

module title: POLYMER PROCESSING		
field of study: Mechanical Engineering	type of study: full-time	course code: S6_3-10
course: Modelling & Simulation in Mechanics	degree: Master (MSc)	year: I semester: I
type of classes: lecture, laboratory	hours per week: 3L, 5Lab	No of ECTS credits: 8

MODULE DESCRIPTION

TARGETS

- T1.** Provide theory of different polymer processing methods and acquire capabilities to adjust processing parameters.
- T2.** Provide knowledge of plastic part design basics and tool design basics and acquire basic skills in design using a CAD software.
- T3.** To acquire capabilities to perform simulation of injection moulding process and provide knowledge about computer aided engineering in polymer processing.

PREREQUISITES & ADDITIONAL REQUIREMENTS

- R1.** Fundamentals of physics, chemistry, mathematics, mechanics and thermodynamics.
- R2.** Fundamentals of materials science.
- R3.** Safety rules during the use of laboratory equipment and technological machines.
- R4.** Capability of using source literature.
- R5.** Capability of individual work and collaboration in a group.
- R6.** Data analysis and presentation of results.

LEARNING OUTCOMES

- LO1.** Knowledge on polymeric materials and their application.
- LO2.** Knowledge on different polymer processing methods - process, tools, products.
- LO3.** Knowledge on plastic part design and tool design basics.
- LO4.** Knowledge on injection moulding simulation method.
- LO5.** Ability to adjust basic processing parameters in selected polymer processing methods.
- LO6.** Ability to design simple injection moulded part.
- LO7.** Ability to perform simulation of conventional injection moulding process.

MODULE CONTENT

LECTURE	hours
L 1-2 – Polymers, plastics, blends, composites – materials for polymer processing	2
L 3-4 – Injection moulding	2
L 5-6 - Non-conventional injection moulding processes	2
L 7 – Metal injection moulding	1
L 8-9 – Extrusion	2
L 10 – Extrusion blow moulding	1
L 11 – Blown film extrusion, coextrusion	1
L 12 – Calendering	1
L 13 – Casting of polymer resins	1
L 14 – Rotational moulding	1
L 15 - Fiber spinning	1
L 16 – Compression moulding	1
L 17 - Thermoforming	1
L 18 – Welding of plastics	1
L 19 – Polymer coatings manufacturing	1
L 20 – EPS products manufacturing, EPS cutting	1
L 21-22 – Rubber processing	2
L 23-24 – Rapid Prototyping	2
L 25-30 – Plastic part design	6
L 31-38 – Tool design for polymer processing	8
L 39-45 – Simulation of polymer processing – basics	7

LABORATORY	hours
Lab 1-2 – Identification of polymers	2
Lab 3-4 – Melt Flow Rate measurement	2
Lab 5-8 – Injection moulding	4
Lab 9-10 – Extrusion, extrusion blow moulding	2
Lab 11-12 – Compression moulding of thermoset resins	2
Lab 13-14 – Thermoforming	2
Lab 15-16 – EPS (Expanded Polystyrene) product manufacturing and EPS cutting	2
Lab 17-18 – Welding of plastic films and other products	2
Lab 19-20 – Silicone mould making	2
Lab 21-22 – Casting of polymer resins	2
Lab 23 – Polymer coatings manufacturing by fluidization	1
Lab 24-25 – Rubber processing – compression moulding	2
Lab 26-35 – Plastics part design (e.g. injection moulded part) – computer laboratory	10
Lab 36-50 – Tool design (e.g. injection mould) – computer laboratory	15
Lab 51-75 – Simulation of injection moulding – computer laboratory	25

TEACHING TOOLS

1 - lecture with the use of multimedia presentations
2 - stands equipped with machines and other equipment for polymer processing
3 - instructions to laboratory exercises
4 - computer laboratory, software for injection moulding simulation, software for plastic part design and tool design

SOURCE LITERATURE

1. Osswald T.A., Baur E., Brinkmann S., Oberbach K., Schmachtenberg E.: International Plastics Handbook, Hanser Publishers, Munich 2006.
2. Rauwendaal C.: Understanding Extrusion. 2nd Edition, Hanser Publishers, Munich, Hanser Publications, Cincinnati, 2010.
3. Davis, B., Gramann, P., Rios, A., Osswald, T.: Compression Molding, HANSER 2003.
4. James L. Throne: Understanding Thermoforming, HANSER 2008
5. Autodesk Moldflow Insight. Design and Concept. Empimeth Consult. Lublin 2010.
6. Glenn L. Beall, James L. Throne: Hollow Plastic Parts: Design and Manufacture, HANSER 2004.
7. Malloy R.A.: Plastic Part Design for Injection Molding. An Introduction, HANSER 2011.
8. Menges G., Michaeli W., Mohren P.: How to Make Injection Moulds, Hanser Publishers, Munich 2001.
9. Stoeckhert, K. Menning, G.: Mould-Making Handbook, Hanser Publishers, Munich 1998.
10. Beaumont J.P.: Runner and Gating Design Handbook. Tools for Successful Injection Moulding, Hanser, Munich, Cincinnati, 2004.
11. Michaeli W.: Extrusion dies for plastics and rubber: design and engineering computations, Carl Hanser Verlag, Munich, 2003

TEACHERS

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