Course code: ……. **Plan position:** ……

A. INFORMATION ABOUT THE COURSE

B. Basic information

Name of course	Recycling and Sustainable Development
Field of studies	Mechanical Engineering
Level of studies	First degree
Profile of studies	Academic
Form of studies	Full-time
Specialty	Research and Development Production Maintenance
Unit responsible for the field of studies	Faculty of Mechanical Engineering
Name and academic degree of teacher(s)	Piotr Szewczykowski, PhD Artur Kościuszko, PhD
Introductory courses	Materials Science and Engineering, Polymer Science and Processing, Manufacturing techniques
Introductory requirements	Basic knowledge in chemistry, physics, and mathematics, knowledge of MS Office package, ability to use databases of scientific publications.

C. Semester/week schedule of classes

Semester	Lectures (W)	Auditorium classes (Ć)	Laboratory classes (L)	Project classes (P)	Seminar (S)	Field classes (T)	Number of ECTS points
Winter/Summer	20		15				4

2. LEARNING OUTCOME

No.	Learning outcomes description	The reference to the learning outcomes of specific field of study	The reference to the learning outcomes for the area
KNOWLEDGE			
K1	A student has in-depth knowledge of integrated production and recycling systems	K_W08	P7S_WG
SKILLS			
S1	A student is able to obtain information from literature, databases, experts and other sources; is able to integrate the obtained information, interpret it, draw conclusions and formulate and justify opinions	K_U01	P7S_UW
S2	A student is able to formulate and test hypotheses related to engineering problems and simple research problems	K_U05	P7S_UW
SOCIAL COMPETENCES			
SC1	A student is aware of the importance and understands the non-technical aspects and effects of engineering activities,	K_K04	P7S_KO P7S_KR

	including their impact on the environment, and the related responsibility for decisions made		

3. TEACHING METHODS

A. Traditional methods used ***

multimedia lecture, laboratory, and other methods, e.g., CES Edupack software, videos, books, catalogs, diagrams, blackboard, online techniques, exercise workbook classes

B. Distance learning methods used ***

Synchronous method (classes conducted in a way that ensures direct interaction between the student and the teacher in real time, enabling immediate flow of information, the method can be used only if it is provided for in the study plan for a given cycle of education): e.g. remote lecture in the form of videoconference, remote discussion, etc.
Asynchronous method used as an auxiliary (a method that does not ensure direct interaction between the student and the teacher in real time, used only as an auxiliary / complementary method): e.g. online educational videos, online multimedia presentations, etc.

4. METHODS OF EXAMINATION

Written test/colloquium, reports from laboratory work

5. SCOPE

Lectures	Theory and tools of physical separation, recycling rare metals, recycling of steel, copper recycling, lead recycling, paper recycling, zinc recycling, recycling of rare metals, plastic recycling, glass recycling, separation of large municipal solid wastes, materials, energy and sustainability, materials supply-chain risks, scaling up biopolymers production, case studies
Laboratories	Grinding of polymeric materials, recycling rubber from car tires, particle size and distribution determination, separation of plastic waste and mixed waste based on differences in the physical properties of the components, processing of recycled materials, multiple processing of polyolefin waste and its characterization, comparison of mechanical properties of original and recycled materials

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES

LEARNING OUTCOME	Form of assessment					
	Oral examination	Written exam	Colloquium	Project	Reports	Class attendance
K1			x		x	x
S1-S2			x		x	x
SC1			x		x	x

7. LITERATURE

Basic literature	- Worrell E, Reuter MA, 2014, Handbook of Recycling, Elsevier Ltd, The Boulevard, Langford Lane, Kidlington, Oxford - Ashby MF, 2016, Materials and Sustainable Development, Elsevier Ltd, The Boulevard, Langford, Lane, Kidlington, Oxford
Supplementary literature	- Rudolph N, Kiesel R, Aumnate C, 2017, Understanding Plastics Recycling, Hanser Publishers, Munich

8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity		Student workload– number of hours
Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes	Participation in classes indicated in point 1B	35
	Supervision hours	10
Student's own work	Preparation for classes	10
	Reading assignments	30
	Other (preparation for exams, tests, carrying out a project etc)	20
Total student workload		105
	Number of ECTS points	4