



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Plastic processing [S1MiBP1>OP]

Course

Field of study

Mechanical and Automotive Engineering

Year/Semester

3/5

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics, mathematics and mechanics; skills of logical thinking; association of knowledge of many branches; getting and using information from library and internet; social expertise: needs of continuous learning, getting new knowledge

Course objective

Getting knowledge about applying of chosen numerical method for solving engineering problems

Course-related learning outcomes

Knowledge:

1. Has basic knowledge of the strength of materials, including the basics of the theory of elasticity and plasticity, stress hypotheses, calculation methods for beams, membranes, shafts, joints and other simple structural elements, as well as methods of testing the strength of materials and the state of deformation and stress in mechanical structures.
2. Has basic knowledge of manufacturing techniques used in the engineering industry, such as casting, forming, reducing and incremental machining, welding and other joining techniques, cutting, coating and surface treatments.

3. Has basic knowledge of tribological processes occurring in machines, i.e. friction, lubrication and wear.

Skills:

1. Can obtain information from literature, the Internet, databases and other sources. Can integrate the obtained information, interpret and draw conclusions from it, and create and justify opinions.
2. Can search in catalogs and on manufacturers' websites ready-made machine components to be used in his own projects.
3. Can interact with other people as part of teamwork (also of an interdisciplinary nature).

Social competences:

1. Is ready to critically assess his knowledge and received content.
2. Is ready to initiate actions for the public interest.
3. Is ready to fulfill professional roles responsibly, including:
 - observing the rules of professional ethics and requiring this from others,
 - caring for the achievements and traditions of the profession.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Written test (positive for min. 50,1% correct answers). Less than 50,0% - ndst, in range (50,1%-60,0%) - dst, (60,1% -70,0%) - dst+, (70,1% - 80%) - db, (80,1% - 90,0%) - db+, more than 90,1% - bdb) done at the end of semester.

Programme content

Information about plastic shaping of metals and their alloys. Properties of materials when shaping products using plastic processing methods.

Technological operations for shaping products from sheets and bars. General information about tool materials and technological lubricants. Calculation of parameters of plastic forming processes.

Determination of parameters of plastic forming processes.

Course topics

1. Theoretical background of plastic forming of metals and metal alloys (yield conditions, mechanisms of plastic deformations).
2. Materials in metal forming. Changes of properties of materials under plastic processes"
3. Estimation of plastic or elastic state of materials based on Huber or Tresca hypotheses.
- 4-7. Technological operation of sheets forming (cutting, bending, stamping).
- 8-10. Technological operations of rods forming (forging, rolling, extrusion).
11. General information about tools materials and technical greases (in plastic processes). Defects in workpieces obtained by plastic processes and method to avoid them.
- 12, 13. Calculation of cutting and bending processes parameters.
- 14, 15. Determining of stamping process parameters.

Teaching methods

Lectures: multimedia presentation, comments ; discussion;

Bibliography

Basic

1. Matysiak W., Plančak M. Equipment for metal forming processes (Poznań University of Technology Press, 2023, ISBN 978-83-7775-700-0, 220 pages).
2. Matysiak W., Plančak M. Terminology of plastic working (terminology handbook PL/EN/DE; edition available at the PUT bookshop).
3. Tomczak J., Bartnicki J., Machines and equipment for plastic working, Lublin University of Technology, Lublin 2012.

Additional

1. Liu et al. (2023) – Flow drill screw (FDS) technique: A state-of-the-art review (ScienceDirect/Journal of

- Manufacturing Processes – review of the technique, mechanisms, parameters, applications).
2. Altvater et al. (2022) – paper on the transition between FDS systems in body structures (selection and comparison of systems, context of multi-material lightweight design).
 3. Eshtayeh et al. (2016) – Clinch joining process for joining dissimilar materials: state of the art (The International Journal of Advanced Manufacturing Technology). This is not the most recent, but still one of the key review papers (mechanisms, geometric parameters: undercut/neck thickness, applications).
 4. Springer Reference – entry Mechanical Joining (2018): synthetic description of clinching and joints by local plastic deformation (good reference point for definitions).
 5. ASM (PDF chapter) Mechanical Joining by Forming – a compendium of the principles of formed mechanical joints (useful for a lecture on the mechanism and quality criteria).
 6. F. Liu et al. (2025) – research on the mechanical properties of multi-layer clinched joints (configuration variants, tests).
 7. Friedlein – description of the impact of thermal effects in clinching (MRF Forum – chapter/item in the collection).
 8. Metal Forming Handbook (Schuler) – classic compendium of pressing and forming technologies (including issues related to presses/tooling; excellent basis for the module on lines).

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00