

Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Angewandte Mechanik für die Automatisierung
Code der Lehrveranstaltung	42185
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	IIND-02/A
Sprache	Italienisch
Studiengang	Bachelor in Industrie- und Maschineningenieurwesen
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Andrea Giusti, Andrea.Giusti@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/47728
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Alle Semester
Studienjahr/e	3
KP	10
Vorlesungsstunden	60
Laboratoriumsstunden	40
Stunden für individuelles Studium	150
Vorgesehene Sprechzeiten	30
Inhaltsangabe	The course belongs to the type "caratterizzanti" – areas: mechanics and automation. It aims at teaching both scientific foundations and practical methods. The course aims at introducing the necessary skills for understanding the basic principles of the mechanics of automatic machines and their functional design and analysis.

	- Degrees of Freedom, kinematic pairs, kinematic scheme of a mechanism, structure equation; - Kinematic analysis of mechanisms (position, velocity, acceleration); - Static and dynamic analysis of (planar) mechanisms. Lagrange's equations; - Mechanisms for automatic machines: motion generation; cam mechanisms; motion irregularities; - Mechanics of Drives: motor-gear-load coupling (introduction); - Mechanics of Robots: introduction to industrial robots and foundations of robot kinematics.
Themen der Lehrveranstaltung	Introduction and fundamentals. Basic concepts and definitions for the study of mechanisms. Degrees of freedom, kinematic pairs and structure equation. Kinematic analysis of planar mechanisms. Kinematic analysis of position, velocity and acceleration (by base and dyads mechanisms). Singular configurations. Examples. Static and dynamic analysis of planar mechanisms. Recalls on Newtonian and Lagrangian approach. Newtonian and Lagrangian method for the static analysis of planar mechanisms. Application examples. D'Alembert's principle. Equation of dynamic equilibrium for mechanisms. Lagrange's equation. Inertia reduced to the free coordinate. Motion irregularities. Mechanisms for automatic machines: introduction to the laws of motion; generation of movements - reciprocating, and translational motion. Cam mechanisms and mechanisms for unidirectional and intermittent motion. Mechanics of drives: introduction, basic concepts on motor-load coupling with and without gearbox. Mechanics of robots: introduction, introduction to the Denavit-Hartenberg convention, characteristics of the main industrial robots, robot simulation.
Stichwörter	Kinematics, Dynamics, Mechanisms, Mechanics of drives, Robots
Empfohlene Voraussetzungen	Mechanics of Structures.
Propädeutische Lehrveranstaltungen	
Unterrichtsform	The topics are presented by the professor by means of Power Point presentations or the blackboard.

	The course also includes exercise sessions and, where possible, practical classes (computer-based, e.g. using MATLAB, WorkingModel, Simscape Multibody or MSC Adams), as well as educational field trips with laboratory activities. A selection of the material presented in class and useful material will be available in the course reserve collection database.
Anwesenheitspflicht	Attendance is not compulsory.
Spezifische Bildungsziele und erwartete Lernergebnisse	Students will learn, in the first part of the course, fundamental concepts and methodologies for the functional design and kinematic (and dynamic) study of the mechanisms used in automatic machines; in the second part of the course, students will acquire skills related to (i) the sizing of components to be used in automatic machines to generate predefined movements and (ii) robotic systems used in automated systems. Knowledge and understanding 1. Knowledge and understanding of applied mechanics fundamentals. 2. Knowledge and understanding of the main mechanical components and their applications. 3. Knowledge of the main mechanisms and robots used in automatic machines and their function. Applying knowledge and understanding 4. Ability to formulate the equilibrium conditions for a mechanical system. 5. Ability to apply the learned principles in the study of planar mechanisms. 6. Ability to apply the learned principles for the synthesis of mechanisms for automatic machines and the choice of robotic systems. Making judgements 7. Making judgments for choosing the suitable mechanical component or kinematic solution. Communication skills 8. Ability to present the acquired knowledge and competences with a proper language. Learning skills 9. Ability to autonomously extend the knowledge acquired during the study course.
Spezifisches Bildungsziel	

und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	- Summative assessment. Written exam with exercises and questions: 60% written exam, exercises: 2 exercises (100 minutes); ILOs assessed: 1 - 8; 40% written exam, theory: 4 questions. (80 minutes): ILOs assessed: 1,2,4,6,7. - Optional midterm test on the first part of the course, consisting of questions and an exercise: 60% optional midterm written test: 1 exercise (50 minutes); ILOs assessed: 1 - 5, 8; 40% optional midterm written test, theory: 2 questions. (40 minutes); ILOs assessed: 1-3, 8. The result of the optional midterm test, if sufficient ($\geq 18/30$), may be considered, for the entire academic year, as the grade for the first part of the course content. In this case, the final written exam result will be computed as the arithmetic mean of the optional midterm test result and the written exam result for the second part of the course.
Bewertungskriterien	The final mark will be awarded according to the following criteria: Theoretical knowledge (35%) Correctness of methods (35%) Correctness in solution (30%)
Pfichtliteratur	Notes from the lectures. Handouts provided by the lecturer. Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it and Ilaria Miceli, Ilaria.Miceli@unibz.it
Weiterführende Literatur	M. Callegari, P. Fanghella, F. Pellicano, "Meccanica applicata alle macchine", terza edizione, Città Studi, 2022. M. Giovagnoni, A. Rossi, Una introduzione allo studio dei meccanismi, Ed. Cortina, Padova. G. Jacazio, S. Pastorelli, "Meccanica applicata alle macchine", Ed.

	Levrotto e Bella, Torino. B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, "Robotica - Modellistica, pianificazione e controllo", McGraw-Hill Education, 3a edizione. G. Legnani, M. Tiboni, R. Adamini, D. Tosi, "Meccanica degli Azionamenti. Azionamenti Elettrici", Società Editrice Euscalpio. 3a edizione.
Weitere Informationen	Software used (possible): Matlab, WorkingModel, Simscape Multibody or MSC Adams.
Ziele für nachhaltige Entwicklung (SDGs)	Industrie, Innovation und Infrastruktur, Menschenwürdige Arbeit und Wirtschaftswachstum