

## **AIS2205: Autonomous systems**

*Fall semester*  
*Duration – 1 semester*  
*7,5 ECTS*

### **Course content**

The course gives an introduction to autonomous systems from an automation and cybernetics perspective. A selection of the following topics will be included:

- Introduction to autonomous systems
- Applications, including autonomous ships and unmanned robotics platforms (UXVs)
- State estimation for autonomous vehicles, including GNSS-aided inertial navigation
- Situational awareness in unstructured environments
- Path planning and collision avoidance algorithms
- Control systems for autonomous vehicles, including cascaded PID and model predictive control (MPC)
- Software frameworks for autonomous systems, including ArduPilot, PX4, ROS2
- Modeling and simulation of autonomous systems, system identification and digital twins
- Artificial intelligence (AI) for autonomy
- Operations, regulations and assurance of autonomous systems
- Possibly other relevant topics

More details on the curriculum will be provided at the start of the semester.

### **Learning outcome**

**Knowledge:** The candidate can explain and compare theory, principles, applications, strengths and weaknesses of methods presented in the course

**Skills:** The candidate can demonstrate the use of methods presented in the course, both through digital tools and simulation

**General competence:**

- The candidate can use digital tools for implementation of autonomous systems
- The candidate can explain the value of autonomous systems for sustainable processes, services, or systems
- The candidate can present problems and relevant solution methods in a professional and scientific manner
- The candidate can discuss ethical challenges of autonomy

### **Teaching methods and activities**

Learning activities generally include a mix of lectures, tutorials and practical lab/project work. A constructivist approach for learning is endorsed, with focus on problem solving and practical application of theory.

The final grade is based on an overall evaluation of the portfolio, which consists of a number of works delivered through the semester. The portfolio contains assignments that are carried out,

digitally documented and submitted during the term. Both individual and team assignments may be given. Assignments are designed to help students achieve specific course learning outcomes, and formative feedback is given during the period of the portfolio. Compulsory assignments: A selection of learning exercises must be approved. The re-sit exam is an oral exam the following spring.

### **Recommended previous knowledge**

- AIS2002 Control Systems Engineering
- AIS2102 Dynamical Systems
- AIS2105 Mechatronics and Robotics

### **Required previous knowledge**

The course has no prerequisites. It is a requirement that students are enrolled in the study programme to which the course belongs. Permission to take the course can be allowed for engineering students at NTNU or from abroad (exchange students) at the discretion of the academic director of the study programme.

### **Course materials**

An updated course overview, including curriculum, is presented at the start of the semester and will typically also include English material.

### **Contact information**

Course Coordinator:

[Erlend Magnus Lervik Coates](#)

Lecturer

[Robin Trulssen Bye](#)

### **Department with academic responsibility**

[Department of ICT and Natural Sciences](#)

Source:

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