MEDICAL ROBOTICS - 2024/5

Module code: ENGM300

Module Overview

Medical robotics is a rapidly developing industry that is vital to healthcare systems seeking better outcomes at reduced overall cost. This module introduces students to the workings of robots and how this is applied in solving both surgical and broader healthcare challenges. Students learn through lectures, practical sessions and tutorial sessions requiring interaction with scientific literature.

Two units of assessment require students to develop an understanding of the general theory behind robotics and identify the particularities applying to medical robots. Case studies are a critical part of the module. These are industrially or research based and require students to think about clinical conditions, ethical considerations and different attitudes to healthcare across the world.

Practical sessions enable students to work with each other to solve problems and demonstrate the theoretical components of the module. An overarching series of lectures delivers critical technical information and links students' learning with case-studies to illustrate mechanical and medical issues. Tutorial sessions complement lectures and are designed for students to critically analyse, discuss and focus on particular aspects of medical robotic research in the scientific literature.

Module provider

Mechanical Engineering Sciences

Module Leader

OLDFIELD Matthew (Mech Eng Sci)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 7

Module cap (Maximum number of students): N/A

Overall student workload

Independent Learning Hours: 67

Lecture Hours: 33

Tutorial Hours: 3

Laboratory Hours: 8

Guided Learning: 6

Captured Content: 33

Module Availability

Semester 1

Prerequisites / Co-requisites

NA

Module content

Indicative content includes:

Basic principles of robotics; kinematic analysis; dynamic performance; motion planning; robotic control; co-operative robotics; different types of sensor and actuators commonly used in medical robots, for example motors, encoders, torque and load cells, and pneumatic muscles; applications of medical robotics; commercial robotic systems; soft robotics; integration of robots with the surgical environment; common procedures; experimental robotic technologies; ethical considerations; and exoskeletons.

Assessment pattern

Assessment type	Unit of assessment	Weighting
Coursework	Written deliverable based on physical laboratory sessions or computational simulations of robotic systems	40
Examination Online	Exam: Online (open book) - two hours within a four-hour window	60

Alternative Assessment

A simulation-based coursework will be required in the event that the pratical part of the coursework cannot be completed,

Assessment Strategy

The assessment strategy is designed to consolidate students' learning and application of theoretical and contextual material delivered in the module. The coursework will assess the ability to apply mathematical and practical concepts to an engineering task. The examination will address the ability of students to understand and appreciate the technical and wider considerations of using robots for medical applications.

Summative Assessment

The summative assessment for this module consists of:

Coursework - learning outcomes 1 and 2;
Examination - learning outcomes 3, 4 and 5.

Formative Assessment and Feedback

Three formative tutorial sessions will be delivered throughout the module. Students will also receive feedback during lectures, laboratory classes and following the coursework assessment.

Module aims

- Gain an understanding of the principles of robotics and their application in a medical context.
- Develop a critical appreciation of the broader issues associated with the practical implementation of medical robotics and the medical robotics industry.
- Acquire and demonstrate practical skills in implementing robotic concepts.
- To gain understanding of the state-of-the-art in medical robotics research and the medical robotics industry.

Learning outcomes

Ref		Attributes Developed	
001	Understand fundamental concepts in robotics and robotic control.	KC	M1
002	Implement the principles of robotics and robotic control in solving practical problems.	CPT	M1, M2, M3, M12, M17
003	Demonstrate an understanding of the links between robotic theory and the design of medical robots.	KC	M13
004	Describe the applications of medical robotics in a range of scenarios including rehabilitation and surgery.	K	M13
005	Appreciate broader issues linked to medical robotics and their practical application.	KCPT	M13, M7

Attributes Developed

C - Cognitive/analytical

K - Subject knowledge

T - Transferable skills

P - Professional/Practical skills

Methods of Teaching / Learning

The learning and teaching strategy is designed to provide a mixture of structured delivery, practical learning and independent study, which includes time spent on the coursework exercise. The practical element provides context to the theoretical content of the module and is used to illustrate important concepts. Tutorials are used to consolidate and deepen material covered during the course. The tutorials can also be used as an opportunity to focus attention on areas that students wish to revisit on an ad-hoc basis.

Indicated Lecture Hours (which may also include seminars, tutorials, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

Reading list

https://readinglists.surrey.ac.uk
Upon accessing the reading list, please search for the module using the module code: ENGM300

Other information

The School of Mechanical Engineering Sciences is committed to developing graduates with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability, and Resourcefulness and Resilience. This module is designed to allow students to develop knowledge, skills, and capabilities in the following areas:

Employability:

Students may work collaboratively in conducting various parts of the coursework exercise prior to submitting their independent assignments. Part of the module will focus on industrial medical robots. As such, students will need to address the organisational and ethical requirements to have a certified medical device on the market.

Digital Capabilities:

Students get hands-on experience with 5 degree-of-freedom desktop robots as part of the coursework exercise. These practical exercises require students to interact with and manipulate the robots using several different input sources. Students may also need to be aware of how other software tools, such as Matlab and Python can be used in the particular application of robotic control and simulation.

Global and Cultural Capabilities:

The practical and tutorial parts of the module give students the chance to work within the cohort to develop their skills and knowledge. Students will find themselves working with each other to solve technical problems and in discussing issues raised by the scientific literature. These interactions must be sensitive to backgrounds and experience while part of the University and prior to joining their respective programmes. Research from around the world is a part of this module. In considering this research and the medical robotics industry, students need to consider the regulations and different approaches to healthcare in regions outside the UK.

Resourcefulness and Resilience:

Tutorial sessions and opportunities for discussion within lectures will develop students' ability to process their own opinions and those of others. The complexities of ethics applied to robotics, for example, allow students to adapt their views based on alternative perspectives where concrete answers are difficult to establish.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Biomedical Engineering MEng	1	Optional	A weighted aggregate mark of 50% is required to pass the module
Computer Vision, Robotics and Machine Learning MSc	1	Optional	A weighted aggregate mark of 50% is required to pass the module
Mechanical Engineering MEng	1	Optional	A weighted aggregate mark of 50% is required to pass the module