

Theoretical Mechanics II (E040060)

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 3.0 **Study time** 90 h **Contact hrs** 30.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 2)	Dutch	Gent	seminar: coached exercises	15.0 h
			lecture	15.0 h

Lecturers in academic year 2020-2021

Van Neck, Dimitri	WE05	lecturer-in-charge
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Offered in the following programmes in 2020-2021

	crdts	offering
Bachelor of Science in Engineering (main subject Engineering Physics)	3	A
Bachelor of Science in 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

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 blackboard 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. 4,- euro.

References

Course content-related study coaching

The lecturer and the assistant 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, open book examination

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

Written examination, 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

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.