

Budapest University of Technology and Economics

# **Metal Forming**

## Course, Requirements & Schedule

BSc - 2023/24 - 1

### Home: Department of Materials Science and Engineering – Since 1889

Course: Metal Forming

Code: BMEGEMTAGE1 Credit: 4

Lecturer: András REÉ Building MT, 1<sup>st</sup> floor, office 106 ree@eik.bme.hu Consultation on Thursday 16:00-18:00

### **Required prior knowledge:**

Materials Science and Testing Materials Engineering

- Materials structure, mechanical properties, effect of temperature, strain rate and stress state on the mechanical behavior
- Microstructural and property changes during heat treatment in metals
- Damage of metals
- The effect of manufacturing processes on properties
- Fundamentals of plastic deformation of metals
- Steels, aluminium and copper alloys
- Heat treatment techniques

+ CAD + Technical drawing

### Topics of the course:

- Deformation and stress, basics of continuum mechanics
- Flow stress and formability
- Friction, lubrication
- Bulk metal forming processes
- Sheet metal forming processes
- Tool design
- Tool materials
- Forming equipments

### Requirements

During the semester	<ul> <li>Laboratory and class practices Required attendance at labs is: 100%</li> <li>Semester project Technology and tool design</li> <li>2 tests: midterm &amp; final written test</li> </ul>
Grading	<ul> <li>Only those students can have a grade, who attended all the laboratory practices (report accepted), and the project report is accepted.</li> <li>Grading is based on the average (ave) of three points: ave = (midterm + final + project) / 3 (required minimum points are 41, max. points are 100 – for each)</li> </ul>
Semester marks: 0-40 71-8	fail (1), 41-55 pass(2), 56-70 satisfactory (3), 5 good (4), 86-100 excellent (5)

# Lectures and practices:

Missed laboratories: max. 2 (!) can be replaced

Failed exams: only 1 (!) can be replaced twice

Replacement week 📫

	Week	Date	Day	Time		Lecture / Laboratory								
	1	Sep. 07	Thursday	14:15-16:00	Lecture	Requirements and introduction								
				16:15-18:00	Lab.									
2	n	2 Sep. 14	4 Thursday	14:15-16:00	Lecture	Deformation and stress								
	Z			16:15-18:00	Lab.	Projects – issue & consultation								
	2 Con 21	1 Thursday	14:15-16:00	Lecture	Friction, lubrication, formability									
	Э	3 Sep. 21	Sep. 21   Inursday	16:15-18:00	Lab.									
	Л	Son 29	Thursday	14:15-16:00	Lecture	Calculation methods								
	4 Sep. 28	Sep. 28   Inursday	16:15-19:45	Lab.	Flow curve measurement (L1 then L2									
	F	5 Oct. 05	5 Oct. 05	Thursday	14:15-16:00	Lecture	Surface treatment	]						
	Э			Thursday	16:15-18:00	Lab.								
	C	6 Oct. 12	6 Oct. 12 T		Thursday	14:15-16:00	Lecture	Upset forging, thread, and gear rolling						
	D			Thursday	16:15-19:45	Lab.	Friction measurement (L1 then L2)							
	7	7 Oct. 19	7 Oct. 19	Thursday	14:15-16:00	Lecture	Extrusion	1						
	/				16:15-18:00	Lab.								
	0	8 Oct. 26	8 Oct. 26 Thurs	Oct 26 Thursday	Thursday	14:15-16:00	Lecture	Wire, rod, and tube drawing	1					
	õ			Thursday	16:15-18:00	Lab.	Midterm exam							
	0	9 Nov. 02	. 02 Thursday	14:15-16:00	Lecture	Closed die forging	]							
	9			16:15-18:00	Lab.									
Ī	10	10 Nov. 09	) Nov. 09 Thu	Nev 00		Nev 00	New 00	10 Nav. 00		Thursday	14:15-16:00	Lecture	Sheet metal forming, deep drawing	]
	10			mursuay	16:15-18:00	Lab.	Control of projects							
1	11 Nov	11	11 Nov. 16	Thursday	14:15-16:00	Lecture	(Students' Scientific Conference)							
				NOV. 16	Thursday	16:15-18:00	Lab.							
12	10	12 Nov. 23	12 Nov. 23 Thursday	2 Nov 22 Thursd	Thursday	14:15-16:00	Lecture	Other sheet metal forming techniques						
	12			16:15-18:00	Lab.	Sheet metal forming								
	10	13 Nov. 30	Nov. 30 Thursday	Thursday	14:15-16:00	Lecture	Forming equipment and die materials	_						
	15			16:15-18:00	Lab.									
	11	14 Dec. 07	14 Dec. 07	Dec. 07 Thursday	14:15-16:00	Lecture	Final exam							
	14					16:15-18:00	Lab.	Project Submission						
		Dec. 11-15				Replacement week (laboratories and exams)	6							

### Semester project

#### Task:

- 1. Plan the forming technology of a given workpiece.
- 2. Design the die of the last forming step.

#### Report content:

- Description of the forming steps; materials, geometries
- Analytical calculations (optionally finite element)
- Production die assembly drawing of the final step.

The project report is to be submitted electronically.

### **Textbooks and resources**

- Department of Materials Science and Engineering webpage: <u>www.att.bme.hu</u>
- Heinz Tschaetsch:
   Metal Forming Practice
- S. Kalpakjian, S.R. Smith: Manufacturing Engineering and Technology
- W. D. Callister:

Materials Science and Engineering, An Introduction.