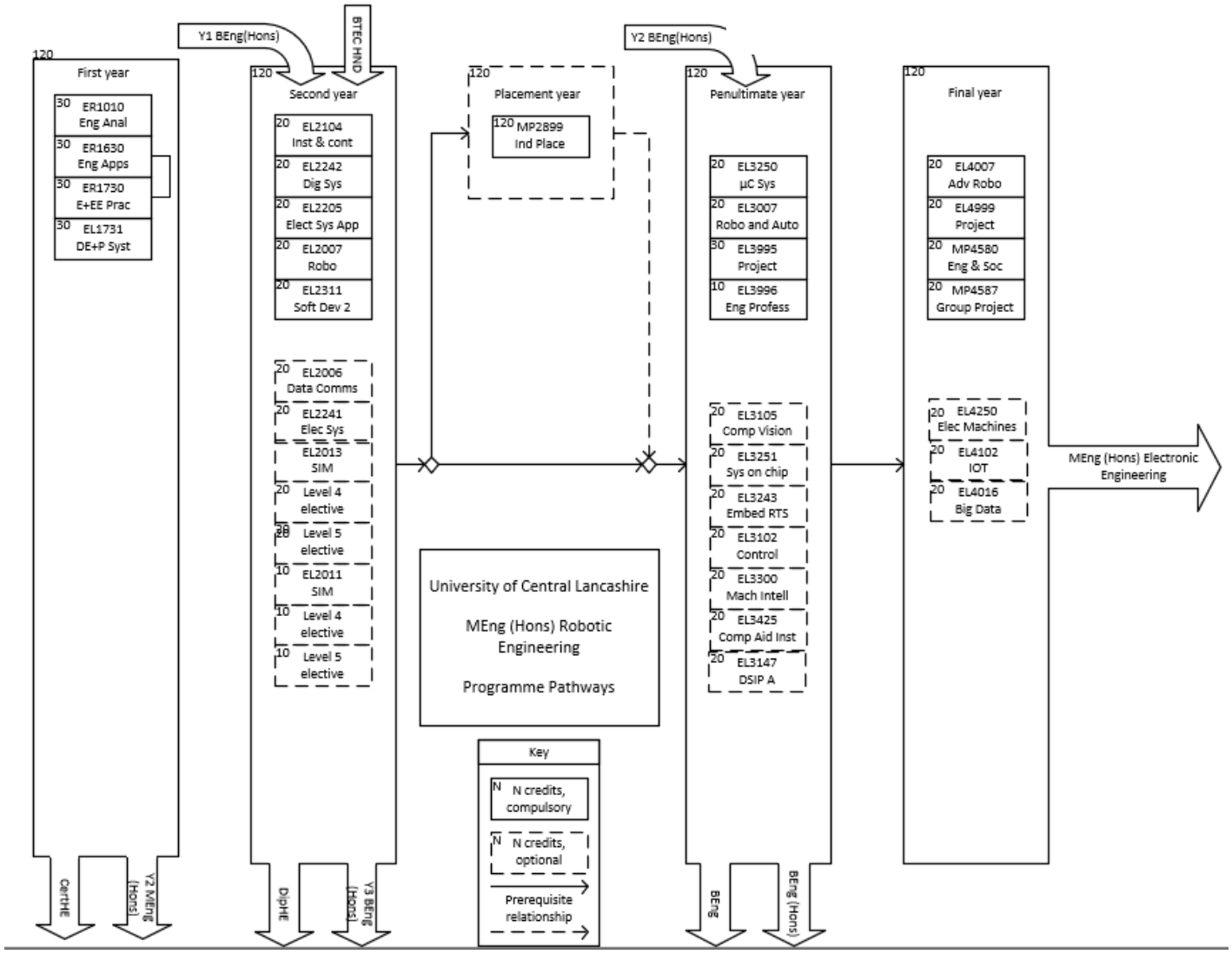



**Figure 2 MEng RE Programme Structure**

**Specific credit requirements for the exit awards:**

*BEng Robotic Engineering* requires 320 credits including a minimum of 180 at level 5 or above and a minimum of 40 at level 6.

*Diploma of Higher Education in Robotic Engineering* requires 240 credits including a minimum of 100 at Level 5 or above

*Certificate of Higher Education in Robotic Engineering* requires 120 credits including a minimum of 100 at Level 4 or above.

### 2.2 Modules available

Each module is a self-contained block of learning with defined aims, learning outcomes and assessment. A standard module is worth 20 credits. It equates to the learning activity expected from one sixth of a full-time undergraduate year. Modules may be developed as half or double modules with credit allocated up to a maximum of 120 credits per module.

The modules that you will be studying in your course are detailed below

| **Level 4 – Stage 1** | | | |
|---|---|---|---|
| **Module Code** | **Module Title** | **Description** | **Credits** |
| ER1010 | Engineering Analysis | | 30 |
| ER1630 | Engineering Applications | | 30 |
| ER1730 | Electronics and Electronic Engineering Practice | | 30 |
| ER1731 | Digital Electronics and Programmable Systems | | 30 |

| **Level 5 – Stage 2.1 (BEng), Stage 2 (MEng)** | | | |
|---|---|---|---|
| **Module Code** | **Module Title** | **Description** | **Credits** |
| EL2006 | Data Communications (O) | Underlying principles of digital communications networks. | 20 |
| EL2007 | Robotic Systems (COMP) | Introduction to robotic systems; sensors, actuation & control. | 20 |
| EL2104 | Instrumentation & Control (COMP) | Theoretical underpinnings of closed loop feedback control systems; analysis, simulation & design. Instrumentation systems & technologies. | 20 |
| EL2205 | Electronic Systems Applications (COMP) | Develop & apply skills in managing execution of small & group project work, in context of electronic system design. | 20 |
| EL2241 | Electronic Systems (O) | Circuit analysis & design with emphasis on processing & conversion of analogue signals | 20 |
| EL2242 | Digital Systems (COMP) | Develop digital system design skills, in dedicated hardware & microcontroller based systems | 20 |
| EL2311 | Software Development 2 (COMP) | Application of high-level & object orientated tools & techniques in engineering. | 20 |

| Level 6 – Stage 2.2 (BEng), Stage 3.1 (MEng) | | | |
|---|---|---|---|
| **Module Code** | **Module Title** | **Description** | **Credits** |
| EL3007 | Robotics & Autonomous Systems (COMP) | Concepts, theories & technologies required to build the next generation of Intelligent Robotic Systems. | 20 |
| EL3102 | Control Systems (COMP) | Further develop understanding of control engineering systems. Necessary theoretical treatment for modern industrial applications. | 20 |
| EL3105 | Computer Vision (O) | Theoretical basis of modern computer vision. Analytical & practical skills to design build & use computer vision systems. | 20 |
| EL3147 | Digital Signal & Image Processing A (O) | Fundamental topics in the fields of DSP & DIP: acquisition, representation & analysis methods for signals & images, digital filter design, image manipulation & enhancement. | 20 |
| EL3243 | Embedded Real Time Systems (O) | Real-time & concurrent systems methodology. Theory & practice for design & use of embedded real-time systems. | 20 |
| EL3250 | Microcontroller Systems (COMP) | Design & implement a microcontroller system through the acquisition of skills in embedded software development & hardware interfacing | 20 |
| EL3251 | System on Programmable Chip (O) | Methods for specifying, designing & deploying a digital system on programmable integrated circuits (e.g. an FPGA). | 20 |
| EL3300 | Machine Intelligence (O) | Fundamental topics in the fields of machine intelligence & machine learning | 20 |
| EL3425 | Computer Aided Instrumentation (O) | Specify, select, apply & develop microcomputer-based systems for data acquisition & to control test equipment. | 20 |
| EL3995 | Project (COMP) | Undertake an individual project, meeting an engineering requirement, integrating relevant technical knowledge & skills | 30 |
| EL3996 | Engineering Professionalism (COMP) | Appreciation of the social & environmental aspects of a career in engineering. | 10 |

| Level 7 – Stage 3.2 (MEng) | | | |
|---|---|---|---|
| **Module Code** | **Module Title** | **Description** | **Credits** |
| EL4007 | Advanced Robotics & Intelligent System Design (COMP) | Extend existing competencies in autonomous robotic systems. Focus on applications in AI, advanced control, & safety critical operation | 20 |
| EL4016 | Big Data Analytics and Visualisation | Understanding and manipulating big data sets, how this can be analysed and visualised | 20 |
| EL4102 | Internet of Things | Development of Internet of things systems, how these are created, developed and deployed | 20 |
| EL4250 | Power electronics and machine control | Power electronics and systems to control electrical machines | 20 |
| MP4580 | The Engineer and Society (COMP) | Experience the methods and processes to maintain product integrity within engineering design and the product cycle | 20 |
| MP4587 | Group Project (C) | Group work within the Product Cycle, an integral part of being an engineer. Finding optimum design and manufacture for a real application. | 20 |

| | | | |
|---|---|---|---|
| MP4999 | Project (C) | The MEng version of the final year project. | 20 |


### 2.3 Course requirements and Module Registration Options

Discussions about your progression through the course normally take place in February each year. It is an opportunity for you to make plans for your study over the next academic year. The course team will tell you about the various modules / combinations available and you will both agree on the most appropriate (and legal) course of study for you.

The prescribed modules for the first year of the Electronics Engineering and Robotics Engineering undergraduate courses are identical, thereby enabling students to change their course after the first year. Changes would also be possible following the second year, but these would be more restricted and dependent on the particular modules studied.

If you do not feel capable of completing your chosen course of study then advice may be given on alternative routes or exit awards. However, it is not usually prudent to make decisions about this until results are known in June. Most likely you will be advised to finish all your modules to the best of your abilities and to seek advice once results are available.
If you wish to discuss your progression, or discuss a change of programme (e.g. from BEng to MEng) you should speak to your course leader or another member of the course team.

**BEng to MEng Transfer:** All students wishing to transfer from the BEng to the MEng degree are required to satisfy the course team that the course can be satisfactorily completed. The process involves an interview with a member of the course team and an average mark of 60% or above from the modules of stage 1 and stage 2.1 of the course. The entry point is determined by the module profile.

**MEng to BEng Transfer:** Transfer from MEng to BEng might be made for a number of reasons including extenuating circumstances or poor academic performance. Academic performance would be considered at an examination board. The examination board would offer counselling, during which time a student would be offered the transfer.

Students applying for transfers from other Universities are required to complete the accreditation of certificated prior learning (ACPL). The UCLan regulations do not allow APL of more than ⅔ of the modules required for an award. The latest entry point for external applicants transferring into the courses is the second year. All applicants transferring into the BEng and MEng courses must have accredited prior certified learning.

### 2.4 Study Time

#### 2.4.1 Weekly timetable

A timetable will be available once you have enrolled onto the programme, through the Student Portal. Please check your timetable regularly

#### 2.4.2 Expected hours of study

20 credits is a standard module size and equals 200 notional learning hours. For a typical module you may have a 2 hour lecture, and a 1 hour tutorial/laboratory session, leaving you approximately 3 hours for self-directed study (further reading, tutorial questions, assignments, revision). This is thinking time – not coffee and biscuits time! Often you will be working in groups for practical work and you should try and arrange to meet up outside the scheduled class times. You will also need to use equipment such as computer and laboratory facilities for practical work, again sometimes outside the scheduled class times.

Explain to your students the hours of commitment required in a typical working week for both attendance and personal study, you may also need to incorporate reference to work based or placement learning requirements where relevant.

### 2.4.3 Attendance Requirements

You are required to attend all timetabled learning activities for each module. Notification of illness or exceptional requests for leave of absence must be made to:

Martin Varley (Academic Lead for Engineering):

☎ +44 1772 893272 | ✉ mrvarley@uclan.ac.uk

Absences due to illness must be reported to the Computing and Technology student hub:

Computing and Technology Hub:

☎ +44 1772 891994 | ✉ candthub@uclan.ac.uk

You are encouraged to seek the advice of your Personal Tutor and/or Course Leader if your personal circumstances make it difficult to meet your study obligations

## 3. Approaches to teaching and learning

### 3.1 Learning and teaching methods

The electronics and robotics engineering programmes use a number of different assessment techniques that will allow you to demonstrate your understanding of concepts and issues covered. These may be broadly categorised as ‘examination’ and ‘coursework’, but several different types are used, e.g. open-book exams, closed-book exams, laboratory reports, practical assessments in the laboratory, computer simulation and analysis, written reports etc.

Evidence of achievement, upon which assessment will be based, will be gained through a programme of practical exercises, assignments and exams. Each week you may be involved in some practical work such as a laboratory exercise, a computer-based assignment, group or individual project work etc. You will often work in groups and make group presentations but you will write up and submit work individually so that you gain credit for your contribution, not that of somebody else.

It should be emphasised that the purpose of assessment is to not only grade you, and provide information to facilitate management of the course, but also to provide feedback to you. In this way you can monitor your own progress, refine your own judgement of your abilities and regulate it accordingly.

You should keep all the returned work in a file and you may have to submit this at the end of the year for the external examiners to assess.

Individual module leaders will distribute information on the methods of assessment used, and their weighting, at the start of each module.

### 3.2 Study skills

The university offers a number of services to aid you in your studies, this is detailed on the following webpage:

https://www.uclan.ac.uk/students/study/study_support.php

You are also encouraged to discuss any issues that you may have with your academic advisor.

### 3.3 Learning resources

#### 3.3.1 Learning Information Services (LIS)

Generic information is available in the student handbook on the services that LIS offer. In addition the School of Engineering has a specific webpage maintained by our subject librarian, this can be found at the following link:

http://www.uclan.ac.uk/students/study/library/Engineering_guide.php

#### 3.3.2 Electronic Resources

Most of your modules will have a Blackboard eLearn site associated with it for distribution of learning material. This may include lecture notes, additional reading, web links, tutorial exercises, past exam papers and so forth.

More general information such as Programme Specifications, External Examiner's reports and information about the Industrial Placements can be found on the Engineering blackboard pages

You can access Blackboard online through the Student Portal, please ensure that you have access to this.

### 3.4 Personal development planning

Personal development planning (PDP) is a reflection on learning, performance and achievement and allows you to plan for personal, educational and career development. As learning is a lifelong process the work in the PDP is not assessed. There are many similarities with work based learning and Continued Professional Development (CPD) – which is required for membership of professional societies.

## 4. Student Support

Within the school of engineering you will find many people will be happy to help you. For module related support, you would normally contact the module tutor in the first instance. Likewise for course enquiries your course leader will assist. Your academic advisor will also be able to provide support and direction on a number of matters. For more general enquiries the you can visit any one of the hubs. There are helpful guides available online too, just visit: http://www.uclan.ac.uk/students/

### 4.1 Academic Advisors

Academic Advisers provide help for students with problems and are responsible for overseeing the progress of students, their welfare, academic counselling and guidance. Your Academic Adviser is allocated when you enrol. You must see your Academic Adviser when requested and meet at least once per semester. Ensure they know you and have your current email address.

Please seek help relating to lecture material and practical classes from the module tutor in the first instance. If necessary make an appointment to seek additional support. Please remember that academic staff are busy people and may not be able to give you instant help.

Although Academic Advisers and Course Leaders will deal with most of the day-to- day questions which arise, the Head of School is always willing to see students and an appointment can be made through the Student Hub. Advice relating to administrative issues may be obtained from the Student Hub.

### 4.2 Students with disabilities

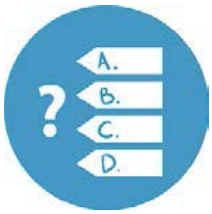
If you have a disability that may affect your studies, please either contact the Disability Advisory Service - disability@uclan.ac.uk - or let one of the course team know as soon as possible. With your agreement information will be passed on to the Disability Advisory Service. The University will make reasonable adjustments to accommodate your needs and to provide appropriate support for you to complete your study successfully. Where necessary, you will be asked for evidence to help identify appropriate adjustments.

The School of Engineering Disability Tutor is: Dr J. Yazdani, Email: JYazdani@uclan.ac.uk

### 4.3 Students' Union

The Students' Union offers thousands of volunteering opportunities ranging from representative to other leadership roles. We also advertise paid work and employ student staff on a variety of roles. You can find out more information on our website: http://www.uclansu.co.uk/

## 5. Assessment




### 5.1 Assessment Strategy

The assessment strategy for each module will be outlined within the module. The modules will be assessed either as coursework or by a combination of coursework and examinations with the weightings reflecting the course content (theory/practical). Each of the assessments that you complete will assess a series of learning outcomes defined in the modules. Note that within some modules you may complete assessments that do not carry marks, these are termed formative and are an opportunity for you to gain feedback on your progress that will help you in your summative (mark carrying) assessments.

### 5.2 Notification of assignments and examination arrangements

This information will be provided within the module session and on blackboard, for examinations you will be informed on your timetable

### 5.3 Referencing

For most of your assignments you will be expected to do some further reading, and you are required to think and produce increasingly original work around the work of others. **Do not fall into the 'plagiarism trap' either deliberately or by accident.** You need to give suitable credit to those that have produced the work that you are using.
You should reference any information you have refer to in your assignment using the Harvard referencing system (a guide to this system can be found on the WISER Blackboard space, accessed through the student portal).
You find information on the Harvard referencing system on the internet (google 'Harvard Referencing').

### 5.4 Confidential material

In the cases where Engineering students might use confidential information you should take guidance from your module tutor on your ethical and legal responsibilities to respect confidentiality and maintain anonymity of individuals within their assignments.

### 5.5 Cheating, plagiarism, collusion or re-presentation

Please refer to the information included in section 6.6 of the University Student Handbook for full definitions. The University uses an online Assessment Tool called Turnitin. A pseudo-Turnitin assignment will be set up using the School space on Blackboard to allow students to check as many drafts as the system allows before their final submission to the 'official' Turnitin assignment. Students are required to self-submit their own assignment on Turnitin and will be given access to the Originality Reports arising from each submission. In operating Turnitin, Schools must take steps to ensure that the University's requirement for all summative assessment to be marked anonymously is not undermined and therefore Turnitin reports should either be anonymised or considered separately from marking. Turnitin may also be used to assist with plagiarism detection and collusion, where there is suspicion about individual piece(s) of work.

## 6. Classification of Awards

The University publishes the principles underpinning the way in which awards and results are decided in Academic Regulations. Decisions about the overall classification of awards are made by Assessment Boards through the application of the academic and relevant course regulations.

## 7. Student Feedback

You can play an important part in the process of improving the quality of this course through the feedback you give.

In addition to the on-going discussion with the course team throughout the year, there are a range of mechanisms for you to feedback about your experience of teaching and learning. We aim to respond to your feedback and let you know of our plans for improvement.

The Students Union can support you in voicing your opinion, provide on-going advice and support, and encourage your involvement in all feedback opportunities. They will be requesting that you complete the National Student Survey (during semester 2 for students in their final year of study) or the UCLan Student Survey (all other students).

The Students' Union and University work closely together to ensure that the student voice is heard in all matters of student-life. We encourage students to provide constructive feedback throughout their time at university, through course reps, surveys and any other appropriate means.

### 7.1 Student Staff Liaison Committee meetings (SSLCs)

Details of the Protocol for the operation of SSLCs is included in section 8.2 of the University Student Handbook

## 8. Appendices

### 8.1 Programme Specification(s)

**UNIVERSITY OF CENTRAL LANCASHIRE**

**Programme Specification**

This Programme Specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided.

***Sources of information on the programme can be found in Section 17***

| | |
|---|---|
| **1. Awarding Institution / Body** | University of Central Lancashire |
| **2. Teaching Institution and Location of Delivery** | University of Central Lancashire |
| **3. University School/Centre** | School of Engineering |
| **4. External Accreditation** | Institution of Engineering and Technology (to 2017 intake) |
| **5. Title of Final Award** | BEng (Hons) Robotics Engineering |
| **6. Modes of Attendance offered** | Full Time; Part Time; Sandwich |
| **7. UCAS Code**<br><br>**7b JACs/HECOS Code** | H617 Robotics<br><br>100170 |
| **8. Relevant Subject Benchmarking Group(s)** | QAA Subject Benchmarking Statement: Engineering (2015) |
| **9. Other external influences** | Engineering Council UK-SPEC,<br>Accreditation requirements of IET,<br>QAA Academic Infrastructure Codes of Practice,<br>Science, Technology, Engineering & Mathematics (STEM) government initiatives. |
| **10. Date of production/revision of this form** | November 2018 |

## 11. Aims of the Programme

- To meet the requirements for accreditation of the programme by the Institution of Engineering and Technology to give graduates the opportunity to progress to Chartered Engineering status.
- To produce resourceful, competent, clear-thinking professional engineers with a range of skills and experience relevant to today's engineering industry.
- To equip graduates of the programme with knowledge, skills, experience, and understanding which underpin a professional career in engineering.

## 12. Learning Outcomes, Teaching, Learning and Assessment Methods

UK-SPEC, published by the Engineering Council, is the standard for accredited engineering degrees in the UK. The IET serve as an accrediting institution licensed by the Engineering Council and publish their own interpretation of UK-SPEC.

UK-SPEC presents General Learning Outcomes (GLO) categorised in a form wholly compatible with the UCLan equivalents, alongside a more detailed set of Specific Learning Outcomes (SLO). In the following sections A to D learning outcomes for the programme are grouped according to the standard UCLan format, cross-referenced (in brackets) to the corresponding SLOs from the IET interpretation of UK-SPEC.

### A. Knowledge and Understanding

**A1** Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:

(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning **(US1, P1)**

(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages **(US1, P1)**

**A2** Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms **(US2)**

**A3** Evaluation of the wider commercial and economic context of engineering, applicable business and management techniques, relevant social and legal constraints **(S1, S2, S4)**

**A4** Explain sustainability issues and ability to produce engineering solutions which promote sustainable development **(S3)**

### Teaching and Learning Methods

Teaching and learning methods include traditional lectures, tutorials, laboratory work, directed self-study, and project work.

### Assessment methods

Written assessment methods include examinations, laboratory-based and research-based assignments, tutorial questions, log books and formal reports.

Oral assessment methods include interviews and presentations

Practical skills are assessed using assignment work, and demonstrations.

### B. Subject-specific skills

**B1** Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems **(US3, E1)**

**B2** Practical application of theory to quantitative models and computer software for the simulation and design of systems within the domain of Robotics **(E2, E3)**

**B3** Manage costs in order to produce system designs which both meet defined requirements and are economically viable **(D3)**

**B4** Demonstrate practical competencies required for the test and measurement of robotic systems and their embedded electronic devices via practical laboratory sessions and structured workshops. **(P1, P2)**

**B5** Evaluate of the wider multidisciplinary context within which engineering knowledge is applicable **(P3)**

**B6** Understanding of the codes of practice, standards and quality management processes applicable to the domain of Robotics, adopting these where appropriate to the design process **(P6, P7)**

**Teaching and Learning Methods**

Teaching and learning methods include traditional lectures, tutorials, laboratory work, directed self-study, and project work.

**Assessment methods**

Written assessment methods include examinations, laboratory-based and research-based assignments, tutorial questions, log books and formal reports.

Oral assessment methods include interviews and presentations

Practical skills are assessed using assignment work, and demonstrations.

**C. Thinking Skills**

**C1** Ability to apply systems analysis techniques to the top-level design of robotic systems, and the decomposition and synthesis of sub-systems using appropriate technologies **(E4)**

**C2** Ability to define a problem including understanding customer needs **(D1, D2)**

**C3** The ability to apply creativity in establishing innovative solutions and to ensure their fitness for purpose **(D4, D5)**

**C4** Manage design processes and evaluate outcomes **(D6)**

**C5** Exercise of engineering judgement accounting for professional & ethical considerations **(S5)**

**C6** Ability to analyse unfamiliar problems, apply unfamiliar concepts and manage the inherent technical uncertainty **(P8)**

**Teaching and Learning Methods**

Teaching and learning methods include traditional lectures, tutorials, laboratory work, directed self-study, and project work.

**Assessment methods**

Written assessment methods include examinations, laboratory-based and research-based assignments, tutorial questions, log books and formal reports.

Oral assessment methods include interviews and presentations

Practical skills are assessed using assignment work, and demonstrations.

**D. Other skills relevant to employability and personal development**

**D1** Effective exploitation of literature, locate and critically evaluate information from a variety of sources **(P4)**

**D2** Communicate in an accurate, persuasive and succinct form, via a variety of media **(GLO)**

**D3** Independence, self-awareness, and the intrinsic motivation to develop technical proficiencies and achieve goals without external influence **(GLO)**

**D4** Work effectively as part of a team **(GLO)**

**D5** Personal development planning, self-directed learning and reflection for future CPD **(GLO)**

**Teaching and Learning Methods**

Teaching and learning methods include traditional lectures, seminars, directed study, demonstrations, guided practical sessions, workshops and project work.

**Assessment methods**

Written assessment methods include laboratory-based and research-based assignments, independent dissertation, log books and formal reports.
Oral assessment methods include presentations, interviews and viva-voce examinations.
Teamwork skills are assessed using assignment work contributions, peer assessment and staff observation.

| 13. Programme Structures* | | | | 14. Awards and Credits* |
|---|---|---|---|---|
| **Level** | **Module Code** | **Module Title** | **Credit rating** | |
| Level 6 | | **Compulsory Modules:** | | **BEng (Hons) Robotics Engineering** Requires 360 credits including a minimum of 220 at Level 5 or above, and a minimum of 100 at Level 6, including the Project. The Project module cannot be condoned.<br><br>**BEng Robotics Engineering** Requires a minimum of 320 credits with 180 at Stage 2, including Level 5 or above, and a minimum of 40 at Level 6. The Project module cannot be condoned. |
| | EL3007 | Robotics & Autonomous Systems | 20 | |
| | EL3250 | Microcontroller Systems | 20 | |
| | EL3995 | Project | 30 | |
| | EL3996 | Engineering Professionalism | 10 | |
| | | **Option Modules:** | | |
| | EL3105 | Computer Vision | 20 | |
| | EL3147 | Digital Signal & Image Processing A | 20 | |
| | EL3243 | Embedded Real-Time Systems | 20 | |
| | EL3251 | System on Programmable Chip | 20 | |
| | EL3300 | Machine Intelligence | 20 | |
| | EL3425 | Computer Aided Instrumentation | 20 | |
| | EL3102 | Control Systems | 20 | |
| Level 5 | | **Industrial placement:** (required for sandwich award) | | **Students who successfully complete module MP2899 will receive the award 'with Industrial Placement'.**<br><br>CertHE and DipHE are not available as sandwich awards. |
| | MP2899 | Industrial Placement (6 modules) | 120 Notional credits | |
| Level 5 | | **Compulsory Modules:** | | **Diploma of Higher Education in Electonic Engineering** Requires 240 credits including a minimum of 220 credits at Level 4 or above and at least 100 credits at level 5 or above |
| | EL2007 | Robotic Systems | 20 | |
| | EL2104 | Instrumentation & Control | 20 | |
| | EL2205 | Electronic System Applications | 20 | |
| | EL2242 | Digital Systems | 20 | |
| | EL2311 | Software Development 2 | 20 | |
| | | **Option Modules:** | | |
| | EL2006 | Data Communications | 20 | |
| | EL2241 | Electronic Systems | 20 | |
| | EL2011 | Student Initiated Module | 10 | |
| | EL2013 | Student Initiated Module | 20 | |
| | Elective | (level 4 or above) | 20 | |
| Level 4 | | **Compulsory Modules:** | | **Certificate of Higher Education** Requires 120 credits at Level 4 or above. |
| | ER1010 | Engineering Analysis | 30 | |
| | ER1630 | Engineering Applications | 30 | |
| | ER1730 | Electronics and Electronic Engineering Practice | 30 | |
| | ER1731 | Digital Electronics and Programmable Systems | 30 | |
| Level 3 (FE) | ERC001 | Study Skills | 20 | Students who exit after the Foundation year will receive a transcript of their modules and grades. |
| | ERC002 | Basic Mathematics | 20 | |
| | ERC003 | Information and Communications Technology | 20 | |
| | ERC004 | Practical Skills | 20 | |

| | | | | |
|---|---|---|---|---|
| | ERC005<br>ERC006 | Design Studies<br>Analytical Studies | 20<br>20 | |

**15. Personal Development Planning**

Various PDP-related issues are presented and discussed throughout the course, including specific sessions on aspects such as time management, preparation for assessments, review and reflection, postgraduate opportunities, etc. PDP guidance specifically for these ECE courses is provided, with relevant issues being discussed in several of the modules, most notably the practical-based modules ER1630, ER1730, EL2205 and the final year project module. The use of an effective Academic Advisor system, with a named lecturer responsible for each of the Year 1 and Year 2, is helpful in this respect. Issues related to the Industrial Placement year (Year 3) are discussed in sessions (MP2899), held during the second year of study, and during placement visits for students on Industrial Placement. Final Year students' Academic Advisor is their individual Project Supervisor, who they will meet regularly throughout the year. There is also a named Final Year Tutor who deals with issues specific to the final year.

The University also has central PDP guidance and support, and reference to this is made in the Student Handbook.

**16. Admissions criteria ***
**(including agreed tariffs for entry with advanced standing)**
***Correct as at date of approval. For latest information, please consult the University's website.**

Our typical offer is 112 UCAS Points including Maths and Physics at C or STEM at C. We operate a flexible admissions policy and treat everyone as an individual. This means that we will take into consideration your educational achievements and predicted grades (where applicable) together with your application as a whole, including work experience and personal statement. General Studies accepted

BTEC Extended Diploma: Distinction, Merit, Merit including Maths units.
Pass Access Course: 112 UCAS Points
International Baccalaureate:Pass Diploma with 112 UCAS points from Higher Level Subjects & HL5 in required subject.
IELTS: 6.0 with no score lower than 5.5

GCSE: 5 at grade C/4 including Maths & English or equivalent

**17. Key sources of information about the programme**

**School and course webpages:**
**http://www.uclan.ac.uk/schools/engineering/index.php**
**http://www.uclan.ac.uk/information/courses/beng_robotics.php**

- **Factsheet for Robotics Engineering courses**
- **UCAS information**
- **External Influences:**
  **http://www.theiet.org/academics/accreditation/policy-guidance/synopsis_handbook.cfm**
  **http://www.engc.org.uk/professional-qualifications/standards/uk-spec**
  **http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/Engineering10.pdf**

**18. Curriculum Skills Map (Part A: Level 6)**

**Please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed**

| Level | Module Code | Module Title | Core (C), Compulsory (COMP) or Option (O) | Programme Learning Outcomes | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Knowledge & Understanding | | | | Subject-specific skills | | | | | | Thinking skills | | | | | | Other skills relevant to employment and personal development | | | | |
| | | | | A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 | B5 | B6 | C1 | C2 | C3 | C4 | C5 | C6 | D1 | D2 | D3 | D4 | D5 |
| LEVEL 6 | EL3007 | Robotics & Autonomous Systems | COMP | X | X | | | X | X | | X | | | X | | X | | | | X | X | | | |
| | EL3102 | Control Systems | O | X | X | | | X | X | | | | | X | | | | | | X | X | | | |
| | EL3105 | Computer Vision | O | X | X | | | X | X | | | | | | | X | X | | | X | X | | | |
| | EL3147 | Digital Signal & Image Processing A | O | X | X | | | X | X | | X | X | | X | | | | | | X | X | | | |
| | EL3243 | Embedded Real-Time Systems | O | | | | | X | X | | X | | | X | | X | X | | | X | X | | | |
| | EL3250 | Microcontroller Systems | COMP | | | | | X | X | | | | | | | | | | | X | X | | | |
| | EL3251 | System on Programmable Chip | O | X | | X | | X | X | | X | | | X | | | | | | | X | | | |
| | EL3300 | Machine Intelligence | O | | X | | | X | X | | | | | X | | | | | | | X | | | |
| | EL3425 | Computer Aided Instrumentation | O | X | | | | X | X | | | | | X | X | | | | | X | X | | | |
| | EL3995 | Project | C | X | | X | | X | X | X | X | X | X | X | X | X | X | | X | X | X | X | | X |
| | EL3996 | Engineering Professionalism | C | | | X | X | | | | | X | X | | | | | X | | X | X | | | X |

**18. Curriculum Skills Map (Part B: Levels 4 & 5)**

**Please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed**

| Level | Module Code | Module Title | Core (C), Compulsory (COMP) or Option (O) | Programme Learning Outcomes | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Knowledge & Understanding | | | | Subject-specific skills | | | | | | Thinking skills | | | | | | Other skills relevant to employment and personal development | | | | |
| | | | | A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 | B5 | B6 | C1 | C2 | C3 | C4 | C5 | C6 | D1 | D2 | D3 | D4 | D5 |
| LEVEL 5 | EL2006 | Data Communications | O | ✗ | ✗ | | | ✗ | ✗ | | ✗ | | | | | | | | | | ✗ | | | |
| | EL2007 | Robotic Systems | COMP | ✗ | ✗ | | | ✗ | ✗ | | ✗ | ✗ | ✗ | ✗ | | ✗ | | | | ✗ | ✗ | | | |
| | EL2104 | Instrumentation & Control | COMP | ✗ | ✗ | | | ✗ | ✗ | | ✗ | | | ✗ | | | | | | ✗ | ✗ | | | |
| | EL2205 | Electronic Systems Applications | COMP | ✗ | ✗ | ✗ | | ✗ | ✗ | ✗ | ✗ | | | ✗ | ✗ | | ✗ | | | ✗ | ✗ | ✗ | ✗ | |
| | EL2241 | Electronic Systems | O | ✗ | ✗ | | | ✗ | ✗ | | ✗ | | | | | | | | | ✗ | ✗ | | | |
| | EL2242 | Digital Systems | COMP | | | | | ✗ | ✗ | | ✗ | | | | | | | | | | ✗ | | | |
| | EL2311 | Software Development 2 | COMP | | ✗ | | | ✗ | | | ✗ | | ✗ | | ✗ | ✗ | | | | | ✗ | | | |
| | EL2011/3 | SIM | O | ✗ | | | | | | | | | | | | | | | | | ✗ | ✗ | | |
| LEVEL 4 | ER1010 | Engineering Analysis | COMP | | X | | | X | | | | | | | | | | | | | X | | | |
| | ER1630 | Engineering Applications | COMP | X | | | X | X | X | | | | | X | | | | | | X | X | | | X |
| | ER1730 | Electronics and Electronic Engineering Practice | COMP | X | X | | | X | X | X | X | | | | X | | X | | | X | X | X | | X |
| | ER1731 | Digital Electronics and Programmable Systems | COMP | X | X | | | X | X | | X | | | X | X | | X | | | X | X | | | |

**Note:** *Mapping to other external frameworks, e.g. professional/statutory bodies, will be included within Student Course Handbooks*

## 19. LEARNING OUTCOMES FOR EXIT AWARDS:

For **each exit award available**, list learning outcomes relating to the knowledge and understanding, subject specific skills, thinking, other skills relevant to employability and personal development that a typical student might be expected to gain as a result of successfully completing each level of a course of study.

**Learning outcomes for the award of: CertHE**

A1 Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:

(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning (US1, P1)

(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages (US1, P1)

A2 Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms (US2)

B1 Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems

B2 Practical application of theory to quantitative models and computer software for the simulation, design and verification of electronic systems and devices

B3 Manage costs in order to produce system designs which both meet defined requirements and are economically viable

B4 Demonstrate practical competencies in laboratory and workshop skills required for the test, measurement and fabrication of electronic systems and devices

C2 Ability to define a problem including understanding customer needs

C4 Manage design processes and evaluate outcomes

D1 Effective exploitation of literature, locate and critically evaluate information from a variety of sources

D2 Communicate in an accurate, persuasive and succinct form, via a variety of media

D5 Personal development planning, self-directed learning and reflection for future CPD

**Learning outcomes for the award of: DipHE Electrical Engineering**

A1 Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:

(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning (US1, P1)

(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages (US1, P1)

A2 Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms (US2)

A3 Evaluation of the wider commercial and economic context of engineering, applicable business and management techniques, relevant social and legal constraints (S1, S2, S4)

B1 Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems

B2 Practical application of theory to quantitative models and computer software for the simulation, design and verification of electronic systems and devices

B3 Manage costs in order to produce system designs which both meet defined requirements and are economically viable

B4 Demonstrate practical competencies in laboratory and workshop skills required for the test, measurement and fabrication of electronic systems and devices

C1 Ability to apply systems analysis techniques to the top-level design of electronic systems, and the decomposition and synthesis of sub-systems using appropriate technologies

C2 Ability to define a problem including understanding customer needs

C3 Manage design processes and evaluate outcomes

D1 Effective exploitation of literature, locate and critically evaluate information from a variety of sources

D2 Communicate in an accurate, persuasive and succinct form, via a variety of media

D4 Work effectively as part of a team

D5 Personal development planning, self-directed learning and reflection for future CPD

**Learning outcomes for the award of: BEng Robotics Engineering**

A1 Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:

(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning (US1, P1)

(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages (US1, P1)

A2 Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms (US2)

A3 Evaluation of the wider commercial and economic context of engineering, applicable business and management techniques, relevant social and legal constraints (S1, S2, S4)

B1 Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems

B2 Practical application of theory to quantitative models and computer software for the simulation and design of systems within the domain of Robotics

B3 Manage costs in order to produce system designs which both meet defined requirements and are economically viable

B4 Demonstrate practical competencies in laboratory and workshop skills required for the test and measurement of robotic systems and their embedded electronic devices

C1 Ability to apply systems analysis techniques to the top-level design of robotic systems, and the decomposition and synthesis of sub-systems using appropriate technologies

C2 Ability to define a problem including understanding customer needs

C3 The ability to apply creativity in establishing innovative solutions and to ensure their fitness for purpose

C4 Manage design processes and evaluate outcomes

D1 Effective exploitation of literature, locate and critically evaluate information from a variety of sources

D2 Communicate in an accurate, persuasive and succinct form, via a variety of media

D3 Independence, self-awareness, and the intrinsic motivation to develop technical proficiencies and achieve goals without external influence

D4 Work effectively as part of a team

D5 Personal development planning, self-directed learning and reflection for future CPD

**UNIVERSITY OF CENTRAL LANCASHIRE**

**Programme Specification**

This Programme Specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided.

***Sources of information on the programme can be found in Section 17***

| | |
|---|---|
| **13. Awarding Institution / Body** | University of Central Lancashire |
| **14. Teaching Institution and Location of Delivery** | University of Central Lancashire |
| **15. University School/Centre** | School of Engineering |
| **16. External Accreditation** | Institution of Engineering and Technology<br>Accreditation to be sought following graduation of first cohort (anticipated in 2015) |
| **17. Title of Final Award** | MEng (Hons) Robotics Engineering |
| **18. Modes of Attendance offered** | Full Time; Part Time; Sandwich |
| **19. UCAS Code**<br><br>**7b JACS/HECOS Code** | H671 Robotics<br><br>H671/100170 |
| **20. Relevant Subject Benchmarking Group(s)** | QAA Subject Benchmarking Statement: Engineering (215) |
| **21. Other external influences** | Engineering Council UK-SPEC,<br>Accreditation requirements of IET,<br>QAA Academic Infrastructure Codes of Practice,<br>Science, Technology, Engineering & Mathematics (STEM) government initiatives. |
| **22. Date of production/revision of this form** | April 2019 |

**23. Aims of the Programme**

To meet the requirements for accreditation at CEng level by the Institution of Engineering and Technology and give graduates the opportunity to progress to Chartered Engineer Status.

To provide an extended, enhanced, and industrially relevant Integrated Master's programme of study in preparation for professional practice and a career in industry or for further study.

To produce resourceful, competent, clear-thinking professional engineers with a range of skills and experience relevant to today's engineering industry.

To Provide extended professional and transferable skills such as complex problem solving, group working in a multidisciplinary setting, product development and communicating complex technical information.

To equip graduates who will provide innovation in a professional engineering setting, underpinned with the knowledge, skills and experience and understanding which will underpin a professional career in engineering.

**24. Learning Outcomes, Teaching, Learning and Assessment Methods**

UK-SPEC, published by the Engineering Council, is the standard for accredited engineering degrees in the UK. The IET serve as an accrediting institution licensed by the Engineering Council and publish their own interpretation of UK-SPEC.

UK-SPEC presents General Learning Outcomes (GLO) categorised in a form wholly compatible with the UCLan equivalents, alongside a more detailed set of Specific Learning Outcomes (SLO). In the following sections A to D learning outcomes for the programme are grouped according to the standard UCLan format, cross-referenced (in brackets) to the corresponding SLOs from the IET interpretation of UK-SPEC.

**A. Knowledge and Understanding**

**A1** Evaluate, compare and contrast the essential concepts and physical principles relevant to the application domain of Robotics:

(iii) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning **(US1, P1)**

(iv) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages **(US1, P1)**

**A2** Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms **(US2)**

**A3** Evaluation of the wider commercial and economic context of engineering, applicable business and management techniques, relevant social and legal constraints **(S1, S2, S4)**

**A4** Explain sustainability issues and ability to produce engineering solutions which promote sustainable development **(S3)**

**A5** Comprehensive understanding of the scientific principles behind the Robotics discipline, the state of the art and technological trends **(US1m)**

**A6** Extensive knowledge of the equipment, materials and processes employed in the design and production of robotic and autonomous systems **(P2m)**

**Teaching and Learning Methods**

Teaching and learning methods include traditional lectures, tutorials, laboratory work, directed self-study, and project work.

**Assessment methods**

Written assessment methods include examinations, laboratory-based and research-based assignments, tutorial questions, log books and formal reports.

Oral assessment methods include interviews and presentations

Practical skills are assessed using assignment work, and demonstrations.

**B. Subject-specific skills**

- **B1** Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems **(US3, E1)**
- **B2** Practical application of theory to quantitative models and computer software for the simulation and design of systems within the domain of Robotics **(E2, E3)**
- **B3** Manage costs in order to produce system designs which both meet defined requirements and are economically viable **(D3)**
- **B4** Demonstrate practical competencies required for the test and measurement of robotic systems and their embedded electronic sub-systems via practical laboratory sessions and structured workshops **(P1, P2)**
- **B5** Evaluation of the wider multidisciplinary context within which engineering knowledge is applicable **(P3)**
- **B6** Understanding of the codes of practice, standards and quality management processes applicable to the domain of Robotics, adopting these where appropriate to the design process **(P6, P7)**
- **B7** Comprehensive understanding of relevant quantitative and numerical models and their limitations, ability to apply these models in engineering analyses and critically evaluate outcomes **(US3m, E2m)**

**Teaching and Learning Methods**

Teaching and learning methods include traditional lectures, tutorials, laboratory work, directed self-study, and project work.

**Assessment methods**

Written assessment methods include examinations, laboratory-based and research-based assignments, tutorial questions, log books and formal reports.

Oral assessment methods include interviews and presentations

Practical skills are assessed using assignment work, and demonstrations.

**C. Thinking Skills**

- **C1** Ability to apply systems analysis techniques to the top-level design of electronic systems, and the decomposition & synthesis of sub-systems using appropriate technologies **(E4)**
- **C2** Ability to define a problem including understanding customer needs **(D1, D2)**
- **C3** Demonstrate creative and innovative ability in the synthesis of solutions and generation of designs for robotic systems and processes to fulfil new and emerging needs **(D4, D5, D2m)**
- **C4** Manage design processes and evaluate outcomes **(D6)**
- **C5** Adopt appropriate ethical and professional standards and practices, demonstrate extensive knowledge of the commercial and economic constraints affecting the exercise of engineering judgement **(S5, S1m, S2m)**
- **C6** Ability to solve complex and unfamiliar problems through application of a comprehensive understanding of design processes to unfamiliar situations and concepts, demonstrably managing the inherent technical uncertainty **(P8, E3m, D1m)**
- **C7** Understanding of current practice & its limitations, ability to investigate likely future developments & emerging technologies **(US2m, E1m, P1m)**
- **C8** Comprehension of the commercial multidisciplinary engineering context, ability to apply concepts including these outside influences effectively in engineering projects **(US4m, P3m)**

**Teaching and Learning Methods**

Teaching and learning methods include traditional lectures, tutorials, laboratory work, directed self-study, and project work.

**Assessment methods**

Written assessment methods include examinations, laboratory-based and research-based assignments, tutorial questions, log books and formal reports.

Oral assessment methods include interviews and presentations

Practical skills are assessed using assignment work, and demonstrations.

**D. Other skills relevant to employability and personal development**

- **D1** Effective exploitation of literature, locate and critically evaluate information from a variety of sources **(P4)**
- **D2** Communicate in an accurate, persuasive and succinct form, via a variety of media **(GLO)**
- **D3** Independence, self-awareness, and the intrinsic motivation to develop technical proficiencies and achieve goals without external influence **(GLO)**
- **D4** Work effectively as part of a team **(GLO)**
- **D5** Personal development planning, self-directed learning and reflection for future CPD **(GLO)**

**Teaching and Learning Methods**

Teaching and learning methods include traditional lectures, seminars, directed study, demonstrations, guided practical sessions, workshops and project work.

**Assessment methods**

Written assessment methods include laboratory-based and research-based assignments, independent dissertation, log books and formal reports.

Oral assessment methods include presentations, interviews and viva-voce examinations.

Teamwork skills are assessed using assignment work contributions, peer assessment and staff observation.

**13. Programme Structures***

.

**14. Awards and Credits***

| Level | Module Code | Module Title | Credit rating | |
|---|---|---|---|---|
| Level 7 | | **Compulsory Modules:** | | **MEng (Hons) Robotics Engineering** Requires 480 credits with 120 at Stage 2 and 240 at Stage 3, including a minimum of 460 at Level 4 or above, 360 at Level 5 or above, 200 at Level 6 or above and 120 at Level 7 or above. The Project modules EL4587 & EL4999 cannot be condoned. |
| | MP4580 | The Engineer & Society | 20 | |
| | MP4587 | Group Project | 20 | |
| | EL4999 | Individual Project | 20 | |
| | EL4007 | Adv. Robotics & Int. Sys. Design | 20 | |
| | | **Option Modules:** | | |
| | EL4147 | Digital Signal & Image Processing B | 20 | |
| | EL4250 | Power Electronics and Machine control | 20 | |
| | EL4012 | Internet of Things | 20 | |
| | EL4016 | Big Data Analytics and Visualisation | 20 | |
| Level 6 | | **Compulsory Modules:** | | **BEng (Hons) Robotics Engineering** Requires 360 credits including a minimum of 220 at Level 5 or above and 100 at Level 6, including the Project. The Project module EL3995 cannot be condoned. **BEng** |
| | EL3007 | Robotics & Autonomous Systems | 20 | |
| | EL3250 | Microcontroller Systems | 20 | |
| | EL3995 | Project | 30 | |
| | EL3996 | Engineering Professionalism | 10 | |
| | | **Option Modules:** | | |
| | EL3105 | Computer Vision | 20 | |
| | EL3147 | Digital Signal & Image Processing A | 20 | |
| | EL3243 | Embedded real-time systems | 20 | |

| | | | | |
|---|---|---|---|---|
| | EL3251<br>EL3425<br>EL3300 | System on Programmable Chip<br>Computer Aided Instrumentation<br>Machine Intelligence | 20<br>20<br>20 | **Robotics Engineering**<br>Requires 320 credits with a minimum of 180 at Stage 2, including Level 5 or above, and 40 at Level 6. The Project module EL3995 cannot be condoned. |
| Level 5 | <br><br><br>MP2899 | **Industrial placement:**<br>(required for sandwich award)<br><br>Industrial Placement<br>(6 modules) | <br><br><br>120 | Satisfactory completion of the Industrial Placement leads to a degree **'with Industrial Placement'**.<br><br>**CertHE** and **DipHE** are not available as sandwich awards. |
| Level 5 | <br>EL2007<br>EL2104<br>EL2205<br>EL2242<br>EL2311<br><br><br>EL2006<br>EL2241<br><br>EL2011<br>EL2013<br><br>Elective | **Compulsory Modules:**<br>Robotic Systems<br>Instrumentation & Control<br>Electronic System Applications<br>Digital Systems<br>Software Development 2<br><br>**Option Modules:**<br>Data Communications<br>Electronic Systems<br><br>Student Initiated Module<br>Student Initiated Module<br><br>(Level 4 or above) | <br>20<br>20<br>20<br>20<br>20<br><br><br>20<br>20<br><br>10<br>20<br><br>20 | **Diploma of Higher Education in Electronic Engineering**<br>Requires 240 credits including a minimum of 220 credits at Level 4 or above and 100 credits at Level 5 or above. |
| Level 4 | <br>ER1010<br>ER1630<br>ER1730<br><br>ER1731 | **Compulsory Modules:**<br>Engineering Analysis<br>Engineering Applications<br>Electronics and Electronic Engineering Practice<br>Digital Electronics and Programmable Systems | <br>30<br>30<br>30<br><br>30 | **Certificate of Higher Education**<br>Requires 120 credits at Level 4 or above. |
| Level 3 (FE) | ERC001<br>ERC002<br>ERC003<br><br>ERC004<br>ERC005<br>ERC006 | Study Skills<br>Basic Mathematics<br>Information and Communications Technology<br>Practical Skills<br>Design Studies<br>Analytical Studies | 20<br>20<br>20<br><br>20<br>20<br>20 | Students who exit after the Foundation year will receive a transcript of their modules and grades. |

## 15. Personal Development Planning

Various PDP-related issues are presented and discussed throughout the course, including specific sessions on aspects such as time management, preparation for assessments, review and reflection, postgraduate opportunities, etc. PDP guidance specifically for these ECE courses is provided, with relevant issues being discussed in several of the modules, most notably the practical-based modules ER1630, ER1730, EL2205 and project modules at Levels 6 and 7.

The use of an effective Personal Tutor system, with a named lecturer responsible for each of the Year 1 and Year 2, is helpful in this respect. Issues related to the Industrial Placement year (year 3) are discussed in sessions (MP2899), held during the second year of study, and during placement visits for students on Industrial Placement. Final Year students' Personal Tutor is their individual Project Supervisor, who they will meet regularly throughout the year. There is also a named Final Year Tutor who deals with issues specific to the final year.

The University also has central PDP guidance and support, and reference to this is made in the Student Handbook.

**16. Admissions criteria ***
**(including agreed tariffs for entry with advanced standing)**
***Correct as at date of approval. For latest information, please consult the University's website.**

Our typical offer is 112 UCAS Points including Maths and Physics at C or STEM at C. We operate a flexible admissions policy and treat everyone as an individual. This means that we will take into consideration your educational achievements and predicted grades (where applicable) together with your application as a whole, including work experience and personal statement. General Studies accepted

BTEC Extended Diploma: Distinction, Merit, Merit including Maths units.
Pass Access Course: 112 UCAS Points
International Baccalaureate:Pass Diploma with 112 UCAS points from Higher Level Subjects & HL5 in required subject.
IELTS: 6.0 with no score lower than 5.5

GCSE: 5 at grade C/4 including Maths & English or equivalent

**17. Key sources of information about the programme**

**School and course webpages:**
**http://www.uclan.ac.uk/schools/engineering/index.php**
**http://www.uclan.ac.uk/information/courses/meng_robotics.php**

- **Factsheet for Robotics Engineering courses**
- **UCAS information**
- **External Influences:**
  **http://www.theiet.org/academics/accreditation/policy-guidance/synopsis_handbook.cfm**
  **http://www.engc.org.uk/professional-qualifications/standards/uk-spec**
  **http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/Engineering10.pdf**

**18. Curriculum Skills Map (Part A: levels 6 & 7)**

**Please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed**

| Level | Module Code | Module Title | Core (C), Compulsory (COMP) or Option (O) | Programme Learning Outcomes | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Knowledge & Understanding | | | | | | Subject-specific skills | | | | | | | Thinking skills | | | | | | | | Other skills relevant to employment and personal development | | | | |
| | | | | A1 | A2 | A3 | A4 | A5 | A6 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | D1 | D2 | D3 | D4 | D5 |
| LEVEL 7 | EL4250 | Int. Digital Sys. Design | O | | | | | | | | X | | | | | X | | | X | | | X | X | X | | X | | | |
| | EL4007 | Adv. Rob's & Int.Sys. Des. | COMP | | | | | | | X | X | | X | X | X | X | | | X | X | | X | X | | X | X | X | | |
| | EL4147 | DSIP B | O | X | X | | | | | X | X | | X | X | | X | | | | X | | X | | | | X | | | |
| | MP4580 | The Engineer & Society | COMP | | | | | | | | | | | | | X | | | | X | | X | X | | | X | | | X |
| | EL4587 | Group Project | C | | | | | X | X | | | | | | | X | | | | X | | X | X | X | | X | X | X | X |
| | EL4999 | Individual Project | C | | | | | X | X | | | | | | | | | | | X | | X | X | | | X | X | | X |
| | EL4012 | Internet of Things | O | | X | X | | | | X | X | | X | | | | | X | X | | | | | | X | | | | |
| | EL4016 | Big Data Analytics and Visualisation | O | X | X | X | | | | X | X | | X | | | | | X | X | | | | | | X | X | | | |
| LEVEL 6 | EL3007 | Robotics & Auton. Sys. | COMP | X | X | | | | | X | X | | X | | | | X | | X | | | | | | X | X | | | |
| | EL3102 | Control Systems | COMP | X | X | | | X | | X | X | | X | | | X | X | | | | | | | | X | X | | | |
| | EL3250 | Microcontroller Sys. | COMP | | | | | | | X | X | | | | | | | | | | | | | | X | X | | | |
| | EL3251 | Sys. on Prog. Chip | O | X | | X | | | | X | X | | X | | | | X | | | | | | | | | X | | | |
| | EL3995 | Project | C | X | | X | | | | X | X | X | X | X | X | | X | X | X | X | | X | | | X | X | X | | X |
| | EL3996 | Engineering Prof. | C | | | X | X | | | | | | | X | X | | | | | | X | | | | X | X | | | X |
| | EL3300 | Machine Intelligence | O | | X | | | | X | X | | | | | | X | | | | | | | X | | | | | X | |

**18. Curriculum Skills Map (Part B: levels 4 & 5)**

**Please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed**

| Level | Module Code | Module Title | Core (C), Compulsory (COMP) or Option (O) | Programme Learning Outcomes | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Knowledge & Understanding | | | | | | Subject-specific skills | | | | | | | Thinking skills | | | | | | | | Other skills relevant to employment and personal development | | | | |
| | | | | A 1 | A 2 | A 3 | A 4 | A 5 | A 6 | B 1 | B 2 | B 3 | B 4 | B 5 | B 6 | B 7 | C 1 | C 2 | C 3 | C 4 | C 5 | C 6 | C 7 | C 8 | D 1 | D 2 | D 3 | D 4 | D 5 |
| LEVEL 5 | EL2006 | Data Communications | O | ✗ | ✗ | | | | | ✗ | ✗ | | ✗ | | | | | | | | | | | | | ✗ | | | |
| | EL2007 | Robotic Systems | COMP | ✗ | ✗ | | | | | ✗ | ✗ | | ✗ | ✗ | ✗ | | ✗ | | ✗ | | | | | | ✗ | ✗ | | | |
| | EL2104 | Instrumentation & Control | COMP | ✗ | ✗ | | | | | ✗ | ✗ | | ✗ | | | | ✗ | | | | | | | | ✗ | ✗ | | | |
| | EL2205 | Electronic Systems Application | COMP | ✗ | ✗ | ✗ | | | | ✗ | ✗ | ✗ | ✗ | | | | ✗ | ✗ | | ✗ | | | | | ✗ | ✗ | ✗ | ✗ | |
| | EL2241 | Electronic Systems | O | ✗ | ✗ | | | | | ✗ | ✗ | | ✗ | | | | | | | | | | | | ✗ | ✗ | | | |
| | EL2242 | Digital Systems | COMP | | | | | | | ✗ | ✗ | | ✗ | | | | | | | | | | | | | ✗ | | | |
| | EL2311 | Software Development 2 | COMP | | ✗ | | | | | ✗ | | | ✗ | | ✗ | | | ✗ | ✗ | | | | | | | ✗ | | | |
| | EL2011 /3 | SIM | O | ✗ | | | | | | | | | | | | | | | | | | | | | | ✗ | ✗ | | |
| LEVEL 4 | ER1010 | Engineering Analysis | COMP (NEW) | | X | | | | | X | | | | | | | | | | | | | | | | X | | | |
| | ER1630 | Engineering Applications | COMP (NEW) | X | | | X | | | X | X | | | | | | X | | | | | | | | X | X | | | X |
| | ER1730 | Electronics and Electronic Engineering Practice | COMP (NEW) | X | X | | | | | X | X | X | X | | | | | X | | X | | | | | X | X | X | | X |
| | ER1731 | Digital Electronics and Programmable Systems | COMP (NEW) | X | X | | | | | X | X | | X | | | | X | X | | X | | | | | X | X | | | |

***Note:*** *Mapping to other external frameworks, e.g. professional/statutory bodies, will be included within Student Course Course Handbooks*

## 19. LEARNING OUTCOMES FOR EXIT AWARDS:

For **each exit award available**, list learning outcomes relating to the knowledge and understanding, subject specific skills, thinking, other skills relevant to employability and personal development that a typical student might be expected to gain as a result of successfully completing each level of a course of study.

**Learning outcomes for the award of: CertHE**

A1 Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:
(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning (US1, P1)
(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages (US1, P1)
A2 Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms (US2)
B1 Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems
B2 Practical application of theory to quantitative models and computer software for the simulation, design and verification of electronic systems and devices
B3 Manage costs in order to produce system designs which both meet defined requirements and are economically viable
B4 Demonstrate practical competencies in laboratory and workshop skills required for the test, measurement and fabrication of electronic systems and devices
C2 Ability to define a problem including understanding customer needs
C4 Manage design processes and evaluate outcomes
D1 Effective exploitation of literature, locate and critically evaluate information from a variety of sources
D2 Communicate in an accurate, persuasive and succinct form, via a variety of media
D5 Personal development planning, self-directed learning and reflection for future CPD

**Learning outcomes for the award of: DipHE Electrical Engineering**

A1 Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:
(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning (US1, P1)
(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages (US1, P1)
A2 Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms (US2)
A3 Evaluation of the wider commercial and economic context of engineering, applicable business and management techniques, relevant social and legal constraints (S1, S2, S4)
B1 Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems
B2 Practical application of theory to quantitative models and computer software for the simulation, design and verification of electronic systems and devices
B3 Manage costs in order to produce system designs which both meet defined requirements and are economically viable
B4 Demonstrate practical competencies in laboratory and workshop skills required for the test, measurement and fabrication of electronic systems and devices
C1 Ability to apply systems analysis techniques to the top-level design of electronic systems, and the decomposition and synthesis of sub-systems using appropriate technologies
C2 Ability to define a problem including understanding customer needs
C3 Manage design processes and evaluate outcomes
D1 Effective exploitation of literature, locate and critically evaluate information from a variety of sources
D2 Communicate in an accurate, persuasive and succinct form, via a variety of media
D4 Work effectively as part of a team

D5 Personal development planning, self-directed learning and reflection for future CPD

**Learning outcomes for the award of: BEng Robotics Engineering**

A1 Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:

(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning (US1, P1)

(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages (US1, P1)

A2 Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms (US2)

A3 Evaluation of the wider commercial and economic context of engineering, applicable business and management techniques, relevant social and legal constraints (S1, S2, S4)

B1 Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems

B2 Practical application of theory to quantitative models and computer software for the simulation and design of systems within the domain of Robotics

B3 Manage costs in order to produce system designs which both meet defined requirements and are economically viable

B4 Demonstrate practical competencies in laboratory and workshop skills required for the test and measurement of robotic systems and their embedded electronic devices

C1 Ability to apply systems analysis techniques to the top-level design of robotic systems, and the decomposition and synthesis of sub-systems using appropriate technologies

C2 Ability to define a problem including understanding customer needs

C3 The ability to apply creativity in establishing innovative solutions and to ensure their fitness for purpose

C4 Manage design processes and evaluate outcomes

D1 Effective exploitation of literature, locate and critically evaluate information from a variety of sources

D2 Communicate in an accurate, persuasive and succinct form, via a variety of media

D3 Independence, self-awareness, and the intrinsic motivation to develop technical proficiencies and achieve goals without external influence

D4 Work effectively as part of a team

D5 Personal development planning, self-directed learning and reflection for future CPD

**Learning outcomes for the award of: BEng (Hons) Robotics Engineering**

A1 Evaluate, compare the essential concepts and physical principles relevant to the application domain of Robotics:

(i) applicable to instrumentation and control systems, sensors and actuators, motion control and modelling, machine learning (US1, P1)

(ii) applicable to electronic sub-systems design, associated methodologies of programming and hardware description languages (US1, P1)

A2 Apply knowledge and understanding of mathematics underpinning the Robotics discipline; system analysis, computational algorithms (US2)

A3 Evaluation of the wider commercial and economic context of engineering, applicable business and management techniques, relevant social and legal constraints (S1, S2, S4)

A4 Explain sustainability issues and ability to produce engineering solutions which promote sustainable development (S3)

B1 Ability to apply engineering principles, general physical principles and underlying engineering science to the analysis and solution of engineering problems (US3, E1)

B2 Practical application of theory to quantitative models and computer software for the simulation and design of systems within the domain of Robotics (E2, E3)

B3 Manage costs in order to produce system designs which both meet defined requirements and are economically viable (D3)

B4 Demonstrate practical competencies required for the test and measurement of robotic systems and their embedded electronic devices via practical laboratory sessions and structured workshops. (P1, P2)

B5 Evaluate of the wider multidisciplinary context within which engineering knowledge is applicable (P3)

B6 Understanding of the codes of practice, standards and quality management processes applicable to the domain of Robotics, adopting these where appropriate to the design process (P6, P7)

C1 Ability to apply systems analysis techniques to the top-level design of robotic systems, and the decomposition and synthesis of sub-systems using appropriate technologies (E4)

C2 Ability to define a problem including understanding customer needs (D1, D2)

C3 The ability to apply creativity in establishing innovative solutions and to ensure their fitness for purpose (D4, D5)

C4 Manage design processes and evaluate outcomes (D6)

C5 Exercise of engineering judgement accounting for professional & ethical considerations (S5)

C6 Ability to analyse unfamiliar problems, apply unfamiliar concepts and manage the inherent technical uncertainty (P8)

D1 Effective exploitation of literature, locate and critically evaluate information from a variety of sources (P4)

D2 Communicate in an accurate, persuasive and succinct form, via a variety of media (GLO)

D3 Independence, self-awareness, and the intrinsic motivation to develop technical proficiencies and achieve goals without external influence (GLO)

D4 Work effectively as part of a team (GLO)

D5 Personal development planning, self-directed learning and reflection for future CPD (GLO)

Addendum to the Course Handbook for

BEng Hons Robotics Engineering
MEng Hons Robotics Engineering
2019-2020

| Page | Section | Summary of change & previous text removed (state whether addition / deletion / amendment / etc) | Date of Approval |
|---|---|---|---|
| 8 | 2.1 MEng | Module MP4999 replaced with new module EL4999. Module MP4586 replaced with EL4587. Changes as per recommendations from the professional body (IET). | 25/6/19 |
| 8 | 2.1 MEng | Addition of new optional modules EL4012 and EL4016. | 25/6/19 |
| 8 | 2.1 MEng | Module EL4250 changed from compulsory to optional. | 25/6/19 |
| | | | |
| | | | |