



### MODULE DESCRIPTION

Module code	full-time studies:	<b>Z-ZIP1-E-631</b>
	part-time studies:	<b>Z-ZIPN1-E-631</b>
Module name	<b>New Products Prototyping</b>	
Module name in Polish	<b>Prototypowanie nowych wyrobów</b>	
Valid from academic year	<b>2019/2020</b>	

### MODULE PLACEMENT IN THE SYLLABUS

Field of study	<b>MANAGEMENT AND PRODUCTION ENGINEERING</b>
Level of education	<b>1st degree</b>
Studies profile	<b>General</b>
Form and method of conducting classes	<b>Full-time and Part-time</b>
Specialisation	<b>Production and Innovation Management</b>
Unit conducting the module	<b>Department of Production Engineering</b>
Module co-ordinator	<b>Artur Szmidt, PhD</b>
Approved by:	<b>Dariusz Bojczuk, PhD, DSc</b>

### MODULE OVERVIEW

Type of subject / group of subjects	<b>Specialist subject</b>
Module status	<b>Non-compulsory</b>
Language of conducting classes	<b>English</b>
Module placement in the syllabus - semester	<b>Semester VI</b>
Initial requirements	<b>Mechanics Materials Strength Engineering Design</b>
Examination (YES/NO)	<b>NO</b>
Number of ECTS credit points	<b>2</b>

Method of conducting classes		Lecture	Classes	Laboratory	Project	Other
Per semester	full-time studies:	<b>15</b>		<b>15</b>		
	part-time studies:	<b>9</b>		<b>9</b>		

## TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	A student has knowledge as regards preparing documentation and product manufacturing technology.	ZIP1_W07 ZIP1_W09
	W02	A student has knowledge as regards the technology of manufacturing prototypes with stereolithography methods as well as other methods in 3D.	ZIP1_W02
	W03	A student has knowledge as regards preparing documentation which concerns submitting an application to the Intellectual Property Centre at Kielce University of Technology.	ZIP1_W04 ZIP1_W06 ZIP1_W16
Skills	U01	A student can assess the usefulness of the selected technology to manufacture his/her own products.	ZIP1_U03
	U02	A student is able to make a project of a CAD-3D product, prepare a method of positioning the product on a machine platform, and initiate printing elements in 3D.	ZIP1_U03 ZIP1_U17
	U03	A student can make appropriate drawings, develop a product manufacturing technology and prepare an application to the Intellectual Property Centre.	ZIP1_U11
Social competences	K01	A student understands the necessity of having skills as regards creating new devices; a student is also able to make necessary calculations and to develop a manufacturing technology.	ZIP1_K01 ZIP1_K04
	K02	A student is aware of new prototype manufacturing methods in a three-dimensional space.	ZIP1_K01 ZIP1_K04
	K03	A student is capable of preparing patent documentation or an industrial design to the Intellectual Property Centre.	ZIP1_K01 ZIP1_K04

## TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	<p>Review of contemporary technologies for the production of products. Technical preparation of new products.</p> <p>The beginnings of shaping elements using the stereolithography method. 3D printing methods, methods: SL, SLA, SLS, FDM, LENS, 3DP - 3D Proting, IJP, LOM</p> <p>Designing new objects and virtually imaging their geometry. CAD methods and programs. Acquisition and processing of spatial data for three-dimensional reconstruction of physical objects.</p> <p>Structures of machine elements and mechanical mechanisms and their engineering calculations.</p> <p>Verification of geometric models of designed objects through physical models with the use of additive technologies. The use of modern methods of measuring the shape to verify the accuracy of the prototype produced on 3D printers.</p> <p>Reverse engineering in engineering design. Methods of acquiring virtual data and their processing methods.</p> <p>Generating G-CODE codes in systems, code analysis.</p> <p>Preparation of CAD models for incremental printing, printing parameters, cleaning of products and their processing.</p>

Laboratory	Review of projects made by students and databases of the Patent Office Developing your own idea for a device, utility model, etc. and making a sketch with a description of the principle of operation. Design and strength calculations of individual elements. Assembling the initial part of the structure and possible corrections - SolidWorks Development of technology for the implementation of your own idea, with the estimate of the cost estimate, unit and serial production. Preparation and completion of the patent application form to the Intellectual Property Protection Center.
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## METHODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes (select X)					
	Oral exam	Written exam	Test	Project	Statement	Other
W01				X		
W02				X		
W03				X		
U01				X		
U02				X		
U03				X		
K01				X		
K02				X		
K03				X		

## FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Credit with grade	Completion of the project, additional questions on the subject of the lectures
Laboratory	Credit with grade	Implementation of the project correctly.

## STUDENT WORKLOAD

Balance of ECTS points												
No.	Type of student's activity	Student's workload										Unit
		full-time					part-time					
1.	Participation in the activities	Lc	C	Lb	P	O	Lc	C	Lb	P	O	h
		15		15			9		9			
2.	Other (consultation, exam)	2		2			2		2			h
3.	Number of hours of a student's as- sisted work	34					22					h
4.	Number of ECTS credit points which are allocated for assisted work	1,4					0,9					ECTS
5.	Number of hours of a student's un- assisted work	16					28					h
6.	Number of ECTS credit points which a student receives for unassisted work	0,6					1,1					ECTS
7.	Work input connected with practical classes	25					25					h
8.	Number of ECTS credit points which a student receives for practical classes	1,0					1,0					ECTS
9.	Total number of hours of a stu- dent's work	50					50					h
10.	Punkty ECTS za modul <i>1 ECTS=25 hours</i>	2										ECTS

## LITERATURE

1. Fabian M. (2022), *Reverse Engineering and Rapid Prototyping in the Process of Developing Prototypes of Automotive Parts*, Manufacturing Technology, 22 (6), 669-678.
2. Kolar V.D, (2008), *Application of Reverse Engineering and Rapid Prototyping to Casting*, ETD Archive. 432.  
(<https://engagedscholarship.csuohio.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1431&context=etdarchive>)
3. Kumar K., Zindani D., Davim J.P. (2020), *Rapid Prototyping, Rapid Tooling and Reverse Engineering*, De Gruyter (<https://dokumen.pub/rapid-prototyping-rapid-tooling-and-reverse-engineering-from-biological-models-to-3d-bioprinters-9783110664904-9783110663242.html>)