

**COURSE SPECIFICATION**

Course code	full-time programme:	M#2-S1-ME-KWW-607
	part-time programme:	
Course title in Polish	Projektowanie procesów obróbki plastycznej	
Course title in English	Metal Forming Design	
Valid from (academic year)	2024/2025	

GENERAL INFORMATION

Programme of study	MECHANICAL ENGINEERING
Level of qualification	first-cycle
Type of education	academic
Mode of study	full-time programme
Specialism	Computer-Aided Manufacturing
Department responsible	Department of Metal Science and Manufacturing Processes
Course leader	dr inż. Tomasz Milek
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 VI
	part-time programme	
Pre-requisites	Fundamentals of Metal Forming, Metal forming	
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
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Knowledge	W01	On completion of the course, the student will have knowledge of the classification of draw pieces and treatments necessary to perform them.	MiBM1_W11
	W02	On completion of the course, the student will have knowledge of the rules of developing technological processes of deep drawing circular-symmetric draw pieces	MiBM1_W11 MiBM1_W15
	W03	On completion of the course, the student will have knowledge of the classification of forgings and forging treatments necessary for their performance.	MiBM1_W11 MiBM1_W15
	W04	On completion of the course, the student will have knowledge of the rules of developing technological processes of forging circular-symmetrical and elongated forgings.	MiBM1_W11 MiBM1_W15
Skills	U01	On completion of the course, the student will be able to use the acquired knowledge to independently develop the technological documentation of the stamping process of circular-symmetric draw pieces.	MiBM1_U04 MiBM1_U08
	U02	On completion of the course, the student will be able to use the acquired knowledge to independently develop technological documentation for the forging process of circular-symmetric forgings on various forging machines.	MiBM1_U04 MiBM1_U08
Competence	K01	Students are aware of the need to critically assess and update their expertise from metal forming and by exchanging knowledge and experiences with other metal forming experts	MiBM1_K01
	K02	Students are able to individually supplement and broaden their knowledge in the area metal forming	MiBM1_K03

COURSE CONTENT

Type of instruction	Topics covered
lecture	Classification of drawpieces and rules for their forming by drawing and redrawing. Rules for determining the diameter of the blank, determining the width of the belt or tape and the feed pitch. Analysis of the cutting of metal sheets into belts. Principles and methods for determining the number of drawing treatments of various types of cylindrical draw pieces. Principles of selection of deep drawing coefficients and correction of deep drawing coefficients. Principles of determining the dimensions of single- and multi-stage draw pieces. Principles of selecting the radii of rounding edges of the draw piece. Methods of determining forces of cutting and stamping of draw piece. Principles of determining material deformation and parameters of annealing workpieces. Classification of die forgings. Principles of development the drawing of the forging and determining or selecting the necessary parameters. Methods for determining the volume of the forgings and the principles of selecting tolerances and dimensional deviations. The role and parameters of flash for forging in open dies on hammers, presses and forging machines. Rules for determining the parameters of the initial material for circular-symmetric forgings. Principles of determining the plastic deformation work and selection of the hammer and the pressure force of the press and selection of the press. Principles of determining the pressure force of a forging machine. Discussion of the flash trimming and punching of the forgings and the principles of determining the forces necessary to perform these procedures.
project	Project 1 – Development of the technology of stamping a drawpiece





	Selection of machining allowance. Division of the drawpiece into elementary fields and determination of its total surface area. Determining the diameter of the blank. Calculating the belt width and feed stroke. Determination of parameters for cutting metal sheets into belts and the degree of material utilization. Selection of the sheet and the method of its division. Checking the possibility of drawing draw piece in one drawing treatment. Checking the possibility of drawing of the drawpiece in one drawing treatment. Determination of the number of drawing treatments and determination of the drawing and redrawing coefficients for individual drawing treatments of the drawpiece. Selection of the radii of rounding of the edges of the drawpiece and determination of the dimensions of the drawpieces in individual drawing treatments. Drawing successive single-stage draw pieces. Checking the possibility of drawing an offset in one drawing treatment. Determination of the treatments number of drawing an offset and determination of the coefficients of redrawing for subsequent drawing treatments. Selection of the radii of rounding of the edges of the draw piece and determination of the dimensions of the draw pieces in individual drawing treatments of an offset. Drawing successive two-stage draw pieces. Calculation of forces in drawing and cutting treatments. Calculation of the deformation after subsequent drawing treatments.
	Project 2 – Development of the forging technology of a circular-symmetric dropforging Determination of material properties and forging parameters. Calculation of the product volume. Development of the drawing of the forging: – determination of the location of the forging division plane, – selection of machining allowances, – selection of edge rounding radii, – selection of forging inclinations, Making a drawing of the forging. Determination of tolerances and dimensional deviations and other parameters of the forging. Calculating the volume of the forging. Calculating the thickness of the flash and selecting the flash gap. Drawing of a flash gap. Determination of parameters of the initial material. Calculation of the plastic deformation work and selection of the hammer size (or calculation of the pressure force of the press and selection of the press).
	A pass mark for two projects.

ASSESSMENT METHODS

Outcome code	Methods of assessment <i>(Mark with an X where applicable)</i>					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
W04			X			
U01				X		
U02				X		
K01						X
K02						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 for two process planning projects. The final mark is an arithmetic average.

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 <i>1 ECTS credit = 25-30 hours of study time</i>	2										ECTS

READING LIST

1. Golatowski T., Projektowanie procesów tłoczenia i tłoczników, Wydawnictwo Politechniki Warszawskiej, Warszawa 1984.
2. Kajzler S., Kozik R., Wusatowski R.: Wybrane zagadnienia z procesów obróbki plastycznej metali. Projektowanie technologii, Wydawnictwo Politechniki Śląskiej, Gliwice 1997.
3. Muster A.: Kucie matrycowe. Projektowanie procesów technologicznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2002.
4. Muster A.: Technologia obróbki plastycznej. Część V - Kucie matrycowe na gorąco. Wydawnictwo SIMP, Warszawa 1987
5. Pacanowski J., Chałupczak J.: Projektowanie procesów kucia matrycowego odkuwek kołowo-symetrycznych na młotach i prasach korbowych. Wydawnictwo Politechniki Świętokrzyskiej w Kielcach, Kielce 2011.
6. Pacanowski J.: Zasady projektowania technologii kucia odkuwek matrycowych o kształtach kołowo-symetrycznych. Wydawnictwo Politechniki Świętokrzyskiej w Kielcach, Kielce 2021
7. Pacanowski J.: Projektowanie procesów ciągnięcia wytłoczek kołowo-symetrycznych i konstrukcji tłoczników. Tom I – Metody i zasady ciągnięcia wytłoczek kołowo-symetrycznych, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2018.





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8. Pacanowski J.: Projektowanie procesów ciągnięcia wytłoczek kołowo-symetrycznych i konstrukcji tłoczników. Tom II – Konstrukcja i klasyfikacja tłoczników, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2018.
9. Pater Z., Gontarz A., Weroński W.: Obróbka plastyczna. Obliczanie sił kształtowania, Wydawnictwo Uczelniane Politechnika Lubelska, Lublin 2002.
10. Pater Z., Samołyk G.: Podstawy technologii obróbki plastycznej metali, Politechnika Lubelska, Lublin 2013.
11. Romanowski W.P.: Poradnik obróbki plastycznej na zimno, WNT, Warszawa 1976.
12. Samołyk G., Pater Z.: Rowek na wpływkę w kuciu matrycowym. Lubelskie Towarzystwo Naukowe, Lublin 2005.
13. Sińczak J. i inni: Podstawy procesów przeróbki plastycznej. Wydawnictwo Naukowe AKAPIT Kraków 2010.
14. Sińczak J. i inni: Procesy przeróbki plastycznej. Wydawnictwo Naukowe AKAPIT, Kraków 2001.
15. Wasiuń P.: Kucie matrycowe. Wydawnictwo WNT, Warszawa 1984.
16. Wasiuń P.: Kucie na kuźniarkach. Wydawnictwo N-T, Warszawa 1973.
17. Polish Standards



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