

Module/Subject Syllabus Summary
Mechanical Engineering
 Undergraduate studies (BA)

Subject:	Polymer processing
Subject type:	Compulsory
Subject code:	MBM
Year:	I
Semester:	2
Form of studies:	Full-time course
Type of classes and hours per semester:	45
Lecture	15
Exercise	-
Laboratory practice	30
Project	-
ECTS points:	3
Form of credit:	Assessment
Lecture language:	English

Subject objective	
C1	To familiarize students with the knowledge concerning methods of obtaining products of the polymer materials and the construction and operation of processing machines and tools.
C2	Preparing students for the correct application of processing methods in the engineering work and practical knowledge of selected methods of processing of polymeric materials.
C3	Preparing students for correct solving of engineering problems in the field of construction and polymers processing technology.
C4	Make students aware of the importance and responsibility of an engineer's work in the environment associated with the processing of polymers.

Prerequisites in knowledge, skills and other competencies	
1	The student should have knowledge, skills and competences in the subject " polymer materials"
2	The student should have knowledge, skills and competences in the subject "basics of machine design."

Educational effects	
	Knowledge:
EK 1	The student has an extended and in-depth knowledge of design and technology of machines for polymers processing.
EK 2	The student has knowledge of construction of tools and machines for polymers processing
EK 3	The student is familiar with current state and development trends and the most



	significant latest achievements in the field of mechanical engineering and tools for polymers processing.
	Skills:
EK 4	Students can work individually and in a team, planning and carrying out and interpreting the obtained results and drawing appropriate conclusions.
EK 5	The student is able to design a technological process of processing to ensure the achievement of the most effective process and product indicators.
EK 6	The student can choose the tools and technological equipment necessary to perform engineering tasks in the field of design and technology of machines for polymers processing with the latest developments.
	Social competencies:
EK 7	The student has a sense of responsibility for the work and sense of responsibility resting on the individual with an engineering degree.

Curriculum content of Subject	
Form of classes – Lecture	
	Curriculum content
W1	Sense of responsibility for the work and sense of responsibility resting on the individual with an engineering degree.
W2	General knowledge. The classification of processing methods. Basics of rheology. The flow curves, mathematical models of Newtonian and non-Newtonian fluids.
W3	Processability of the materials, the processability indicators, melt flow index, press formability, the length of the material spiral, Brabender universal testing device.
W4	Plasticization. Types of plasticizing systems. screw-barrel system: Single- and multiscrews system. Construction of screws and barrels. Hopper and feed zone. Passive and active grooved feed section. An outline of the theory of the single screw system.
W5	Methods of first kind physic-chemical processing. Joining – Bonding and welding. Expanded polystyrene foam.
W6	Methods of second kind physico-chemical processing. Extrusion. Kinds of extrusion: piston, auto-thermal, blow molding, foam, coating, co-extrusion. Construction and types of extrusion heads. Injection molding. Variety of injection molding process: multiple, foam, thermosets materials, gas-assisted, assisted with water. Construction of the injection molding form (cold and heated channels). Press moulding and its variants – pre-pressing, high pressure pressing and low pressure pressing. Rotational molding, calendering.
W7	Methods of chemical and physical processing. Fluidization and metalization.
W8	Extrusion process lines, preparatory and finishing supplementary devices. Technological injection molding stands.

Class form: laboratory practice	
Curriculum content	
L1	Introductory classes: health and safety training, rules of completing the course, the division into subgroups, exercise schedule.
L2	Processability of the materials. The melt flow index.
L3	The joining of materials. The methods of bonding and welding of materials. Heat sealing capacitive and resistive process.
L4	Extrusion of profiles. Structure and functions of the extrusion process line. The process of extrusion.
L5	Extrusion with film blow moulding. Methods for blown film extrusion. The construction and operation of the elements of the technological line. The process run.
L6	Extrusion with hot pelletizing. Characteristics of the process.
L7	Co-rotating twin screw extrusion.
L8	Injection molding of thermoplastics. Structure and function of the injection molding machine units. The cycle of injection molding process and the main parameters. The process run.
L9	Injection molding - the length of the spiral of material.
L10	Piston injection molding.
L11	Pre-press moulding - palletizing. Methods of pre-press moulding, tools and machines applied. The process run.
L12	High-pressure moulding. Moulding plasticity. Compression molding. Cycle pressing process and the main parameters. The process run.
L13	Rotational molding of polymers. Construction and operation of the machine for casting. The process run.
L14	Fluidization
L15	Examination

Teaching methodology	
1	Lecture – information lecture using multimedia techniques
2	Laboratory - a demonstration of selected machines, tools and equipment with explanations and descriptions
3	Laboratory - The activating method with students practical activity

Student workload	
Form of activity	Average hours to complete activity
Teacher contact hours, including:	48
Attendance at lectures	15
Attendance at laboratory practice	30
Consultation	3
Student own work, including:	45
Preparation for laboratory practice	30



Preparation for classes	15
Total student work time	93
Total subject ECTS credits	3
Total of ECTS for practical classes (exercise, laboratory practice, projects)	3

Basic reference literature	
1	Sikora R.: Przetwórstwo tworzyw wielkocząsteczkowych. Wydawnictwo Edukacyjne, Warszawa 1993.
2	Praca zbiorowa pod red R. Sikory: Przetwórstwo tworzyw polimerowych. Podstawy logiczne, formalne i terminologiczne. Wydawnictwo Politechniki Lubelskiej, Lublin 2006.
3	White J.L., Potente H.: Screw Extrusion. Carl Hanser Verlag, Munich 2003.
4	Bociąga E.: Specjalne metody wtryskiwania tworzyw polimerowych. Wydawnictwa Naukowo-Techniczne, Warszawa 2008.

Educational effect matrix					
Educational effect	Specific educational effect reference to curriculum-wide effects (PEK)	Subject objective	Curriculum content	Teaching methodology	Evaluation methods
EK 1	MBM2A_W08	C1, C2, C3	W2÷W8, L2÷L8	1, 2, 3	O1, O2, O3
EK 2	MBM2A_W09	C1, C2, C3	W2÷W8, L2÷L8	1, 2, 3	O1, O2, O3
EK 3	MBM2A_W13	C1, C2, C3	W2÷W8, L2÷L8	1, 2, 3	O1, O2, O3
EK 4	MBM2A_U19	C2	L2÷L8	2, 3	O2, O3
EK 5	MBM2A_U24	C1, C3	W2÷W8	1	O1
EK 6	MBM2A_U18 MBM2A_U15	C1, C3	W2÷W8	1	O1
EK 7	MBM2A_K03	C4	W1 L1	1	O1, O2, O3

Evaluation methods and criteria		
Evaluation method symbol	Evaluation method description	Pass threshold
O1	Written lecture assessment	50%
O2	Short tests during the laboratory.	50%
O3	Student work in the form of a report from the laboratory exercises	100%



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