Department of Materials Science and Engineering

# Introduction

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Building MT, 60/B
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Materials Engineering
BMEGEMTBGF1
2022 Fall semester

# Venue

The subject will be held **in-person form**. For the lectures and and laboratories please wait in the lobby of building G in time.

The lectures will be held at **every Monday 10:15 – 12:00.**

**Personal consultation is provided** on every Monday from 12:00 – 13:00 in BME building MT, office 60/B. If you would like to consult about the lessons, please write an email to varbai.balazs@gpk.bme.hu on the previous day.

The laboratories will also be held in building G. **The laboratory practices will start on the 2nd week.** Please follow the instructions of your laboratory group leader.

The exams will be held at the end of the semester.

If you have any question, feel free to contact me through varbai.balazs@gpk.bme.hu.

# Venue

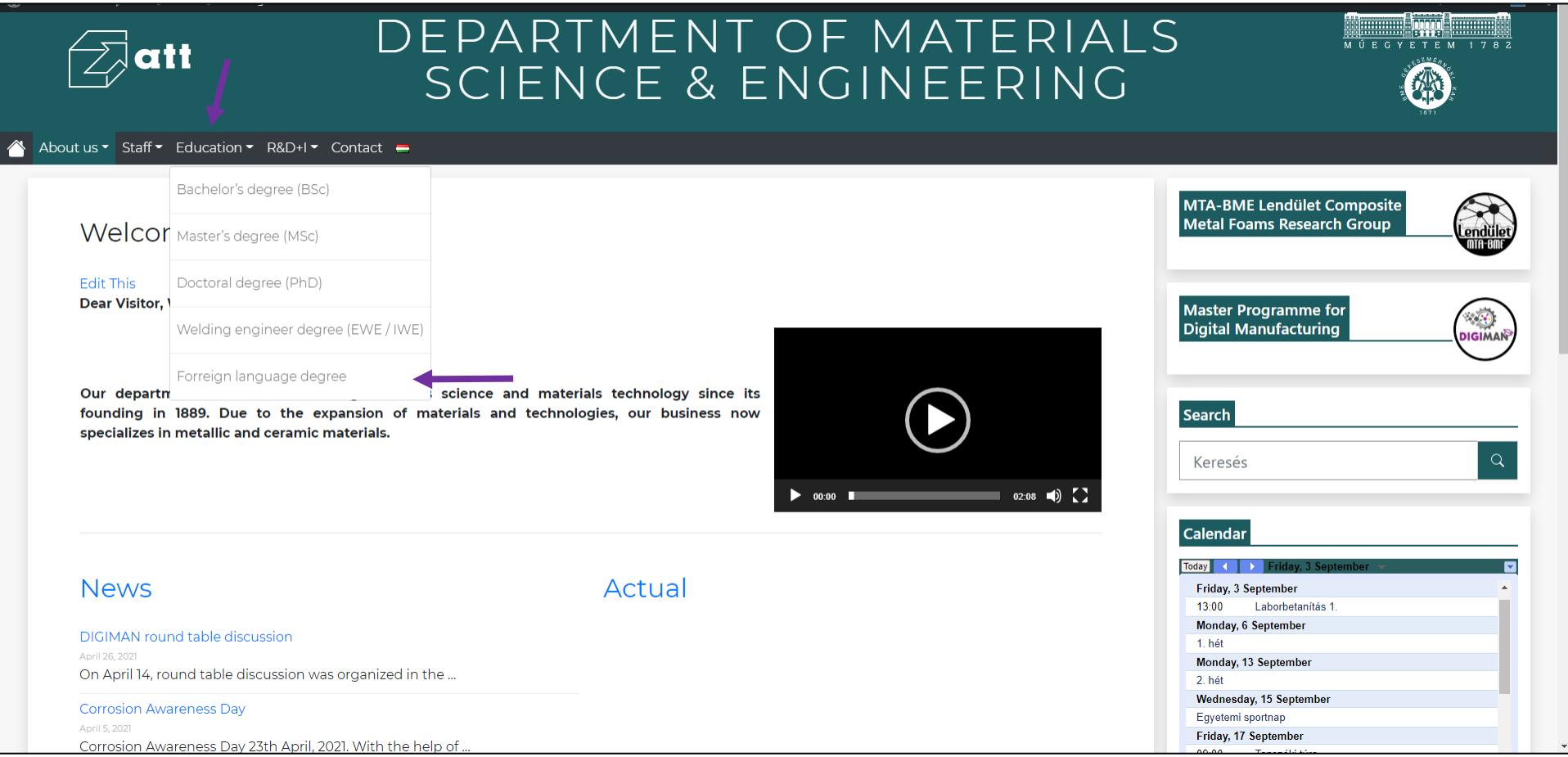

**Lectures**

- G building 120
- Every mondays, 10:15 – 12:00

**Laboratory practice**

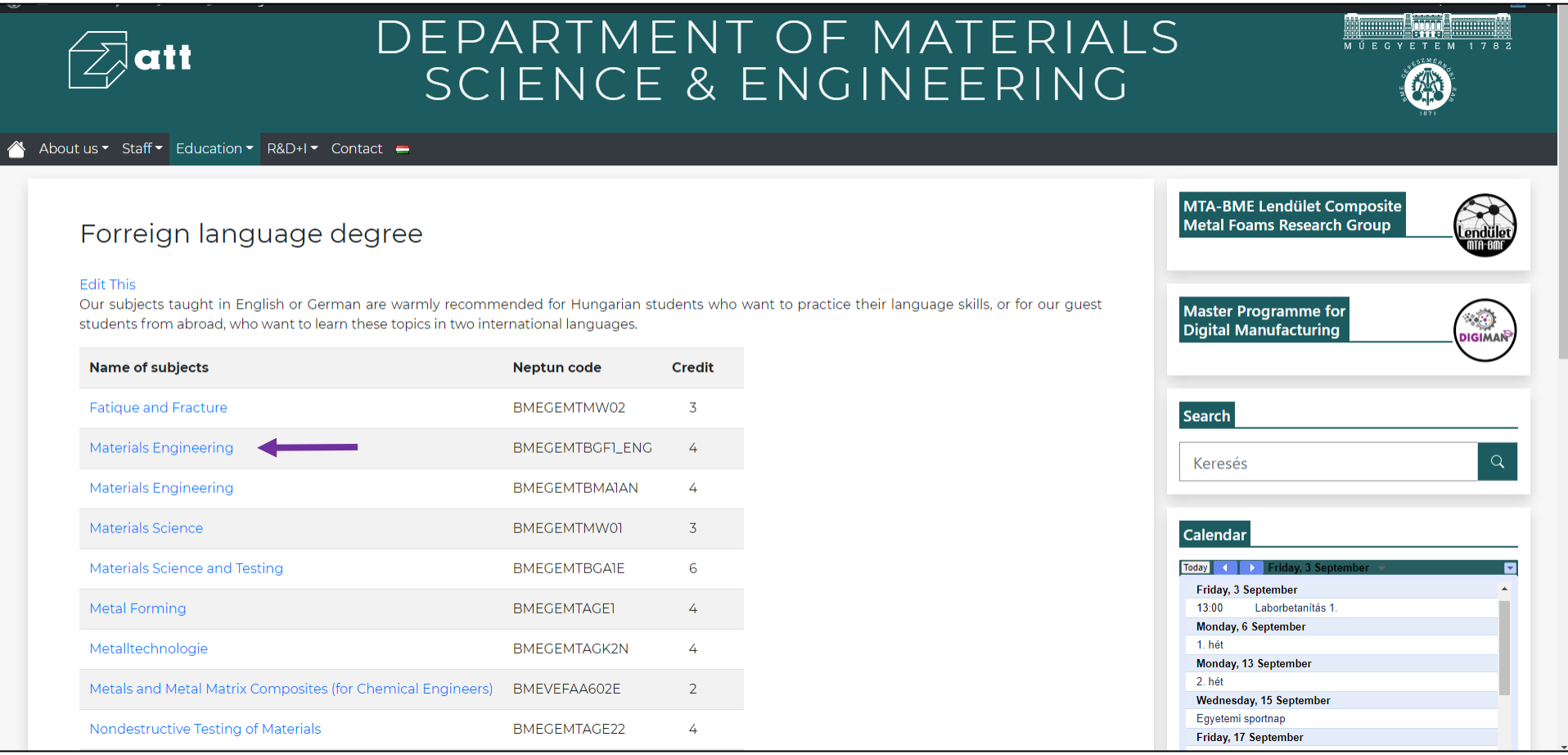
- G building, please wait in the hall
- L1 →Every second Monday, starting from the 2nd week 16:15 – 17:45
- L2 →Every second Wednesday, starting from the 2nd week, 12:15 – 13:45

# Lesson materials




http://www.att.bme.hu/en

# Lesson materials



DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING

About us | Staff | Education | R&D+I | Contact

## Forreign language degree

Edit This

Our subjects taught in English or German are warmly recommended for Hungarian students who want to practice their language skills, or for our guest students from abroad, who want to learn these topics in two international languages.

| Name of subjects | Neptun code | Credit |
|---|---|---|
| Fatique and Fracture | BMEGEMTMW02 | 3 |
| Materials Engineering | BMEGEMTBGF1_ENG | 4 |
| Materials Engineering | BMEGEMTBMA1AN | 4 |
| Materials Science | BMEGEMTMW01 | 3 |
| Materials Science and Testing | BMEGEMTBGA1E | 6 |
| Metal Forming | BMEGEMTAGE1 | 4 |
| Metalltechnologie | BMEGEMTAGK2N | 4 |
| Metals and Metal Matrix Composites (for Chemical Engineers) | BMEVEFAA602E | 2 |
| Nondestructive Testing of Materials | BMEGEMTAGE22 | 4 |

MTA-BME Lendület Composite Metal Foams Research Group

Master Programme for Digital Manufacturing

Search

Keresés

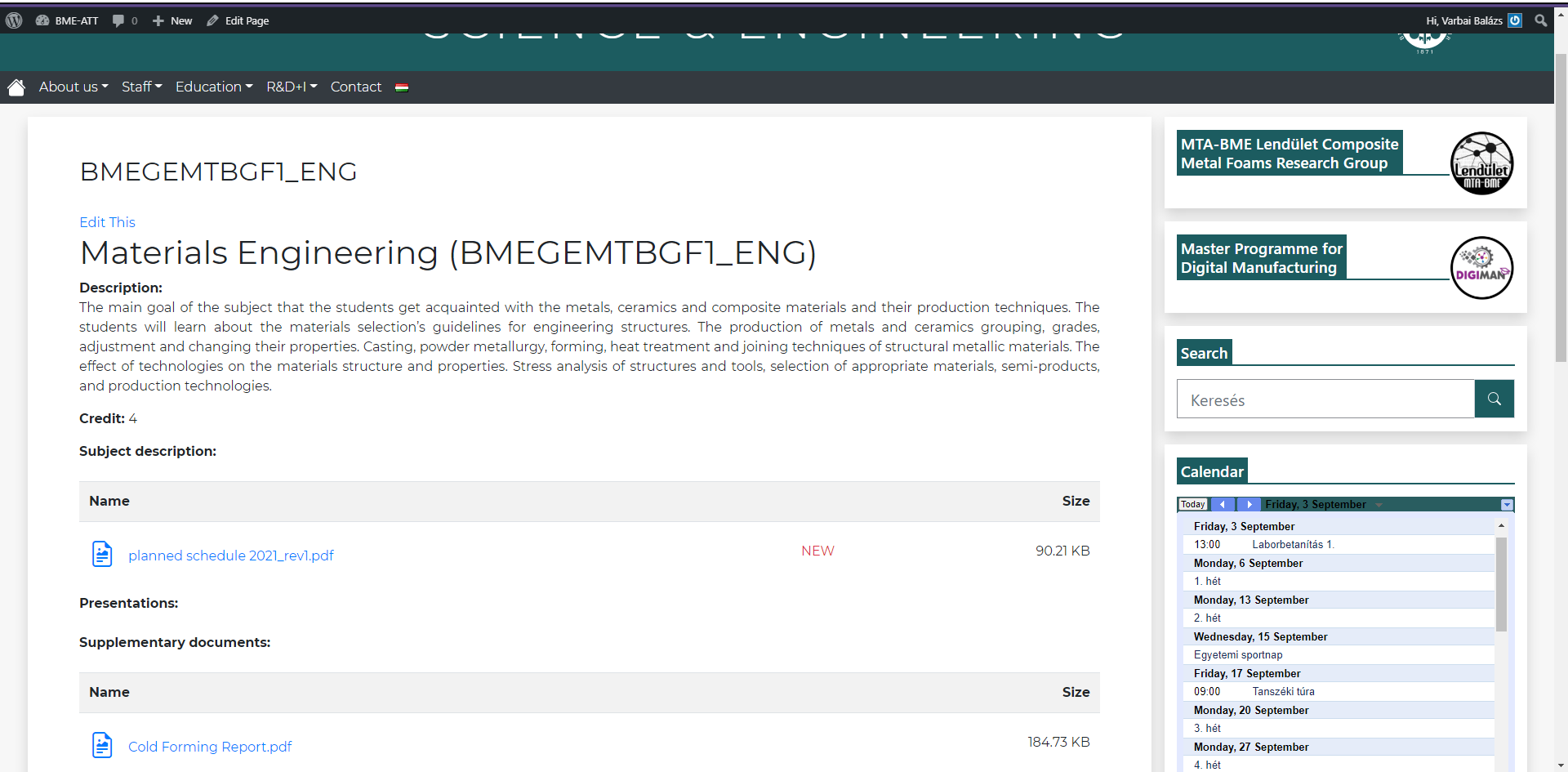
Calendar

Today | Friday, 3 September

Friday, 3 September
13:00 Laborbetanítás 1.
Monday, 6 September
1. hét
Monday, 13 September
2. hét
Wednesday, 15 September
Egyetemi sportnap
Friday, 17 September

http://www.att.bme.hu/en

# Lesson materials



# Planned schedule

| IN-PERSON course schedule | | | | | | |
|---|---|---|---|---|---|---|
| **Materials Engineering 2022 Schedule** | | | | | | |
| **Week** | **Date, time** | | **Venue** | **Lab groups** | **Laboratory practice / Lecture** | **Report deadline** |
| 1 | 05/09/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| 2 | 12/09/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| | 12/09/2021 | 16:15 - 18:00 | | | Materials selection | Project final report deadline 09/12/2022 |
| | | | Building G, Forming lab | L1B | | |
| | 14/09/2022 | - | - | - | Sports Day, no lecture | Project final report deadline 09/12/2022 |
| | | | - | - | | |
| 3 | 19/09/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| 4 | 26/09/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| | 26/09/2022 | 16:15 - 18:00 | | | | |
| | | | Building G, Heat treating lab | L1B | Jominy test | Materials selection 1st signature, Jominy test report, 10/10/2022 |
| | 28/09/2022 | 12:15 - 14:00 | Building G, Forming lab | L2A | Heat treating | Materials selection 1st signature, Heat treating report, 12/10/2022 |
| | | | Building G, Heat treating lab | L2B | Jominy test | Materials selection 1st signature, Jominy test report, 12/10/2022 |
| 5 | 03/10/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| 6 | 10/10/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| | 10/10/2022 | 16:15 - 18:00 | | | | |
| | | | Building G, Forming lab | L1B | Heat treating | Heat treating report, 24/10/2022 |
| | 12/10/2022 | 12:15 - 14:00 | Building G, Heat treating lab | L2A | Jominy test | Jominy test report, 26/10/2022 |
| | | | Building G, Forming lab | L2B | Heat treating | Heat treating report, 26/10/2022 |
| | 15/10/2022 | 10:15-12:00 | Building G, room 120 | All | Lecture | - |
| 7 | 17/10/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| 8 | 24/10/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| | 24/10/2022 | 16:15 - 18:00 | | | | |
| | | | Building G, Heat treating lab | L1B | Arc welding | No report |
| | 26/10/2022 | 12:15 - 14:00 | Building G, Forming lab | L2A | Hot forming | Hot forming report, 09/11/2022 |
| | | | Building G, Heat treating lab | L2B | Arc welding | No report |
| 9 | 31/10/2022 | Holiday | Holiday | All | Holiday | - |
| 10 | 07/11/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| | 07/11/2022 | 16:15 - 18:00 | | | | |
| | | | Building G, Forming lab | L1B | Hot forming | Materials selection 2nd signature, Hot forming report, 21/11/2022 |
| | 09/11/2022 | 12:15 - 14:00 | Building G, Heat treating lab | L2A | Arc welding | Materials selection 2nd signature, 23/11/2022 |
| | | | Building G, Forming lab | L2B | Hot forming | Materials selection 2nd signature, Hot forming report, 23/11/2022 |
| 11 | 14/11/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| 12 | 21/11/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| | 21/11/2022 | 12:15 - 14:00 | | | | |
| | | | Building G, Heat treating lab | L1B | Resistance welding | Resistance welding report, 05/12/2022 |
| | 23/11/2022 | 12:15 - 14:00 | Building G, Forming lab | L2A | Cold forming | Cold forming report, 07/12/2022 |
| | | | Building G, Heat treating lab | L2B | Resistance welding | Resistance welding report, 07/12/2022 |
| 13 | 28/11/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| 14 | 05/12/2022 | 10:15 - 12:00 | Building G, room 120 | All | Lecture | - |
| | 05/12/2022 | 12:15 - 14:00 | | | | |
| | | | Building G, Forming lab | L1B | Cold forming | Cold forming report, 09/12/2022 |
| | 07/12/2022 | 12:15 - 14:00 | Building G, Heat treating lab | L2A | Resistance welding | Resistance welding report, 09/12/2022 |
| | | | Building G, Forming lab | L2B | Cold forming | Cold forming report, 09/12/2022 |

# Requirements

**During the semester**

- Attendance at lectures: min. 70 %
- Attendance at lab. practices: 100 %
- **Five laboratory reports** (deadline: next two weeks).
- **Materials selection project**

**Examination period**

- **Written exam**
- Only those students can take the exam who attended at min. 70 % of the lectures, all the laboratory practices and have
- **Five accepted laboratory reports, and the accepted materials selection project**

**Grade**

- Grades according to the score of final exam

# Laboratory practices

| | |
|---|---|
| • Heat treating | Report |
| • Jominy test | Report |
| • Hot Forming | Report |
| • Cold Forming | Report |
| • Resistance welding | Report |
| • Materials selection project | Report |

The deadline for the Materials Selection semester project is:

09/12/2022

Please follow the instructions of your laboratory group leader!

# Prior knowledge

**Materials Science and Testing discipline**

- Rudiments of physics and chemistry
- Materials structure, mechanical properties, effect of temperature, deformation speed, and stress state on the mechanical behavior
- Materials testing methods
- Microstructural and property changes during heat treatment in metals
- Damage and fatigue of metals
- The effect of manufacturing processes on properties

# Topics of the course

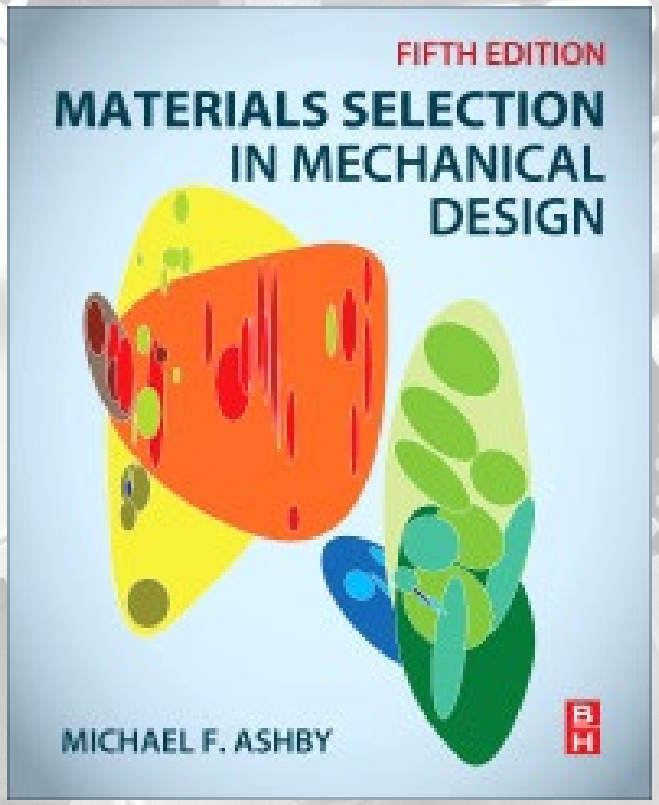
- **Metals**, ceramics and composite materials for engineering purposes, and their production techniques.
- Adjustment and changing of properties.
- Casting, powder metallurgy, forming, heat treatment and joining techniques of structural metallic materials.
- The effect of technologies on the materials structure and properties.
- Materials selection's guidelines for engineering structures.

„Technology” Greek origin

„Technos” → technical
„logos” → logical

Theory and practice of some technical processes.

*Production, planning, organizations (+ information and experience)*



**Meaning changed with time**

*Before the industrial revolution:*

The sum of the knowledge of a single worker.

*After the industrial revolution, first part of XIX century:*

Manufacturing industry, technical knowledge and the science are separated into various technologies.

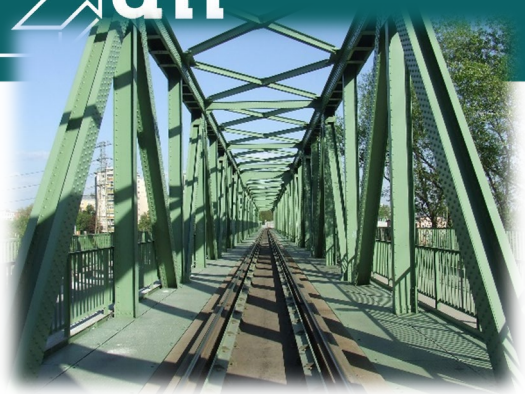
*After the industrial revolution, second part of XIX century:*

Mass production, important technologies: Mechanization, automatization, organization

*From the XX century:*

New disciplines (electronics, informatics, computer science), various scientific background, digital manufact., industry 4.0

# Materials Engineering → Metals Technology



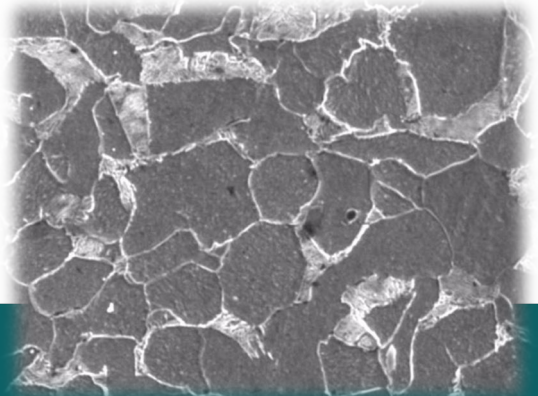
**Construction**

*Product quality*

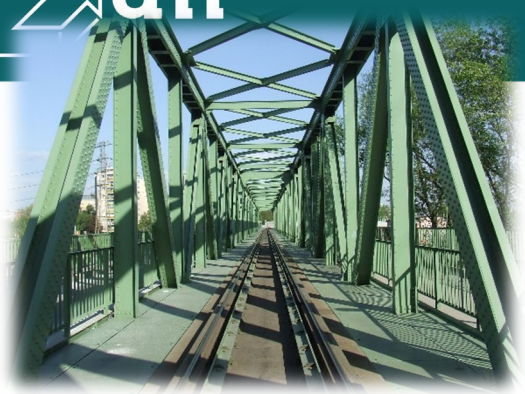
*Production possibilities*

**Material** ⟷ **Technology**

*Production abilities*



# Materials Engineering → Metals Technology



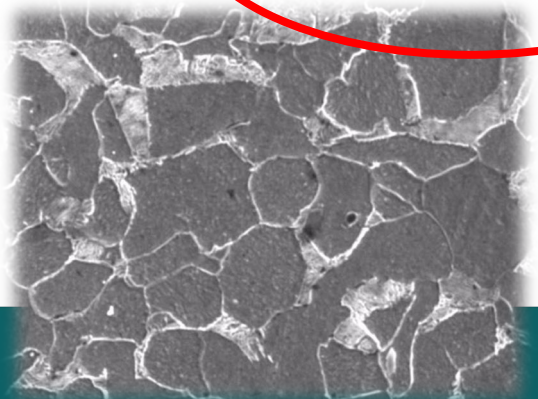
**Construction**

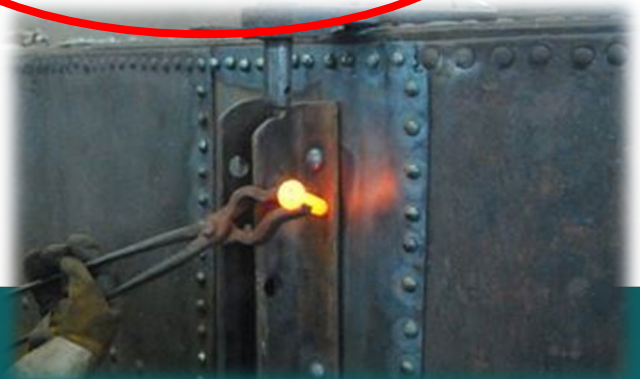
*Product quality*

*Production possibilities*

**Material** ⟷ **Technology**

*Production abilities*





# Materials

**Metallic**

**Ferrous**

→ iron, steel

**Nonferrous**

→ Al, Mg, Cu, Ni, Pb

**Non-metallic**

**Organic**

Plastics or polymers
Wood, paper, rubber

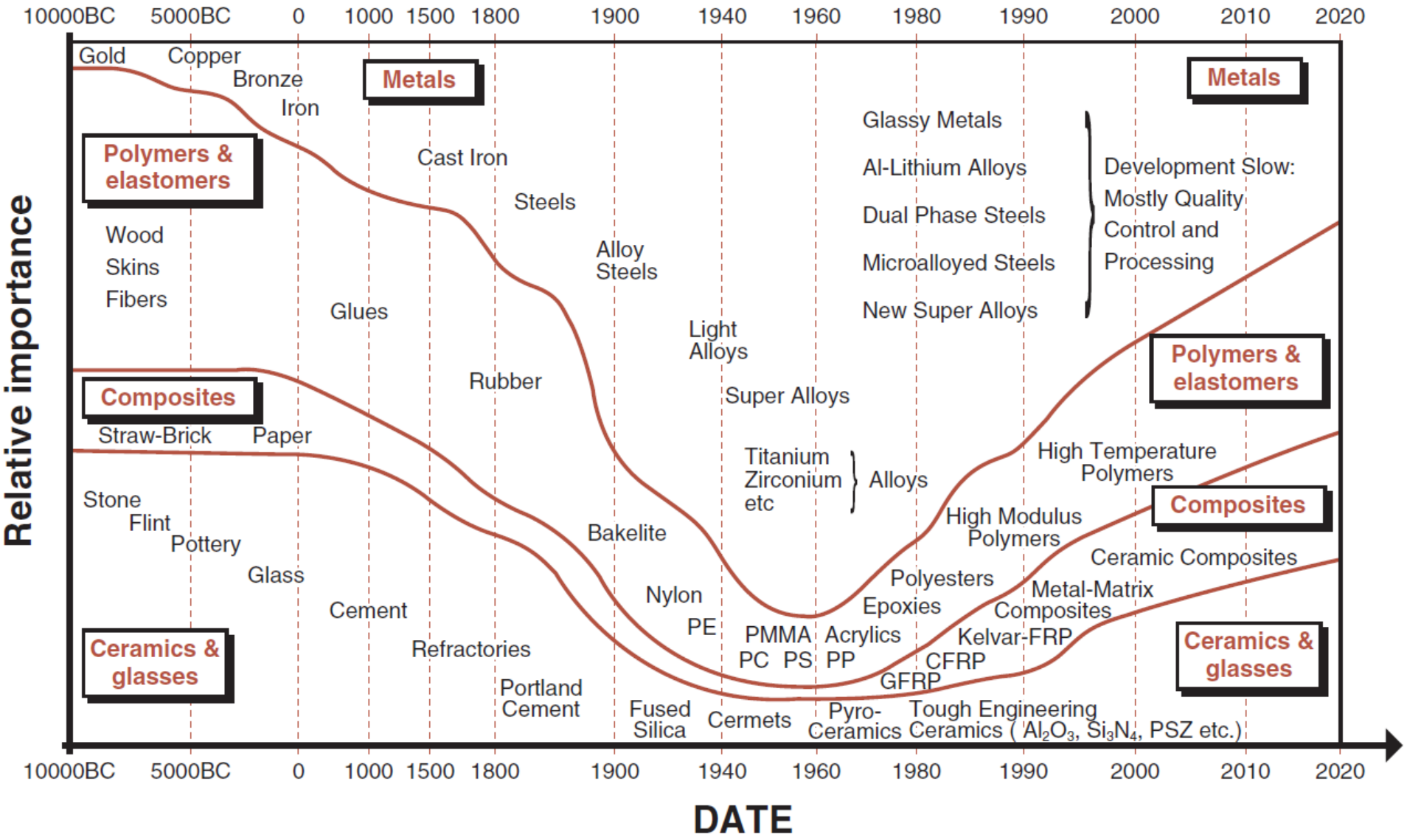
**Inorganic**

(technical) ceramics
glass

**Composites:**

utilize more than one type of material

# Materials timeline



# Materials properties

The properties of materials are determined by **two group of factors**:

**Internal factors** → determine the material's structure

- Chemical composition (impurity and alloying)
- Microstructure (equilibrium or non-equilibrium phases, their amount, quality distribution, and sizes)

**External factors** → determine the service condition of a machine part

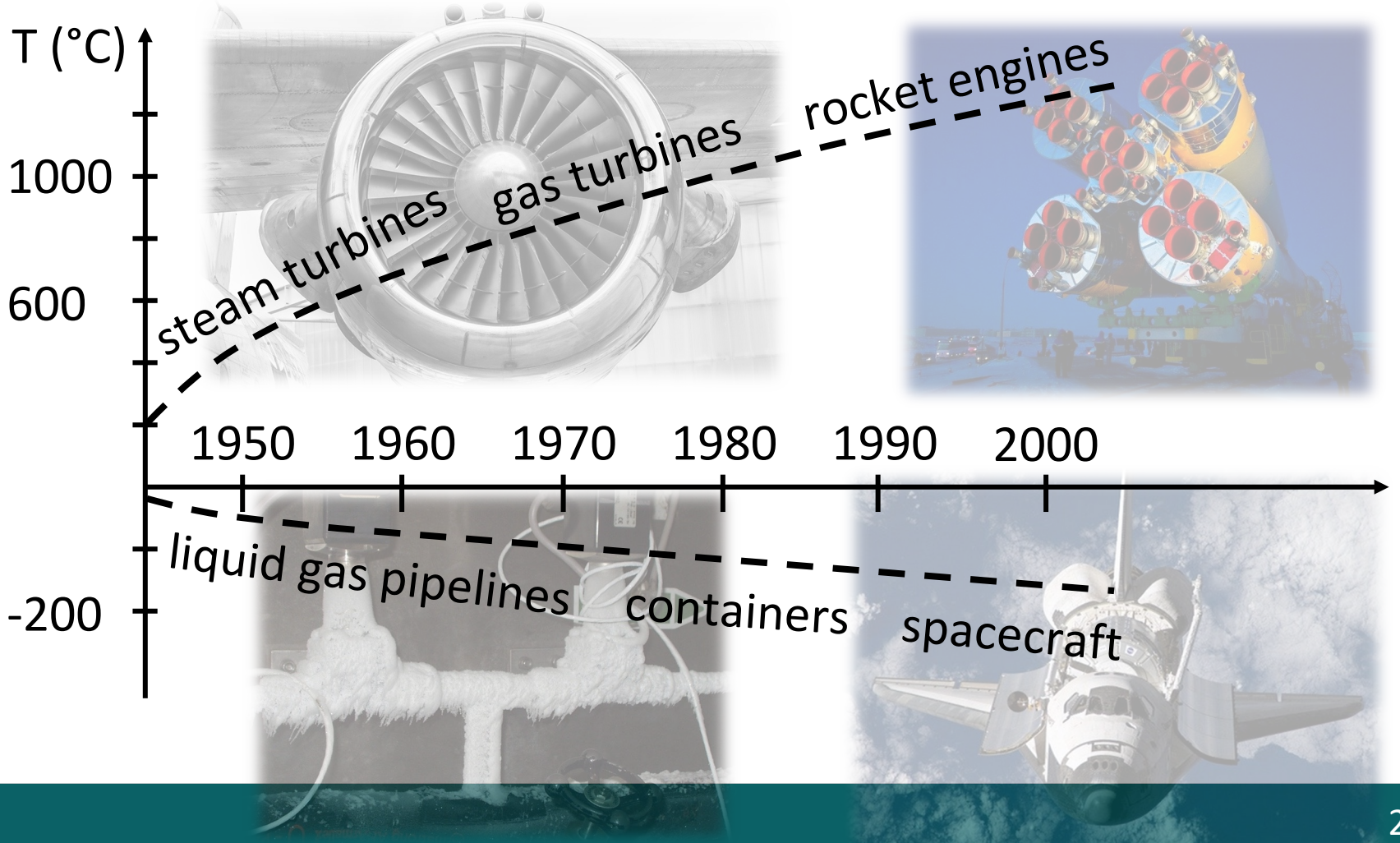
- Temperature (mean value and amplitude)
- Rate of deformation
- Stress state
- Chemical effects
- Corrosion effects
- Irradiation effects

# Internal factors

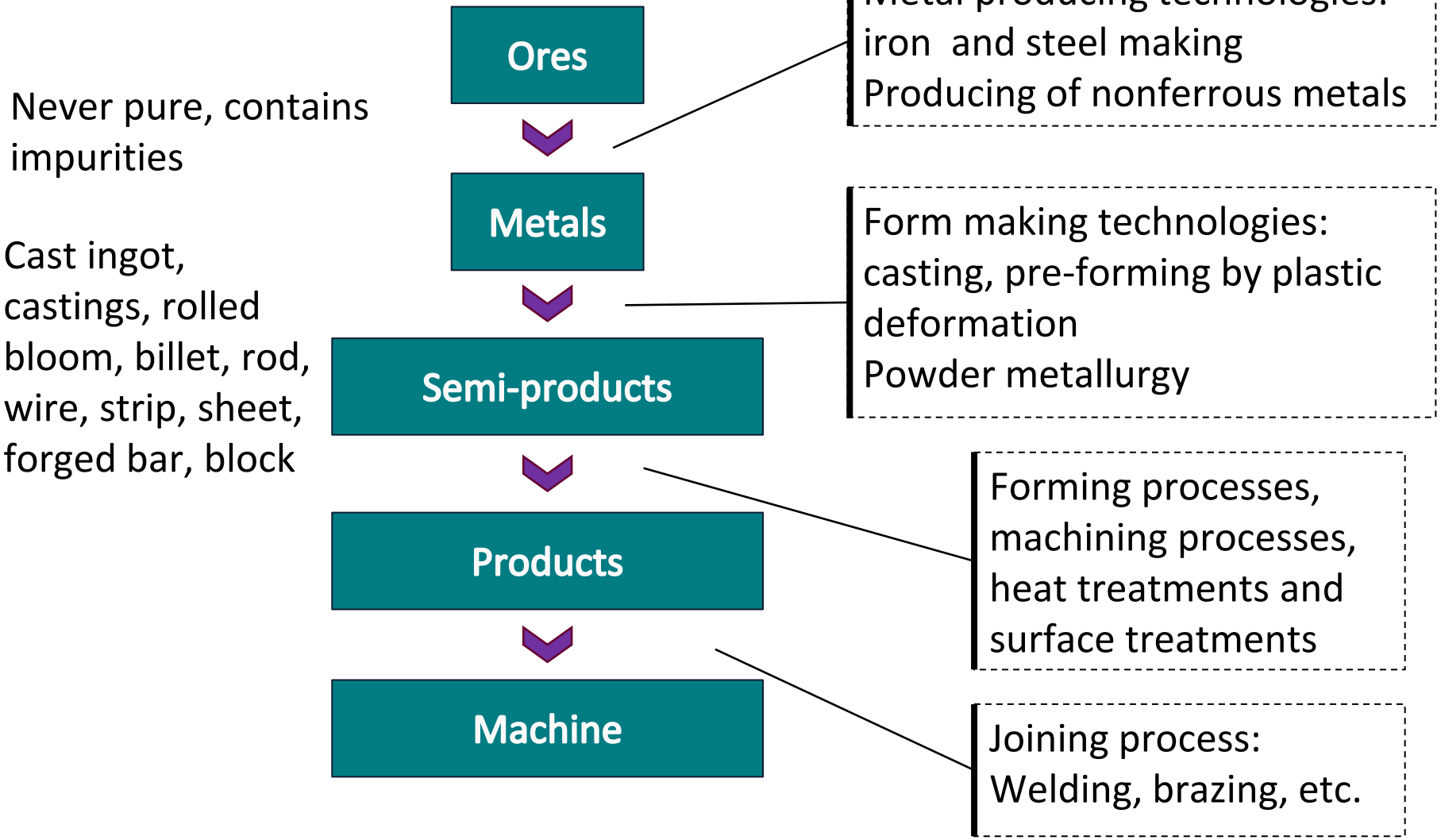
**Internal factors** are determined by:

- Metal production
- Form making
- Forming
- Heat treating
- Surface treating
- Joining process

**External factors** – service conditions are determined by how the machine part is used



# General layout of the discipline



# Textbooks and resources

- *Department of Materials Science and Engineering webpage: www.att.bme.hu/en*
- *W. D. Callister:*
  *Materials Science and Engineering, An Introduction.*
- *S. Kalpakjian, S.R. Smith:*
  *Manufacturing Engineering and Technology*
- *Michael F. Ashby:*
  *Materials Selection in Mechanical Design*

Thank you for your attention!