Kielce University of Technology

FACULTY OF MECHATRONICS AND MECHANICAL ENGINEERING

Annex 9
to the Rector's Ordinance No. 35/19
of 12 June 2019

COURSE SPECIFICATION

Course code	**M#1-S1-ME-KWW-509**
Course title in Polish	**Podstawy projektowania procesów obróbki plastycznej**
Course title in English	**Fundamentals of Metal Forming Design**
Valid from (academic year)	**2019/2020**

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time**
Specialism	**Computer-Aided Manufacturing**
Department responsible	**Department of Metal Science and Manufacturing Processes**
Course leader	**Dr inż. Jarosław Pacanowski**
Approved by	

COURSE OVERVIEW

Course type	**specialism-related**
Course status	**compulsory**
Language of instruction	English
Semester of delivery	**semester 5**
Pre-requisites	**Fundamentals of Metal Forming**
Examination required (YES/NO)	NO
ECTS value	**3**

Mode of instruction	**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	**15**			**30**	

LEARNING OUTCOMES

Category of outcome	Out-come code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	On completion of the course, the student will have knowledge of the classification of drawpieces and treatments necessary to perform them.	**MiBM_W10 MiBM_W11 MiBM1_W12 MiBM1_W19**
	W02	On completion of the course, the student will have knowledge of the rules of developing technological processes of deep drawing circular-symmetric drawpieces	**MiBM_W10 MiBM_W11 MiBM1_W12 MiBM1_W19**
	W03	On completion of the course, the student will have knowledge of the classification of forgings and forging treatments necessary for their performance.	**MiBM_W10 MiBM_W11 MiBM1_W12 MiBM1_W19**
	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.	**MiBM_W10 MiBM_W11 MiBM1_W12 MiBM1_W19**
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 drawpieces.	**MiBM1_U02 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 and elongated forgings on various forging machines.	**MiBM1_U02 MiBM1_U04 MiBM1_U08**
	U03	On completion of the course, the student will be able to work individually and in a team, and will be able to estimate the time needed to perform tasks related to the design of technological processes.	**MiBM1_U020**
	U04	On completion of the course, the student will ability to self-educate in order to solve problems related to the design of metal forming processes	**MiBM1_U021**
Competence	K01	On completion of the course, the student will understand the need for lifelong learning in order to improve professional qualifications regarding the preparation of technological documentation of metal forming processes, which increases his professional competences.	**MiBM1_K01**
	K02	On completion of the course, the student will be aware of responsibility for their own work and responsibility for the tasks performed.	**MiBM1_K04**
	K03	On completion of the course, the student will be aware of the social role of a graduate of a technology-oriented university and understand the need to inform in a comprehensive way the general public about accomplishments in mechanical engineering.	**MiBM1_K06**

COURSE CONTENT

Type of instruction*	Topics covered
lecture	1. 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

	2. Principles and methods for determining the number of drawing treatments of various types of cylindrical drawpieces. Principles of selection of deep drawing coefficients and correction of deep drawing coefficients.
	3. Principles of determining the dimensions of single- and multi-stage drawpieces. Principles of selecting the radii of rounding edges of the drawpiece. Methods of determining forces of cutting and stamping of drawpiece. Principles of determining material deformation and parameters of annealing workpieces.
	4. Classification of die forgings. Principles of development the drawing of the forging and determining or selecting the necessary parameters.
	5. 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.
	6. Principles of forging elongated forgings on hammers and forging machines. Principles of developing an ideal forging preform for hammer forging technology. Rules for the selection of auxiliary blanks for forging an ideal forging preform. Principles of determining parameters of the forging stock for elongated forgings.
	7. Principles of upsetting and initial upsetting used in forging machines. Rules for determining the parameters of the initial material for elongated and circularly symmetric forgings.
	8. 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 two-stage drawpiece with a collar.**
	1. Selection of an allowance for trimming the collar. 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.
	2. 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 posibility of drawing drawpiece in one drawing treatment.
	3. Checking the possibility of drawing the upper part 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 upper part of the drawpiece.
	4. Selection of the radii of rounding of the edges of the drawpiece and determination of the dimensions of the drawpieces in individual drawing treatments of the upper part. Drawing successive single-stage drawpieces.
	5. 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.
	6. Selection of the radii of rounding of the edges of the drawpiece and determination of the dimensions of the drawpieces in individual drawing treatments of an offset. Drawing successive two-stage drawpieces.
	7. Calculation of forces in drawing and cutting treatments. Calculation of the deformation after subsequent drawing treatments. Preparation of a technological card for the developed technology of stamping a drawpiece.
	Project 2 – Development of the forging technology of a circular-symmetric forging
	1. Determination of material properties and forging parameters. Calculation of the product volume.

	2. 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, – determination of the bottom thickness and its location.
	3. Making a drawing of the forging. Determination of tolerances and dimensional deviations and other parameters of the forging.
	4. Calculating the volume of the forging. Calculating the thickness of the flash and selecting the flash pan. Drawing of a flash pan.
	5. 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).
	6. Preparation of a technological card for the developed technology of forging a forgings with a given shape and dimensions
	7. A pass mark for two projects.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
W04			X			
U01				X		
U02				X		
U03				X		
U04				X		
K01						X
K02						X
K03						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	A pass mark for two process planning projects.

OVERALL STUDENT WORKLOAD

ECTS weighting							
	Activity type	**Student workload**					**Unit**
1.	Scheduled contact hours	L	C	Lab	P	S	h
		15			**30**		
2.	Other contact hours (office hours, examination)	**2**			**2**		h
3.	**Total number of contact hours**	**49**					
4.	**Number of ECTS credits for contact hours**	**2**					

5.	**Number of independent study hours**	**26**	
6.	**Number of ECTS credits for independent study hours**	**1**	
7.	**Number of practical hours**	**50**	
8.	**Number of ECTS credits for practical hours**	**2**	
9.	**Total study time**	**75**	
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**3**	

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