Theoretical Mechanics II (E040060)

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

Credits 3.0 **Study time** 90 h

Course offerings and teaching methods in academic year 2025-2026

A (semester 2)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2025-2026

Van Neck, Dimitri	WE05	lecturer-in-charge

Offered in the following programmes in 2025-2026	**crdts**	**offering**
Bachelor of Science in Engineering(main subject Engineering Physics)	3	A

Teaching languages

Dutch

Keywords

Rigid bodies, small oscillations

Position of the course

This is a continuation to the course "Theoretical Mechanics I" of the second year of bachelor in engineering physics, where the attention is focused on the mechanics of rigid bodies . The Newtonian approach as well as the Lagrangian and the Hamiltonian approach will be discussed. Within the Lagrangian formalism, a study is made of small oscillations in the neighbourhood of a stable equilibrium. Applications to engineering problems are discussed.

Contents

- Part 1: Rigid bodies: Basic concepts: mass density, linear momentum, angular momentum, forces on a rigid body, moment of a force, Centre of mass, Kinematics of rigid bodies: Eulerian angles, instantaneous rotation vector, relative kinematics, rolling and slipping, Equivalence and reduction of force systems, Statics, Inertia tensor, moment of inertia, Dynamics of a rigid body: Euler's laws, Euler's dynamical equations, kinetic energy and power, Lagrange and Hamilton formalism for rigid bodies
- Part 2: Small oscillations in the neighbourhood of a stable equilibrium.

Initial competences

Having followed successfully the following courses from the first year of bachelor and from the second year of bachelor in engineering physics, or having acquired equivalent objectives: Mathematical Analysis I: functions of one variable; Mathematical Analysis II: functions of several variables; Geometry and linear algebra; Theoretical Mechanics I. Students are in particular assumed to be familiar with the theory of eigenvalues and eigenvectors of a linear transformation and with the diagonalisation of a symmetric matrix.

Final competences

1 To have a thorough command of the basic concepts and techniques concerning the statics and dynamics of rigid bodies, and to be able to apply them to simple engineering problems.
2 To be able to give a mathematical formulation of problems from mechanics of rigid bodies, and to solve them analytically in simple cases.
3 To be able to apply the Lagrangian and Hamiltonian formulation to the mechanics of rigid bodies.

4 To have insight in the technique of small oscillations in the neighbourhood of a
   stable equilibrium.
5 To be able to solve simple problems of small oscillations.

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: 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).

Study material

Type: Slides

Name: Slides Theoretical mechanics II
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Slides : 103
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No

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.

Assessment moments

end-of-term assessment

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

Written assessment open-book, Written assessment

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

Written assessment open-book, Written assessment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

During examination period; theory: written closed-book exam; exercises: written
open-book exam.

Calculation of the examination mark

Special conditions: Theory and exercises each have the same weight.