Module Specification

Robotic Systems

Version: 2022-23, v4.0, 07 Jun 2022

Contents

Part 1: Information

Module title: Robotic Systems

Module code: UFMFJA-30-2

Level: Level 5

For implementation from: 2022-23

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: Frenchay Campus

Field: Engineering, Design and Mathematics

Module type: Standard

Pre-requisites: Introduction to Robotics and Electronics 2022-23

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: In this module students will learn about robot systems are designed. The module focuses on two aspects of this activity:

The mechanics and dynamics of robot bodies; how to make robots move efficiently and accurately to achieve desired aims.

The architectures and algorithms and techniques that enable us to build complicated machines that respond to stimuli in a timely, intelligent fashion.

Features: Not applicable

Educational aims: The aim of this module is to build upon work covered at level 4 so that students confidently understand the engineering design process as applied to robotic systems.

Outline syllabus: The module consists of two sections.

Section 1.
Students will learn about kinematics and dynamics in mobile robots and in robot manipulators. Topics will include:

Forward and Inverse kinematics solutions for manipulators with more than 4 degrees of freedom, Denavit Hartenberg notations.

Manipulator trajectories, velocities and static forces.

Dynamics basics, Manipulator dynamics, Newton Euler and Lagrange methods.

Control techniques for manipulators.

Section 2.
In addition, students will learn about the software systems used in robots to address the problems found in building these complex machines. Topics will include:

The problems which face robot builders. A variety of architectural approaches to solve these problems; where they differ and where they are similar. For example, Deliberative, Reactive, Behavioural, Hybrid, Agent-based.

Some software engineering methods which can be applied to the problems of designing robots, with an introduction to object-oriented modelling and UML and a brief introduction to project management methodologies.

Some methods of addressing navigation, localisation and route planning using symbolic representations.

Adaptation, and learning on robotic platforms. Why these mechanisms may be difficult to implement in commercial systems.

Students' explorations of these topics will be supported by the use of tools such as Matlab and UML-based design tools.

Part 3: Teaching and learning methods

Teaching and learning methods:

Scheduled Learning.
Sessions will include lectures and facilitated group work or practical sessions. In section 1 students will work towards accomplishing a variety of tasks in controlling robot manipulators. In section 2, they will work in small groups to present a design portfolio outlining a proposed robotic solution to a real-world problem.

Independent learning includes hours engaged with essential reading, case study preparation, assignment preparation and completion etc. Students will be expected to spend about 150 hours outside of the scheduled time in these activities. We will help students form study groups for mutual support as they tackle the material.

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

MO1 Demonstrate knowledge and understanding of theories and techniques required to design robot systems and control their movement in a purposeful and efficient manner to achieve desired goals

MO2 Show skills in applying this knowledge in solving novel problems in the design or control of robots

MO3 Demonstrate familiarity with commonly used tools and techniques to enable the efficient solution of mechanics and design problems

MO4 Demonstrate management of information through finding, assessing and using technical literature and other information sources

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/ufmfja-30-2.html

Part 4: Assessment

Assessment strategy: The module will be assessed in two components. Component A contains two exams, and deals with the material covered in the first and second semesters respectively. Component B comprises a group coursework portfolio, again dealing with the material covered in the first and second semesters.

Component A consists of two assessments:

A computer-based open-book Exam in which students will use Matlab to solve some kinematics and related problems.

A written exam on the software, architecture and AI topics covered in section 2.

Component B consists of a group coursework portfolio:

A report of not more than 2000 words based upon practical work in section 1.

A report of not more than 2000 words based upon the coursework in section 2.

This portfolio will contain individual sections which enable each student's performance to be assessed, and individual marks for group sections will recognise the relative work of the group members.

The resit will be assessed in two components. Component A contains two exams, and deals with the material covered in the first and second semesters respectively. Component B comprises an individual report, again dealing with the material covered in the first and second semesters.

Component A consists of two assessments:

A computer-based open-book Exam in which students will use Matlab to solve some kinematics and related problems.

An exam on the software, architecture and AI topics covered in section 2.

Component B consists of an individual report covering elements from sections 1 and 2. (2000 words).

The GCET delivery of this exam is a 2 hour face-to-face/invigilated exam. It was agreed that GCET can deliver the exam in a different way to UWE for in-country reasons for 2021/22 and 2022/23 providing there is no change to the UWE assessment during this time.

Assessment components:

Examination (Online) - Component A (First Sit)
Description: Computer-based open book exam (2 hours)
Weighting: 25 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3

Examination (Online) - Component A (First Sit)

Description: Online Exam (4 hours)

Weighting: 25 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2

Report - Component B (First Sit)

Description: Group work portfolio (4000 words)

Weighting: 50 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO1, MO2, MO3, MO4

Examination (Online) - Component A (Resit)

Description: Computer-based open book exam

Weighting: 25 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3

Examination (Online) - Component A (Resit)

Description: Online Exam (4 hours)

Weighting: 25 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2

Written Assignment - Component B (Resit)

Description: Coursework

Weighting: 50 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Automation and Robotics Engineering {Foundation} [Feb][FT][GCET][4yrs] BEng (Hons) 2020-21

Automation and Robotics Engineering {Foundation} [Oct][FT][GCET][4yrs] BEng (Hons) 2020-21

Robotics {Foundation} [Sep][SW][Frenchay][5yrs] - Not Running BEng (Hons) 2020-21

Robotics {Foundation} [Sep][FT][Frenchay][4yrs] - Not Running BEng (Hons) 2020-21