

Course description

Course abbreviation:	KMM/MMEA	Page:	1 / 3
Course name:	Modern Materials in Engineering		
Academic Year:	2023/2024	Printed:	03.06.2024 08:42

Department/Unit /	KMM / MMEA			Academic Year	2023/2024
Title	Modern Materials in Engineering			Type of completion	Pre-Exam Credit
Accredited/Credits	Yes, 3 Cred.			Type of completion	Combined
Number of hours	Lecture 2 [Hours/Week] Tutorial 1 [Hours/Week]				
Occ/max	Status A	Status B	Status C	Course credit prior to	NO
Summer semester	0 / -	0 / -	0 / -	Counted into average	YES
Winter semester	0 / -	0 / -	0 / -	Min. (B+C) students	10
Timetable	Yes			Repeated registration	NO
Language of instruction	English			Semester taught	Summer semester
Optional course	Yes			Internship duration	0
Evaluation scale	1 2 3 4				
No. of hours of on-premise					
Auto acc. of credit	Yes in the case of a previous evaluation 4 nebo nic.				
Periodicity	K				
Substituted course	KMM/MPE				
Preclusive courses	N/A				
Prerequisite courses	N/A				
Informally recommended courses	N/A				
Courses depending on this Course	N/A				

Course objectives:

Provide to the students a theoretical background of solid-state physic and material structure, explain how does this structure relate to the response of the material to mechanical, thermal, chemical, and radiation effects of its environment; and how can be the structure of the material and subsequently its properties improved.
To present an overview and characterization of modern engineering materials.

Requirements on student

Compulsory attendance at seminars;
Successful passing the check tests, seminary work and presentation.
Final grade is calculated as a weighted average
Test: 60%
Seminar work: 40%

Content

Lectures:
Crystallography, ideal and real crystal structures
Diffusion in solids, mechanisms, Fick laws, diffusion coefficients
Phase transformations, decomposition of solid solutions, the coherency of a precipitate, precipitation hardening;
Dislocations, plastic, and elastic deformation, slip systems, dislocation reactions with lattice defects; dislocation mobility, and plastic deformation;
Recovery, primary recrystallization and secondary recrystallization
Metallic corrosion - types, principles, protections
Mechanical testing - basics tests overview, evaluated values, interpretation of results, special test (small punch, sub-sized samples) and their use for life prediction

Modern materials - types, processing, microstructure, properties. Steels and non-ferrous metals, composites, surface layers, and coatings

Materials for extreme temperatures and environments

Additively manufactured materials, methods, applications

Seminars:

Crystallography basic: lattice characterization, directions, and planes in a cubic lattice, density calculations

Diffusion: First and second Fick laws - practical applications, calculations

Creep and fatigue

Defectoscopy - methods and applications

Binary diagrams interpretation, phase transformations in steels

Projects presentations and discussions, assessments

Fields of study

COURSEWARE

Guarantors and lecturers

- **Guarantors:** Prof. Ing. Ludmila Kučerová, Ph.D. (100%)
- **Tutorial lecturer:** Prof. Ing. Ludmila Kučerová, Ph.D. (100%)

Literature

- **Extending:** Humphreys F. J.; Hatherly, M. *Recrystallization and related annealing phenomena*. 2nd ed. Oxford : Elsevier, 2004. ISBN 0-08-044164-5.
- **Recommended:** Ashby, M. F.; Johnson, Kara. *Materials and design : the art and science of material selection in product design*. 3rd ed. Amsterdam : Butterworth-Heinemann, 2014. ISBN 978-0-08-098205-2.
- **Recommended:** Smallman, R. E.; Bishop, R. J. *Modern physical metallurgy and materials engineering science, process, applications*. 6th ed. Oxford : Elsevier Butterworth-Heinemann, 1999. ISBN 0-7506-4564-4.
- **Recommended:** Haasen, Peter. *Physical metallurgy*. 3rd enl. and rev. ed. Cambridge : Cambridge University Press, 1996. ISBN 0-521-55092-0.

Time requirements

Full-time form of study

Activities	Time requirements for activity [h]
Preparation for comprehensive test (10-40)	18
Presentation preparation (report in a foreign language) (10-15)	15
Contact hours	45
Total:	78

assessment methods

Knowledge - knowledge achieved by taking this course are verified by the following means:

Seminar work

Individual presentation at a seminar

Test

Skills - skills achieved by taking this course are verified by the following means:

Seminar work

Individual presentation at a seminar

Competences - competence achieved by taking this course are verified by the following means:

Individual presentation at a seminar

Seminar work

prerequisite

Knowledge - students are expected to possess the following knowledge before the course commences to finish it successfully:

Fundamentals of physics and chemistry.

Fundamentals of material science

Skills - students are expected to possess the following skills before the course commences to finish it successfully:

The ability of individual work with scientific texts

Competences - students are expected to possess the following competences before the course commences to finish it successfully:

N/A

teaching methods

Knowledge - the following training methods are used to achieve the required knowledge:

Lecture

Practicum

Individual study

Multimedia supported teaching

Skills - the following training methods are used to achieve the required skills:

Practicum

Seminar

Individual study

Multimedia supported teaching

Competences - the following training methods are used to achieve the required competences:

Students' portfolio

Individual study

Multimedia supported teaching

learning outcomes

Knowledge - knowledge resulting from the course:

Knowledge of modern engineering materials

Knowledge of materials response to various types of loadings and environments

Knowledge of the basics of solid-state physics and material structure

Skills - skills resulting from the course:

Ability to explain the relationship between material processing, structure, and resulting properties

Competences - competences resulting from the course:

N/A

Course is included in study programmes: