Module 15114 Intro to Robotics

1	**Module number** 15114	**Study program** DEB/MTB	**Semester** 6	**Offered in** ☒WS ☐SS	**Duration** 1 Semester	**Module Type** Compulsory	**Workload (h)** 150	**ECTS Points** 5
2	**Courses**		**Teaching and learning form**		**Contact Time**		**Self Study**	**Language**
					(SWS)	**(h)**	**(h)**	
	a) Intro to Robotics		Lecture		2	30	90	English
	b) Robotics Exercise		Exercise		1	15		
	c) Robotics Lab		Lab		1	15		

3 **Learning outcomes and competences**

After successfully completing the module, students can...

Knowledge and Understanding

- … explain the fundamental principles of robotic design, control, and operation.
- … understand the mathematical models used to describe robot kinematics and dynamics.
- … demonstrate a foundational knowledge of robot sensors, actuators, and their roles in robot functionality.
- … recognize the various programming languages and control systems used in robotics.
- … understand the application of artificial intelligence and machine learning in autonomous robots.
- … discuss ethical issues, societal impact, and emerging trends in robotics.

Application, Use, and Generation of Knowledge

Use and Transfer

- … develop and implement basic programs for robot control.
- … analyze robot movements and performance based on sensor data and control algorithms.
- … categorize the functions and interconnections of robot components and systems.
- … apply problem-solving skills to design and implement solutions for simple robotic tasks.
- … build on acquired knowledge to explore advanced topics in robotics, such as AI-driven autonomy.

Scientific Innovation

- … apply mathematical methods and simulation tools to evaluate robot performance.
- … design and optimize robotic systems for specific tasks, considering efficiency and effectiveness.
- … propose hypotheses and test them in relation to robot functionality and design improvements.
- … independently develop concepts for new robotic applications and assess their feasibility.
- … innovate in the field of robotics by improving or modifying existing robotic systems.

Communication and Cooperation

- … actively communicate technical concepts and gather feedback in team projects.
- … present robotic designs, control strategies, and performance analyses to peers and instructors.
- … justify design decisions and solution methods using theoretical and methodological principles.
- … collaborate effectively within a group to develop and implement robotic projects.

By the end of the course, students will be equipped with both theoretical knowledge and practical skills, enabling them to further explore the vast field of robotics or apply their understanding to real-world robotic applications.

4	**Content** *Lecture* • **History and Evolution of Robotics**: Explore the origins and development of robotic technologies, from early mechanical devices to modern autonomous systems. • **Robot Kinematics and Dynamics**: Understand the mathematical models that describe the movement of robots, including concepts like forward and inverse kinematics. • **Actuators and Sensors**: Learn about the mechanical components that allow robots to move and the sensory devices that enable them to interact with their surroundings. • **Robot Programming and Control Systems**: Introduction to various programming languages and control algorithms used to operate robots effectively. • **Autonomous Systems and AI in Robotics**: An overview of how artificial intelligence and machine learning are integrated into modern robotics to enhance decision-making and autonomy. *Exercise* • **Practical Exercises:** Control Systems, (control) algorithms and system programming based on a mobile robot system *Paper Work* • **Ethical Considerations and Future Trends**: Discuss the social and ethical implications of robotics, as well as emerging trends such as humanoid robots, swarm robotics, and collaborative robots (cobots).
5	**Participation requirements** obligatory: none recommended:
6	**Examination Forms and Requirements for the Award of Credits** • 30 min oral exam • oral presentation 20 min and written Scientific Survey Paper, 6 pages to a predefined ethical consideration or future trend
7	**Verwendung des Moduls**
8	**Modulverantwortliche/r und hauptamtlich Lehrende** Prof. Johannes Baumgartl
9	**Literature** Lecture Skript
10	**Last updated** 05.12.2024
