Course description

Department/Unit /	KMM / TTV			**Academic Year**	2023/2024	
Title	Theory of Metal Forming			**Type of completion**	Exam	
Accredited/Credits	Yes, 4 Cred.			**Type of completion**	Combined	
Number of hours	Lecture 2 [Hours/Week] Tutorial 2 [Hours/Week]					
Occ/max	Status A	Status B	Status C	**Course credit prior to**	YES	
Summer semester	8 / -	4 / -	3 / -	**Counted into average**	YES	
Winter semester	0 / -	0 / -	0 / -	**Min. (B+C) students**	10	
Timetable	Yes			**Repeated registration**	NO	
Language of instruction	Czech			**Semester taught**	Summer semester	
Optional course	Yes			**Internship duration**	0	
Evaluation scale	1|2|3|4			**Ev. sc. – cred.**	S|N	
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/TTV*					
Preclusive courses	N/A					
Prerequisite courses	N/A					
Informally recommended courses	KMM/TTSS					
Courses depending on this Course	KMM/ZSZT1					

Course objectives:

The tutorial deals with the theoretical fundamentals of stress and force computation in metal forming technology. The students are acquainted with principles and laws of plastic strain mechanics. The state of stress, mathematic relations for small strain computation, the compatibility equations and plasticity conditions are analyzed. Equilibrium differential equations for forming processes are derived and the methods of strain force and power determination are specified. In the user-oriented part, the stress conditions and forces are calculated for upsetting, rolling, wire, and tube drawing using equilibrium equations and the plasticity condition formula. The slip line method is interpreted and several selected tasks are calculated by this method.

Requirements on student

Credits: The laboration of the final calculation test
Examination: The succesfull elaboration of the written part and graduation of the verbal part of the exam

Content

Mechanics of plastic deformation, derivation of partial differential equations of equilibrium. Small deformations and strain rate, compatibility conditions. Methods for determining deformation forces, plasticity conditions. Stress ratios at the contact surface during compaction. Rolling theory. Theory of wire and tube drawing. Deformation behavior of metallic materials during volume and surface forming. Deformation behavior of plastics.

Fields of study

COURSEWARE ZČU

Guarantors and lecturers

- **Guarantors:** Ing. Soňa Benešová, Ph.D. (100%)
- **Lecturer:** Ing. Soňa Benešová, Ph.D. (50%), Dr. Ing. Hana Jirková, Ph.D. (50%)
- **Tutorial lecturer:** Ing. Soňa Benešová, Ph.D. (50%), Dr. Ing. Hana Jirková, Ph.D. (50%)

Literature

- **Basic:** Žídek M. *Metalurgická tvařitelnost ocelí za tepla a za studena*. Praha, Aleko, 1995.
- **Basic:** Počta, B. *Základy teorie tváření kovů*. Praha: SNTL, 1966.
- **Recommended:** Altan, T., Ngaile, G., Shen, G. *Cold and Hot Forging, Fundamentals and Applications*. ASM International, 2005.
- **Recommended:** Altan, T., Tekkaya A.E. *Sheet Metal Forming, Fundamentals*. ASM International, 2012.
- **Recommended:** Mojžíš, Antonín. *Teorie a technologie tváření kovů*. 1. vyd. Plzeň : VŠSE, 1977.

Time requirements

All forms of study

Activities	Time requirements for activity [h]
Preparation for an examination (30-60)	50
Contact hours	40
Preparation for comprehensive test (10-40)	10
Total:	**100**

assessment methods

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

Combined exam

Test

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:

Use trigonometric functions.
Find solutions to simple integrals.
Rearrange mathematical equations.
Use and know the meaning of a differential.

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

Draw schematics.
Use spatial ability.

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:

Practicum

Interactive lecture

Lecture

Multimedia supported teaching

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

Skills demonstration

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:

Describe the stress state in plastic deformation.
Give a list of basic forming factors.
Interpret the relationship between stress and strain.
Define exact partial differential balance of forces in orthogonal and cylindrical coordinate systems.
Calculate stresses and forces for selected forming operations.

Skills - skills resulting from the course:

Know the meaning of basic forming factors in hot and cold forming.
Calculate the forming velocity profile for a press and a power hammer.
Apply yielding conditions and analyze stress state using Mohr circle.

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.
Mechanical Engineering	Bachelor	Full-time	Engineering Materials and Technology	1	2020	2023	Compulsory courses	A	3	LS
Design Engineering of Machines and Technical Devices	Postgraduate Master	Combined	Design Engineering of Manufacturing Machines and Equipment	1	2020	2023	Core elective courses "B"	B	2	LS
Design Engineering of Machines and Technical Devices	Postgraduate Master	Full-time	Design Engineering of Manufacturing Machines and Equipment	1	2020	2023	Core elective courses "B"	B	2	LS
Mechanical Engineering	Bachelor	Combined	Engineering Materials and Manufacturing Technology	1	2020	2023	Core elective courses	B	3	LS