# CS313-15 Mobile Robotics

## 23/24

**Department**
Computer Science
**Level**
Undergraduate Level 3
**Module leader**
Hongkai Wen
**Credit value**
15
**Module duration**
10 weeks
**Assessment**
Multiple
**Study location**
University of Warwick main campus, Coventry

---

## Description

### Introductory description

The main aim of the module is to provide an understanding of the fundamental principles of mobile robotics and related concepts. The module introduces various mechanisms of mobility for different kinds of mobile robots, algorithms and data structures for safe navigation of the robot, and some techniques for equipping the robot with an intelligent vision system.

### Module aims

The main aim of the module is to provide an understanding of the fundamental principles of mobile robotics and related concepts. The module introduces various mechanisms of mobility for different kinds of mobile robots, algorithms and data structures for safe navigation of the robot, and some techniques for equipping the robot with an intelligent vision system.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Introduction to mobile robots
- Sensors
- State Estimation

- Discrete Filter
- Linear Gaussian Filter
- Non-parametric Filters
- Mapping
- SLAM
- Motion Planning
- Markov Decision Process

### Learning outcomes

By the end of the module, students should be able to:

- - Demonstrate an understanding of the underlying principles of mobile robotics
- - Demonstrate a knowledge of the applications of mobile robotics
- - Apply these to analyse and solve real-world problems

### Indicative reading list

(a) Sebastian Thrun, Wolfram Burgard, Dieter Fox, Probabilistic Robotics, MIT Press, 2005.
(b) Siegwest and Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2004.
(c) Dudek G and Jenkin M, Computational Principles of Mobile Robotics, Cambridge University Press, 2000.
(d) Craig JJ, Introduction to Robotics: Mechanics and Control (3rd ed), Prentice-Hall, 2005.
(e) Gonzalez R and Woods RC, Digital Image Processing, Prentice-Hall, 2002.

### Subject specific skills

- A fair grasp of knowledge about the following mathematical tools is required: trigonometry, matrix algebra, vector spaces, and differential equations.

### Transferable skills

To be confirmed

---

## Study

## Study time

| Type | Required |
|---|---|
| Lectures | 20 sessions of 1 hour (13%) |
| Practical classes | 5 sessions of 2 hours (7%) |
| Private study | 120 hours (80%) |
| Total | 150 hours |

### Private study description

- Background reading
  - Study lecture materials
  - Team discussion and work for lab materials
  - Revision

## Costs

No further costs have been identified for this module.

---

## Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

### Assessment group D3

| | Weighting | Study time |
|---|---|---|
| Lab report<br>Lab report. | 20% | |
| In-person Examination<br>CS313 examination | 80% | |

---

- Answerbook Gold (24 page)
- Students may use a calculator
- Engineering Data Book 8th Edition

### Assessment group R2

| | Weighting | Study time |
|---|---|---|
| In-person Examination - Resit<br>CS313 resit examination | 100% | |

---

- Answerbook Gold (24 page)
- Students may use a calculator
- Engineering Data Book 8th Edition

### Feedback on assessment

Written feedback for the lab report will be provided on Tabula

Past exam papers for CS313

---

## Availability

### Pre-requisites

- Ideally the student would find it useful to have completed CS130 Mathematics for Computer Scientists I, CS131 Mathematics for Computer Scientists II, ES107 Mathematics for Engineers, or a similar Mathematics module.

## Courses

This module is Optional for:

- UCSA-G4G1 Undergraduate Discrete Mathematics
  - Year 3 of G4G1 Discrete Mathematics
  - Year 3 of G4G1 Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year

This module is Option list A for:

- Year 4 of UCSA-G504 MEng Computer Science (with intercalated year)
- UCSA-G500 Undergraduate Computer Science
  - Year 3 of G500 Computer Science
  - Year 3 of G500 Computer Science
- UCSA-G502 Undergraduate Computer Science (with Intercalated Year)
  - Year 4 of G502 Computer Science with Intercalated Year
  - Year 4 of G502 Computer Science with Intercalated Year
- UCSA-G503 Undergraduate Computer Science MEng
  - Year 3 of G500 Computer Science
  - Year 3 of G503 Computer Science MEng
  - Year 3 of G503 Computer Science MEng
- Year 3 of UCSA-G406 Undergraduate Computer Systems Engineering
- Year 3 of UCSA-G408 Undergraduate Computer Systems Engineering
- Year 4 of UCSA-G407 Undergraduate Computer Systems Engineering (with Intercalated Year)
- Year 4 of UCSA-G409 Undergraduate Computer Systems Engineering (with Intercalated Year)

This module is Option list C for:

- USTA-G302 Undergraduate Data Science
  - Year 3 of G302 Data Science
  - Year 3 of G302 Data Science
- Year 3 of USTA-G304 Undergraduate Data Science (MSci)
- Year 4 of USTA-G303 Undergraduate Data Science (with Intercalated Year)