STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Physical Chemistry of Polymers		**1010702211010700084**
Field of study: **Chemical Technology**	Profile of study (general academic, practical): **general academic**	Year /Semester: **1 / 1**
Elective path/specialty: **Polymer Technology**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time): **full-time**	
No. of hours: Lecture: **30** Classes: **-** Laboratory: **45** Project/seminars: **-**		No. of credits: **5**
Status of the course in the study program (Basic, major, other): **other**	(university-wide, from another field): **university-wide**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **5 100%** **5 100%**

Responsible for subject / lecturer:

dr hab. inż. Sławomir Borysiak
email: Slawomir.Borysiak@put.poznan.pl
tel. 61 665 3649
Wydział Technologii Chemicznej
ul. Berdychowo 4 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of polymer chemistry and plastics.
2	**Skills**	Student is able to search for information in scientific literature, databases and other properly chosen sources. Student is able to laboratory work and operate the scientific equipment.
3	**Social competencies**	Understanding the need for further education and improve their professional competences.

Assumptions and objectives of the course:

Gaining knowledge related to the physico-chemistry of polymers.

Knowledge related to research techniques used in the study of polymers.

Acquire the skill the prediction the macroscopic properties of polymeric materials based on their structure.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has a well-established and expanded knowledge in the field the physico-chemistry polymers - [K_W02]
2. The student has a well-established and expanded knowledge in the field molecular and supermolecular structure of polymers and phase transitions occurring in the polymers. - [K_W11]
3. The student knows the modern research methods of structure and properties of polymers and can find a relationship between structure and properties. - [K_W07]

Skills:

1. Student has the ability of analyzing and interpreting of the results of experiments in the field of physico-chemistry of polymers - [K_U01]
2. The student has the skills necessary to work in industrial environment and research teams on the analysis of polymer structure and relationships between structure and properties of polymers - [K_U18]
3. Student has the ability of presenting the results of laboratory exercises in the form of report. - [K_U06]

Social competencies:

1. Students can work in a team and have aware of their responsibility for your work and responsibility for the results of the team's work. - [K_K04]
2. Student is conscious of limitation of his knowledge and understands the need of further continuous education in the field of physico-chemistry of polymers. - [K_K01]
3. The student is able to think and act creatively as well as actively engage in solving problems - [K_K06]

Assessment methods of study outcomes

1. Rating of written exam (K_W02, K_W07, K_W11)
2. Evaluation of laboratory exercises and reports (K_U01, K_U06, K_U18)

Course description

- Introduction to macromolecules and physico-chemical of polymers.
- Basic issues concerning polymer structure. Intermolecular interaction of macromolecules.
- Isomerism and the stereochemistry of the polymer chain - conformation, configuration, chirality, tacticity.

I, II and III-row structures of polymers. Structure types of amorphous and crystalline polymers.

- Molecular weight ? definitions and importance. Methods for determining the molecular weight. Polydispersion. Influence of molecular weight on the rheological properties of polymers.
- Polymers: amorphous, crystalline, crosslinked, blends, gels.
- Amorphous state. Glass transition, models of glass transition. Glass temperature. Relationships between glass temperature and polymer structure, parameters affecting the glass temperature.
- Crystalline state, nucleation theory, kinetic of crystallization, Avrami model, Hoffman theory, polymer morphology, crystalline structure and melting process.
- Polymer solution: viscosity of polimer solution, relationships between viscosity and molecular weight, molecular theory of viscosity, miscibility of polymers, thermodynamics of the dissolution process, Flory-Huggins theory, lattice model, solubility parameter, phase diagrams of polymer solutions.
- Physical states and phase transitions of polymers. Viscoelasticity. Molecular interpretation of viscoelastic properties of solutions and polymer blends. Rouse theory and molecular reptation conception. Relaxation. Stress-strain relationships.
- Polymer networks, crosslink polymers, elastomers. Thermoelasticity.
- Blends and composites
- Research methods of structure and chase transitions of polymers. Thermal, spectroscopic, microscopy, and X-ray investigations.

Basic bibliography:

1. H. Galina, Fizykochemia polimerów, Wydawnictwo Politechniki Rzeszowskiej, Rzeszów, 1998.
2. W. Przygocki, A. Włochowicz, Fizyka polimerów, PWN, Warszawa, 2001.
3. Z. Florianczyk, S. Penczek, Chemia polimerów, tom. 1,2, Wydawnictwo Politechniki Warszawskiej, Warszawa, 1997.
4. W. Przygodzki, Metody fizyczne badań polimerów, PWN, Warszawa, 1990

Additional bibliography:

1. W. Przygocki, A. Włochowicz, Uporządkowanie makrocząsteczek w polimerach i włóknach, WNT, Warszawa 2006
2. H. Sperling, Introduction to Physical Polymer Science, J.Wiley, New York, 1992

Result of average student's workload

Activity	Time (working hours)
1. Lectures	30
2. Laboratory	45
3. Preparation of reports	10
4. Preparation for laboratory	10
5. Preparation for exam	25
6. Participation in consultations related to the implementation of the education process	15

Student's workload

Source of workload	hours	ECTS
Total workload	135	5
Contact hours	90	0
Practical activities	45	0