

Course description

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| Course abbreviation: | KMM/MOL | Page: | 1 / 3 |
| Course name: | Metallurgy of metals and alloys | | |
| Academic Year: | 2023/2024 | Printed: | 03.06.2024 07:47 |

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|---|--|----------|----------|-------------------------------|-----------------|
| Department/Unit / | KMM / MOL | | | Academic Year | 2023/2024 |
| Title | Metallurgy of metals and alloys | | | Type of completion | Exam |
| Accredited/Credits | Yes, 5 Cred. | | | Type of completion | Combined |
| Number of hours | Lecture 3 [Hours/Week] Tutorial 2 [Hours/Week] | | | Course credit prior to | YES |
| Occ/max | Status A | Status B | Status C | Counted into average | YES |
| Summer semester | 0 / - | 0 / - | 0 / - | Min. (B+C) students | 10 |
| Winter semester | 0 / - | 12 / - | 2 / - | Repeated registration | NO |
| Timetable | Yes | | | Semester taught | Winter semester |
| Language of instruction | Czech | | | Internship duration | 0 |
| Optional course | Yes | | | Ev. sc. – cred. | S/N |
| 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 | None | | | | |
| Preclusive courses | N/A | | | | |
| Prerequisite courses | N/A | | | | |
| Informally recommended courses | N/A | | | | |
| Courses depending on this Course | KMM/ZSZT1 | | | | |

Course objectives:

The subject provides theoretical and practical findings from the area of steel and cast iron production in electrical arc and induction furnaces and cupola furnaces. Attention is paid to modern trends in the area of steel and cast iron metallurgy, which enables more purity of the melt and hence better mechanical features of casts.

Requirements on student

Essay completion.
Completion of written part of test and successful completion of oral exam.

Content

The course provides theoretical and practical knowledge in the field of steel and cast iron production in electric arc and induction furnaces and cupolas. Attention is also paid to modern trends in steel and cast iron metallurgy, which increase the purity of melts and thus the mechanical properties of castings.

Overview of lecture topics:

1. Solutions of molten metals, applications in metallurgy.
2. Interaction of gases with solid and molten metal, molten slag.
3. Production of steels in basic EOP, oxidation period of melting, reaction of oxidation period, dephosphorization.
4. Refining of steel on secondary metallurgy equipment (LF, VD / VOD, AOD ...).
5. Continuous steel casting.
6. Casting of ingots and castings.
7. Electroslag remelting (ESR) and vacuum arc remelting (VAR).
8. Melting of cast irons.
9. Metallurgical reactions in the production of cast irons.
10. Vaccination and modification of cast irons.
11. Metallurgy of non-ferrous metals.
12. Quality control in metallurgical production.
13. Defects caused by incorrect metallurgy.

Fields of study

Guarantors and lecturers

- **Guarantors:** Doc. Ing. Josef Odehnal, Ph.D. (100%)
- **Lecturer:** Doc. Ing. Josef Odehnal, Ph.D. (50%), Ing. Filip Votava (50%)
- **Tutorial lecturer:** Doc. Ing. Josef Odehnal, Ph.D. (50%), Ing. Filip Votava (50%)

Literature

- **Basic:** Myslivec, T.: *Fyzikální metalurgické základy ocelářství*.
- **Basic:** Roučka, J. *Metalurgie litin*. VUT Brno, 1998.
- **Basic:** Losertová, M. *Technologie speciálních slitin*. Ostrava, 2013. ISBN 978-80-248-3379-8.
- **Basic:** Lapčík, V. *Výrobní a environmentální technologie*. Ostrava, 2008.
- **Recommended:** Macásek, Igor. *Metalurgie litin a neželezných kovů*. 4. přeprac. vyd. Brno : VUT, 1986.
- **Recommended:** Setnička, Rudolf. *Metalurgie oceli*. 2. vyd. Brno : VUT, 1987.

Time requirements

All forms of study

| Activities | Time requirements for activity [h] |
|--|------------------------------------|
| Presentation preparation (report) (1-10) | 10 |
| Contact hours | 65 |
| Preparation for an examination (30-60) | 60 |
| Total: | 135 |

assessment methods

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

- Combined exam
- Individual presentation at a seminar

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

- Skills demonstration during practicum

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

- Oral exam

prerequisite

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

- to explain the basics of crystallization of metal melts
- to describe phase transformations during solidification and cooling of Fe-C base alloys
- to describe fundamental differences of mechanical properties of steels and cast-irons and to explain their causes
- to describe the kinetics of chemical reactions
- to describe States of aggregation of matters and to explain the fundamentals of thermochemistry

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

- to manage individual execution of metallographic sections
- to interpret the observed structures of metallic materials
- to perform an evaluation of mechanical tests
- to solve basic chemical equations

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:**

Interactive lecture
Field trip
Multimedia supported teaching

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

Practicum
Group discussion
Multimedia supported teaching

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

Lecture
Multimedia supported teaching

learning outcomes**Knowledge - knowledge resulting from the course:**

to describe the interaction of gases with a solid and a molten metal
to describe the basic metallurgical processes of steelmaking in EOP and IP
to explain the fundamentals of vacuum metallurgy
to describe the basics of melting and crystallization of cast iron
to explain the nature and basic ways of secondary metallurgy of steels and alloys
to define basic types of slags and to explain their role during the production of steels and alloys
to describe the basic principles of non-ferrous metallurgy

Skills - skills resulting from the course:

to determine a suitable material and subsequently to solve the appropriate metallurgy on the basis of desired properties of a structural component
to determine a suitable type of slag including chemical composition for the designed metallurgy through the form of a technical report to propose an alternative solutions of a metallurgical process
to make out a metallographic sample and on the basis of identified structure to be able to analyze the kind of iron or steel respectively

Competences - competences resulting from the course:

N/A

Course is included in study programmes:

| Study Programme | Type of | Form of | Branch | Stage | St. plan v. | Year | Block | Status | R.year | R. |
|--|---------------------|-----------|--|-------|-------------|------|-----------------------|--------|--------|----|
| Materials Science and Manufacturing Technology | Postgraduate Master | Full-time | Materials Science and Manufacturing Technology | 1 | 2020 | 2023 | Core elective courses | B | 1 | ZS |
| Materials Science and Manufacturing Technology | Postgraduate Master | Combined | Materials Science and Manufacturing Technology | 1 | 2020 | 2023 | Core elective courses | B | 1 | ZS |