COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S2-ME-PT-114**
	part-time programme:	
Course title in Polish	**Technologia przeróbki plastycznej**	
Course title in English	**Metal Forming: Analysis of Process Parameters**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**second-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**Design and Manufacturing**
Department responsible	**Department of Metal Science and Manufacturing Processes**
Course leader	**dr inż. Tomasz Miłek**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**specialism-related**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester I**
	part-time programme	**Semester I**
Pre-requisites		
Examination required (YES/NO)		**NO**
ECTS value		**2**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**15**			**15**	
	part-time programme					

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	On completion of the course, the student will have detailed and in-depth knowledge of the technology of manufacturing multi-stage draw pieces using the multi-operational deep drawing method from a sheet blank in metal forming.	**MiBM2_W05**
Skills	U01	On completion of the course, the student will be able to develop the technological documentation concerning the implementation of an engineering task using specialist terminology from the area of mechanical engineering with particular emphasis on the metal forming. The student will be able to prepare a text containing a discussion of the results of the implementation of this task. The student will be able to analyze and synthesize the obtained results.	**MiBM2_U04**
	U02	On completion of the course, the student will be able to design the technological process of metal forming by multi-operational deep drawing of typical machine parts in the area of mechanical engineering and select appropriate machines and devices for this purpose.	**MiBM2_U07**
Competence	K01	Student is aware of the need to independently supplement and expand knowledge in the field of mechanical engineering with particular emphasis on the metal forming. Student is ready to critically evaluate the knowledge he possesses, the importance of knowledge in solving technological problems related to metal forming and the need to acquire new information both from literature and from experts in the field of mechanical engineering.	**MiBM2_K01**

COURSE CONTENT

Mode of instruction	Topics covered
lecture	Characteristics of sheets and strips for deep drawing processes. Classification of circularly symmetrical draw pieces and methods of their manufacturing. Preparation of starting material for deep drawing (sheet metal cutting methods). Principles of drawing multi-stage draw pieces from a blank: calculating the blank diameter, determining the width of the belt or strip and the feed stroke, analysis of cutting sheet metal into belts, determining the number and sequence of deep drawing procedures, principles of forming shoulders, principles of drawing conical and curvilinear draw pieces, deformation in deep drawing procedures, annealing of draw pieces, pickling and cleaning, lubrication in deep drawing procedures. Forming forces of draw pieces in individual operations. Selection of presses for the implementation of deep drawing procedures.
project	Development of technology for deep drawing a circularly symmetrical multi-stage draw piece without thinning the wall on single-stage and compound dies for a given drawing and dimensions (as part of the project, appropriate calculations will be performed according to literature guidelines together with drawings of the draw pieces in individual operations and development of operation sheets for the process of forming a multi-stage draw piece under industrial conditions).

ASSESSMENT METHODS

Outcome code	Methods of assessment					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
U01				X		
U02				X		
K01						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	The pass mark is a minimum of 50% for the final in-class test
project	non-examination assessment	The pass mark is a minimum of 50% for the process planning project.

OVERALL STUDENT WORKLOAD

ECTS weighting												
No.	Activity type	Student workload										Unit
		full-time programme					part-time programme					
1.	Scheduled contact hours	L	C	Lb	P	S	L	C	Lb	P	S	h
		15			**15**							
2.	Other contact hours (office hours, examination)	**2**			**2**							h
3.	**Total number of contact hours**	**34**										h
4.	**Number of ECTS credits for contact hours**	**1,4**										ECTS
5.	**Number of independent study hours**	**16**										h
6.	**Number of ECTS credits for independent study hours**	**0,6**										ECTS
7.	**Number of practical hours**	**25**										h
8.	**Number of ECTS credits for practical hours**	**1,0**										ECTS
9.	**Total study time**	**50**										h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**2**										ECTS

READING LIST

1. Erbel J. i inni.: *Encyklopedia technik wytwarzania stosowanych w przemyśle maszynowym.* T. 1. Oficyna Wydawnicza Politechniki Warszawskiej. Warszawa 2001.
2. Golatowski T.: *Projektowanie procesów tłoczenia i tłoczników*. Wydawnictwo Politechniki Warszawskiej. Warszawa 1991.
3. Kajzler S., Kozik R., Wusatowski R.: *Wybrane zagadnienia z procesów obróbki plastycznej metali. Projektowanie technologii.* Wydawnictwo Politechniki Śląskiej. Gliwice, 1997.
4. Kapiński S.: *Kształtowanie elementów nadwozi samochodów*. Wydawnictwo Komunikacji i Łączności, Warszawa 1996.

5. Lange K.: *Handbook of metal forming*, 1975
6. Marciniak Z.: *Odkształcenia graniczne przy tłoczeniu blach.* WNT, Warszawa, 1961
7. Morawiecki M., Sadok L., Wosiek E.: *Teoretyczne podstawy technologicznych procesów przeróbki plastycznej.* Wydawnictwo Śląski, Katowice, 1977.
8. Pacanowski J.: *Projektowanie procesów ciągnienia wytłoczek kołowo-symetrycznych i konstrukcji tłoczników.* Tom 1. *Metody i zasady ciągnienia wytłoczek kołowo-symetrycznych.* Politechnika Świętokrzyska, Kielce, 2018.
9. Pater Z., Samołyk G.: *Podstawy technologii obróbki plastycznej metali.* Wydawnictwo Politechniki Lubelskiej, Lublin 2013
10. Romanowski W.P.: *Poradnik obróbki plastycznej na zimno.* WNT, Warszawa 1976