1. **Title of the module**

 EENG6460 (EL646) Robotics and Artificial Intelligence

1. **Division or partner institution which will be responsible for management of the module**

 Computing, Engineering and Mathematical Sciences

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

 Level 6

1. **The number of credits and the ECTS value which the module represents**

 15 credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

 Term 1

1. **Prerequisite and co-requisite modules**

 EL313 Introduction to Programming

EL323 Engineering Design and Mechanics

EL517 Control and Mechatronics

1. **The courses to which the module contributes**

BEng Mechanical Engineering

BEng Mechanical Engineering with a year in industry

BEng/MEng Electronic and Computer Engineering

BEng/MEng Electronic and Computer Engineering with a year in industry

BEng Biomedical Engineering

BEng Biomedical Engineering with a year in industry

1. **The intended subject specific learning outcomes.
On successfully completing the module students will have knowledge and understanding of:**
	1. The theory and implementation of robotics, for both physical and simulated robots;
	2. The basic theoretical tools to describe kinematics and dynamics for robot systems with several degrees of freedom;
	3. The software/hardware integration in robot architectures for advanced tasks and industrial applications;
	4. The adoption of artificial intelligence (AI) and machine learning (ML) algorithms in robotic systems;
2. **The intended generic learning outcomes.
On successfully completing the module students will be able to:**
	1. Critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete), to make judgements and propose solutions
	2. Communicate more effectivelyusing a variety of methods;
	3. apply methods and techniques to review, consolidate, extend and apply their knowledge and understanding, and to initiate and carry out a project;
	4. Exercise initiative and personal responsibility to manage their time and resources within a task.
3. **A synopsis of the curriculum**

**Robotics:** Introduction to robotics; Design, Components and Programming of a robotic system (e.g. mechanical arm, controller, electrical drive, hydraulic drive, etc.);

Modelling of kinematics and dynamics; Sensing, control and human-robot interaction technologies; Design and build of a small robot for a particular application (e.g. space/aerospace, automotive, driverless cars, renewable energy, healthcare, agriculture, mining, etc.);

**AI and ML:** Introduction to Artificial Intelligence (AI) and Machine Learning (ML); applications of AI in robotics; unsupervised, supervised and reinforcement learning; ML in robot path planning, navigation, positioning, and obstacle avoidance.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**
* Handbook of Robotics – Bruno Siciliano and Oussama Khatib, Springer, 2016.
* Robotic Systems and Autonomous Platforms: Advances in Materials and Manufacturing – Shawn M. Walsh, Michael S. Strano, Elsevier, 2019.
* Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques – Francis X. Govers, Packt Publishing, 2018.
1. **Learning and teaching methods**

Contact hours 34
Private study hours 116
Total study hours: 150

1. **Assessment methods**
	1. Main assessment methods

 Exam, 2 hours (40%)

 Presentation, 15 minutes (20%)

 Project report , 4000 words (40%)

* 1. Reassessment methods

Like for like

1. **Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | *8.1* | *8.2* | *8.3* | *8.4* | *9.1* | *9.2* | *9.3* | *9.4* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |
| **Private Study** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| lectures | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Example classes | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Labs |  |  | **x** | **x** | **x** | **x** | **x** | **x** |
| **Assessment method** |  |  |  |  |  |  |  |  |
| Exam | **x** | **x** | **x** |  | **x** |  | **x** |  |
| Presentation |  | **x** | **x** | **x** | **x** |  |  |  |
| Project Report |  |  | **x**  | **x** | **x** | **x** | **x** | **x** |

1. **Inclusive module design**

The Division recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/ declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Engineering is an international discipline with techniques developed and refined by scientists across the globe. Mastery of the subject-specific learning outcomes, will equip students to apply the theories and techniques of this module in a wide range of international contexts. Internationally recognised books are used as reading material for this course.

The module will use internationally developed and recognised tools for design and simulation of robotic and autonomous systems. The module team includes many members of staff with international experience of teaching and research collaboration. In compiling the reading list, consideration has been given to the range of texts that are available internationally and a selection of texts has been identified to complement the delivery of the material. The support provided to the students is also internationally attuned given our international student body.

**DIVISIONAL USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

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| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 15/10/2020 | Minor | Sept 2022 | 1, 6, 7, 8, 10,11,13,14,17 | No |
|  |  |  |  |  |