GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Theoretical Mechanics (C004210)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	Dutch	Gent	seminar
			lecture

Lecturers in academic year 2024-2025

Van Neck, Dimitri	WE05	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Science in Mathematics	6	A
Bachelor of Science in Physics and Astronomy	6	A

Teaching languages

Dutch

Keywords

Newtonian mechanics, formalisms of Lagrange and Hamilton.

Position of the course

This course unit belongs to the learning pathway "Theoretical physics" in the Bachelor program Physics and Astronomy.
Deepening of the basic principles of classical Newtonian mechanics that were acquired in the Mechanics course. Getting acquainted with theoretical physics as the modeling of natural phenomena using mathematical concepts and techniques. Application to physics problems of the course material on Linear algebra and Analysis.

Contents

Introduction and rehearsal of mathematical concepts; Kinematics: velocity and acceleration in various reference frames; Dynamics: Newton's laws. Inertial and non-inertial frames. Motion of a particle in a force field. Power, energy and conservative forces. Applications: central forces, Kepler's problem, motion constrained to a surface or curve; Systems of interacting particles; Kinematics and dynamics of rigid bodies. Euler's laws; Lagrange-Hamilton formalism: classification of constraints and forces. Concept of generalized coordinates. Lagrangian equation of motion with applications. Conservation laws. Legendre transformation. Hamilton's equations of motion. Small-amplitude excursions from equilibrium: vibrational analysis.

Initial competences

This is a second-semester course using material from the introductory physics (Mechanics) and mathematics (Algebra and Functions) courses. It is assumed the students have acquired the final competences of these courses.

Final competences

1 Understanding and being able to apply the mathematical description of classical Newtonion mechanics, both in terms of Newton's laws as in terms of the Lagrange-Hamilton formalism.
2 Understanding the idealizations unavoidably present in mathematical modeling, and of the associated computational techniques.
3 Exhibiting problem-solving capabilities when dealing with mechanical problems.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Extra information on the teaching methods

- Theory: lectures
- Exercises: guided sessions

Study material

Type: Slides

Name: slides
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Slides : 250
Available on Ufora : Yes
Online Available : Yes

References

- H. Goldstein, C. Poole, J. Safko, “Classical mechanics”, Addison Wesley

Course content-related study coaching

Additional consultations with teacher and assistants are possible. Presentation slides will be made available on Ufora.

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

- Theory: written exam with closed book
- Exercises: written exam with open book

Calculation of the examination mark

Equal weights for theory and exercises.