GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2018-2019

Introduction to Theoretical Physics (C003133)

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

Credits	6.0	Study time	180 h	Contact hrs	52.5 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	Dutch	seminar: coached exercises	22.5 h
		lecture	30.0 h

Lecturers in academic year 2018-2019

Van Neck, Dimitri	WE05	lecturer-in-charge

Offered in the following programmes in 2018-2019	crdts	offering
Bachelor of Science in Physics and Astronomy	6	A
Bachelor of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

Newtonian mechanics, formalisms of Lagrange and Hamilton

Position of the course

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 courses on Mechanics, Linear Algebra and Analytic Geometry, and Mathematical Analysis. 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

Lecture, seminar: coached exercises

Extra information on the teaching methods

Theory: lectures
Exercises: guided sessions

Learning materials and price

Syllabus (available via the e-learning platform)
Textbook (optional, used as guide): H. Goldstein, C. Poole, J. Safko, “Classical mechanics”, Addison Wesley . Estimated cost: 65 EUR; there is a legal pdf version available e.g. via Google Books

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 maide available on Minerva.

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 exam with closed book
Exercises: written exam with open book

Calculation of the examination mark

Equal weights for theory and exercises.