

Course: Polymer Science and Technology		
Language: English		
Lecturer: Prof. Zlata Hrnjak-Murđić, Assist. prof. Ljerka Kratofil Krehula		
TEACHING	WEEKLY	SEMESTER
Lectures	2	30
Laboratory	1	15
Seminar	1	15
		Overall: 60
		ECTS: 4.0

PURPOSE:

The aim is to introduce students to polymer science and technology. The knowledge includes polymer processes; bulk, solvent, suspension and emulsion polymerization. Basis of polymer thermodynamics of solubility, degradation, compatibility. Polymers waste management, methods for reducing the volume of plastic waste.

THE CONTENTS OF THE COURSE:

lectures:

1. Introduction to polymer science. Classification of polymers. Nomenclature of polymers.
2. Chain growth polymerization. Step growth polymerization. Catalysts.
3. Ionic polymerization: anionic and cationic polymerization. Living polymers.
4. Reaction of copolymerization. Lewis-Mayo equation. Typical copolymerization diagrams. Q-e scheme.
5. Ring-opening polymerization.
6. Polymer processes: Bulk polymerization and polymerization in solution. Suspension polymerization. Emulsion polymerization.
7. Reactors in polymer chemistry. Reactions of crosslinking.
8. 1st Partial exam
9. Polymer Materials; structure –properties relationships
10. Technology of plastics processing
11. Polymer degradation and stability (thermal degradation, oxidative and UV stability)
12. Thermodynamics of solubility, Compatibility of polymers blends and composites
13. Biopolymers
14. Polymer Waste Management and Sustainable development
15. 2nd Partial exam

Seminar:

- Making presentations and / or written seminar paper on a given topic

Laboratory:

1. Determination of molecular mass (viscosity)

2. Swelling of rubber
3. Identification of polymers: FTIR spectrophotometry, TGA, DSC
4. Extrusion

GENERAL AND SPECIFIC COMPETENCE:

General competences:

- understanding polymer systems during synthesis
- competence to understanding and analysing production processes of polymers
- understanding of the basic knowledge of synthesis, structure and properties
- competence to identify and solve problems in the field of waste plastics.

Specific competences:

- gaining knowledge about the synthesis of polymeric materials,
- understanding the mechanisms of catalytic polymerization process
- knowledge and competence of understanding the basic elements of chemistry and engineering materials related to the chemical composition, structure, manufacturing, properties and applications
- knowledge about the basic principles of environmental protection and polymers waste management
- ability to independently presenting lab results in written and oral form.

KNOWLEDGE TESTING AND EVALUATION:

Students have to attend lectures and seminars. They also have to write a report based on their lab exercises.

MONITORING OF THE COURSE QUALITY AND SUCCESSFULNESS:

Student survey

LITERATURE:

1. H. Mark, N. Bikales, C. Overberger, G. Menges, Encyclopedia of Polymer Science and Engineering, John Wiley & Sons, New York, Vol. 1-17, 1985-1989.
2. Joel R. Fried, Polymer Science and Technology, Prentice Hall Professional, USA, 2003.
3. L.A. Utracki: Polymer Alloys and Blends, Hanser Publishers, New York, 1989.
4. A. L. Andrady, Plastics and the Enviroment, J.Wiley & Sons, Hoboken, New Jersey, 2003.
5. A. Azapagic, A. Emsley, I. Hamerton Polymers, the Enviromental and Sustanible Development J. Wiley & Sons, N.Y. 2003.