

Materials Technology (E066012)

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

Credits 4.0

Study time 120 h

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)

Dutch

Gent

lecture

independent work

seminar

Lecturers in academic year 2024-2025

Verbeken, Kim

TW11

lecturer-in-charge

Offered in the following programmes in 2024-2025

crdts

offering

[Bachelor of Science in Engineering\(main subject Biomedical Engineering\)](#)

4

A

[Bachelor of Science in Engineering\(main subject Chemical Engineering and Materials Science\)](#)

4

A

[Bachelor of Science in Engineering\(main subject Civil Engineering\)](#)

4

A

[Bachelor of Science in Engineering\(main subject Computer Science Engineering\)](#)

4

A

[Bachelor of Science in Engineering\(main subject Electrical Engineering\)](#)

4

A

[Bachelor of Science in Engineering\(main subject Electromechanical Engineering\)](#)

4

A

[Bachelor of Science in Engineering\(main subject Engineering Physics\)](#)

4

A

[Bachelor of Science in Engineering \(Joint Section\)](#)

4

A

[Master of Science in Biology](#)

4

A

[Master of Science in Geology](#)

4

A

Teaching languages

Dutch

Keywords

Materials, metals, polymers, composites, ceramics, material selection, processing, material performance, material properties, microstructure, life cycle analysis, sustainability

Position of the course

The aim of this course is to get the students acquainted with the correlation between material behaviour and material properties. In engineering, designs are put into practice by making use of materials. As the student gets to know the mechanisms and concepts that determine the material behaviour, (s)he will have the required knowledge to make an optimal material choice. Finally, the student will understand how properties of the material can be optimized by adapting the material processing and consequently change the structural characteristics of the material.

Contents

CLASSES (teaching and exercises)

- Introduction: classification of the different material groups; advanced materials; processing/structure/properties/performance correlations; atomic structure and interatomic bonds
- Structure of crystalline solids: crystal structures; crystallographic points, directions and planes; crystalline and noncrystalline materials; metallic and ceramic crystal structures
- Polymers: basic properties; structure; thermoplastic and thermosetting polymers; co-polymers, crystallinity

- Imperfections in solids: point defects, imperfections and impurities; defects in different dimensions (linear, interfacial and bulk defects); diffusion mechanisms in metals, ceramics and polymers
- Mechanical properties: elastic deformation; mechanical behaviour of materials; hardness; plastic deformation of materials, strengthening mechanism in metals and polymers; recovery; recrystallization and grain growth; deformation behaviour of elastomers; material testing
- Material failure: brittle and ductile fracture; fatigue; creep
- Phase diagrams: definitions and basic concepts; different types of binary phase diagrams, the Fe-C system
- Phase transformations: kinetic aspects; equilibrium versus metastable equilibrium; microstructural changes and effect on properties in Fe-C alloys; precipitation hardening; crystallization, melting and glass transition of polymers
- Composites: particle reinforced, fibre reinforced and structural composites
- Basic concepts on electrical, thermal and magnetic properties
- Types and applications of the different material groups; aspects on the sustainable use of materials; embodied energy of materials and energy recuperation, life cycle analysis; recycling of materials

PC EXERCICES

By using the CES materials selection software package, the student will make exercises to select the most appropriate material for a specific application based on mechanical, thermal or electrical properties. Additionally, aspects such as CO₂-footprint, recyclability and life cycle analysis are addressed as well. Consequently, the student will learn to determine the optimal compromise in material selection taking into account different and often contradictory material requirements.

Initial competences

Secondary school.

Final competences

- 1 To name materials properties and to be able to distinguish between the different groups of materials
- 2 To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
- 3 To be able to correlate the structure and properties of materials
- 4 To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties.
- 5 To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties

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, Independent work

Study material

Type: Handbook

Name: Materials Science and Engineering an introduction

Indicative price: € 50

Optional: no

Language : English

Author : W.D. Callister Jr.

ISBN : 978-1-11945-391-8

Online Available : No

Available in the Library : Yes

Available through Student Association : Yes
Usability and Lifetime within the Course Unit : intensive
Usability and Lifetime within the Study Programme : regularly
Usability and Lifetime after the Study Programme : occasionally

Type: Other

Name: Handouts and kennisclips
Indicative price: Free or paid by faculty
Optional: no
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Usability and Lifetime within the Course Unit : intensive
Usability and Lifetime within the Study Programme : regularly
Usability and Lifetime after the Study Programme : occasionally
Additional information: Online available, free of charge via UFORA

References

Course content-related study coaching

The lecturer is available before and after classroom lectures. Personal coaching by the lecturer as scheduled. Additional tutoring services are available.

Assessment moments

end-of-term and continuous assessment

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

Written assessment

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

Written assessment

Examination methods in case of permanent assessment

Written assessment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

- During semester / permanent evaluation: two mandatory written tests with closed book (exact dates will be announced at the start of the semester).
- During examination period: written closed-book examination.

Calculation of the examination mark

Continuous assessment:

The scores on the two tests T1 and T2 (both marked out of 20), form a weighted score of respectively 40% and 60%, thus $T' = 0.4 T1 + 0.6 T2$

The total result of the permanent evaluation T, is determined as follows:

- if $T' < 10$ then $T = T'$
- if $10 \leq T' < 17$ then $T = T' + 3$
- if $T' \geq 17$ then $T = 20$

End-of-term evaluation: written examination (marked out of 20, score E)

Calculation of the final mark in the second-term examination period:

- If $E \geq 8$ then the final mark equals $\max(0.25 T + 0.75 E; 0.1 T + 0.9 E) - 2A$
- If $E < 8$ then the final mark equals $E - 2A$

A sets the number of tests (T1 and T2) for which the student was illegitimately absent ($A = 0, 1$ or 2). For each test in which the student did not participate, two points will be deducted from the final mark ($2A = 0, -2$ or -4).

Calculation of the final mark in the resit examination period:

- If $E \geq 8$ then the final mark equals $\max(0.25 T + 0.75 E; E)$
- If $E < 8$ then the final mark equals E

