EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

STUDY GUIDE

NAVIGATION TECHNOLOGIES FOR

Organised by

University of Vaasa (UVA)

1. IDENTIFYING DATA.

· **Course Name.**	*Navigation Technologies for Autonomous Systems*
· **Coordinating University.**	*University of Vaasa*
· **Partner Universities Involved.**	*-*
· **Course Field(s).**	*Information, Communication and Automation Technology*
· **Related Study Programme.**	*Sustainable and Autonomous Systems, Master of Science*
· **ISCED Code.**	*0618*
· **SDG.**	*SDG 4: Quality Education* *SDG 8: Decent Work and Economic Growth* *SDG 9: Industry, Innovation, and Infrastructure* *SDG 11: Sustainable Cities and Communities* *SDG 15: Life on Land*
· **Study Level.**	*Master and Doctorate*

· **Number of ECTS credits allocated.**	*5*
· **Mode of Delivery.**	*Online live*
· **Language of Instruction.**	*English*
· **Course Dates.**	*10 February 2025 - 20 March 2025*
· Precise Schedule of the Lectures.	**Time zone: Europe/Helsinki** *10 Feb 2025 08.00-10.00* *12 Feb 2025 10.00-12.00* *17 Feb 2025 08.00-10.00* *19 Feb 2025 10.00-12.00* *20 Feb 2025 12.00-14.00* *25 Feb 2025 10.00-12.00* *26 Feb 2025 10.00-12.00* *27 Feb 2025 12.00-14.00* *3 Mar 2025 14.00-16.00* *4 Mar 2025 12.00-14.00* *6 Mar 2025 14.00-16.00* *10 Mar 2025 12.00-14.00*

	12 Mar 2025 08.00-10.00 13 Mar 2025 14.00-16.00 17 Mar 2025 12.00-14.00 19 Mar 2025 10.00-12.00 20 Mar 2025 12.00-14.00 *Any potential changes to the timetable will be announced in Moodle*
· Key Words.	*navigation, positioning, autonomous systems, localization, autonomous cars, drones, situational awareness, robotics.*
· Catchy Phrase.	*"Navigate the Future: Mastering the Technologies for Autonomous Mobility!"*

· Prerequisites and corequisites.	*-Be enrolled at any of the EUNICE partner universities.* *-English B2* *-Master's student (Note: Doctoral students can join if their supervisor accepts)*
· Number of EUNICE students that can attend the Course.	*36* *(BTU, IPV, KAU, PUT, UC, UMONS, UNIC, UOP, UPHF: 4 each. UVA: Check course ICAT3250 in Peppi)*
· Course inscription procedure(s).	*Enrolment via the EUNICE website*

2. CONTACT DETAILS.

· Department.	*School of Technology and Innovations, Computing Sciences*
· Name of Lecturer.	*Heidi Kuusniemi, Director, Professor in Computer Science*
· E-mail.	*heidi.kuusniemi@uwasa.fi*
· Other Lecturers.	*Kannan Selvan, Petri Välisuo, Jani Boutellier, Mahmoud Elsanhoury, Mohammed Elmusrati*

3. COURSE CONTENT.

The course starts with going through the various applications where navigation technologies are utilized in autonomous systems followed by going through the different navigation technologies and their pros and cons in details. Autonomous systems need to have means to typically answer the questions Where am I? What is around me?, Where is my destination?, What is the best way to reach my destination while avoiding local obstacles? and the technologies that can answer these will be introduced. In addition to details of the technologies, also their security and privacy are emphasized. After introducing the technologies, mathematical models, sensor fusion approaches and related simulation techniques are included. Students will also learn about open-source software packages relevant for navigation technologies in autonomous systems. Finally, everything introduced will be brought to practical applications with case studies where students get to experiment with relevant data.

4. LEARNING OUTCOMES.

Several positioning and localization techniques are needed for increasingly autonomous systems. The course "Navigation Technologies for Autonomous Systems" aims at bringing an understanding about these different navigation technologies essential for the positioning, guidance, and control tasks of autonomous systems on land, sea and in the air. First, various applications of navigation are introduced in the context of autonomous systems including e.g. logistics, robotics, and autonomous vehicle. Then, the most important localization and positioning techniques are introduced emphasizing their accuracy, availability and coverage, requirements, challenges, costs, and reliability.

5. OBJECTIVES.

The objective of the course is that students learn about all the various navigation technologies applicable for autonomous systems and can apply information about the technologies to assess their safety as well as ethics.

6. COURSE ORGANISATION.

LEARNING RESOURCES AND TOOLS.

Lecture notes and material to be announced

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.

Lectures, exercises, exam

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.

Teaching methods lectures 2 x 2 x 6 h = 24 h; self-study 40 h; exercises, guided 12 h; independent exercise work 40 h; exam + preparation 19 h

Grading: On a scale of 1-5, or fail (0)

OBSERVATIONS.

Recognition-related issues:
Please contact your home university's International Relations Office if you encounter any issues concerning the recognition of the ECTS at the end of the course. Lecturers are not in charge of the recognition process.

8. BIBLIOGRAPHY AND TEACHING MATERIALS.

- Lecture notes and material to be announced