GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2019-2020

Theoretical Mechanics I (E040050)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

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

Credits 6.0	**Study time** 180 h	**Contact hrs**	60.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	Dutch	Gent	lecture	30.0 h
			seminar: coached exercises	30.0 h

Lecturers in academic year 2020-2021

Van Neck, Dimitri	WE05	lecturer-in-charge

Offered in the following programmes in 2020-2021	**crdts**	**offering**
Bachelor of Science in Engineering (main subject Engineering Physics)	6	A
Bachelor of Science in Engineering Physics	6	A
Bridging Programme Master of Science in Engineering Physics	6	A

Teaching languages

Dutch

Keywords

Theoretical mechanics, systems of particles, Newtonian formalism, Lagrangian formalism, Hamiltonian formalism

Position of the course

Theoretical Mechanics aims at providing a mathematical formulation of mechanics. It gives the students insight into the construction of a mathematical model for a physical theory. In the course 'Theoretical Mechanics I' attention is paid to the mechanics of point particles. The first part which is devoted to Newtonian mechanics, is partly complementary to the mechanics which students have seen in the first bachelor's course "Physics I", at least in the sense that it covers the same concepts and techniques, but is presented now in a more mathematical and less descriptive way. The second part, Lagrange and Hamilton dynamics, offers an acquaintance with a more general formulation of mechanics which plays an important role in many domains of theoretical physics (quantum mechanics, field theories, ...).

Contents

- Introduction: goal of the course.
- Elements of vector calculus and kinematics: complements to vector calculus, motions, special coordinate systems, relative motion.
- Basic principles of dynamics.
- General theorems: linear momentum and angular momentum; kinetic and potential energy; conservation laws; qualitative study of 1-dimensional conservative systems; general phase diagram in the plane.
- Applications: oscillators, central forces and Kepler's problem, charged particle motion, motions with constraints (along a curve or on a surface).
- Dynamics of systems of particles: general theorems, centre of mass, application to the two-body problem.
- Introduction to the Lagrangian and Hamiltonian formalism.

Initial competences

Having followed successfully the following courses from the first year of bachelor and from the first semester of the second year of bachelor in the engineering sciences, or

having acquired equivalent objectives: Mathematical Analasys I: functions of one variable; Mathematical Analysis II: functions of several variables; Geometry and linear algebra.

Final competences

1 To have insight in the Newtonian formulation of classical mechanics of point masses.
2 To be able to analyse and solve simple problems in mechanics and to be able to interpret their solution.
3 To have insight in the Lagrangian and the Hamiltonian formalism for point masses.
4 To be able to set up the Lagrange and the Hamilton equations in concrete applications.
5 To have a general insight in the construction and the meaning of a mathematical model for a physical theory.

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

Lecture, seminar: coached exercises

Extra information on the teaching methods

Theory: plenary lectures.
Exercises: a combination of plenary exercises (some problems are worked out explicitly on the blacboard by way of example) and guided self-study (the students can work individually or in group on some problems).

Learning materials and price

Lecture notes in Dutch - price: ca. 6,- euro.

References

Course content-related study coaching

The lecturer and the assistent are always available for explanations immediately after the lectures or during and after the practical classes, or after making an appointment. Smaller problems can also be dealt with by e-mail. General information concerning the lectures, the exercises and the exams is distributed via the electronic learning platform

Evaluation methods

end-of-term evaluation

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

Written examination with open questions, open book examination

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

Written examination with open questions, open book examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Theory: written closed-book exam; Exercises: written open-book exam.

Calculation of the examination mark

Special conditions: theory and exercises each have equal weight.