

Detailed course description (SUBJECT CARD)

Course title: New trends in chemistry and chemical technology
Course code:
Classification of a course group:
Course type: field-related
 obligatory
Field of study: Chemical Technology
Level of study: first-cycle
Profile of study: general academic
Mode of study: full-time programme
Specialty (specialisation):
Year of study: I
Semester: II
Teaching modes and teaching hours: lectures – 15 h;
Language/s of instruction: English
Number of ECTS credits (according to the study programme): 1
** – leave the appropriate option*

1. Course objectives: To familiarize students with the role of polymers in many areas of life, and in particular with their use in nanotechnology and medicine. Thanks to the participation in the lectures, students acquire the ability to associate the properties of materials with their potential application in practice. Another goal is to familiarize the student with stochastic differential equations and fractional differential equations. The student masters their formalism and learns the applications of these equations in mass transport problems. They also learn the methods of solving problems - both numerical and, if possible, formal.
2. Relation of the field-related learning outcomes to modes of teaching and methods of verification as well as to assessment of student's learning outcomes:

| symbol | assumed learning outcomes <i>a student who completed the course:</i> | teaching modes | verification methods and learning outcomes assessment |
|--|---|----------------|---|
| Knowledge: a student knows and understands | | | |
| K1A_W04 | A student has an ordered knowledge of thermodynamics and statistical physics, electromagnetism, optics, the basics of quantum mechanics | lecture | A multiple-choice written test |
| K1A_W13 | A student has a basic knowledge of techniques and methods for characterizing polymers | lecture | A multiple-choice written test |
| K1A_W16 | A student has a basic knowledge of the life cycle of products, equipment, and installations in the chemical industry | lecture | A multiple-choice written test |
| Skills: a student can | | | |
| K1A_U01 | A student can obtain information from literature, databases and other sources, also in English, related to chemical sciences, integrates them, interprets and draws conclusions and formulates opinions | lecture | A multiple-choice written test |
| K1A_U02 | A student can communicate using various techniques in a professional environment, also in English | lecture | A multiple-choice written test |

3. The content of study programme ensuring learning outcomes (*according to the study programme*):
 Knows and understands issues in the field of physics, in particular, fundamental issues on the general principles of physics, physical quantities, fundamental interactions; issues in the field of material point mechanics and rigid body, vibrating and wave motion, basics of thermodynamics, electricity, magnetism, optics, quantum physics.
 A student has knowledge of techniques and methods for the characterization and identification of chemical products.
 A student has a basic knowledge of the life cycle of products, equipment, and installations in the chemical industry.
 Can obtain information from literature, databases and other sources, also in English, related to chemical sciences, integrates them, interprets them and draws conclusions and formulates opinions.
 Can communicate using various techniques in a professional environment and other environments, also in English.
4. Description of methods of determination of ECTS credits:

| Type of activity | Number of hours / ECTS credits |
|---|--------------------------------|
| Number of course hours regardless of a teaching mode | 15/0,5 |
| Student's workload 1*: Preparation for the written test | 15/0,5 |

| | |
|---|-----------|
| Total hours: | 30 |
| Number of ECTS credits allocated to a course | 1 |

Explanation:

* – student's workload - fill in the types of activities, e.g. *preparation for a course, interpretation of results, making a course report, preparation for an exam, studying sources, making a project, presentation and report, doing written assignment, etc.*

** – the other e.g. *extra course hours*

5. Summary indexes:

- number of course hours and ECTS credits at the course with a direct participation of academic teachers or other persons running the course and supervising students: 15/0.5;
- number of course hours and ECTS credits at the course related to the scientific activity conducted at the Silesian University of Technology in a discipline or in disciplines to which a field of study is assigned - in the case of studies with a general academic profile: 15/0.5;
- number of course hours and ECTS credits at the course developing practical skills- in the case of practical studies: 0/0;
- number of course hours conducted by academic teachers employed by the Silesian University of Technology as their primary workplace: 15.

6. Persons conducting particular modes of courses (name, surname, academic degree or degree in arts, title of professor, business e-mail address):

Przemysław Borys, dr hab. inż., e-mail: przemyslaw.borys@polsl.pl

Przemysław Data, dr hab. inż., prof. PŚ., e-mail: przemyslaw.data@polsl.pl

Anna Mielanńczyk, dr inż., e-mail: anna.mielanczyk@polsl.pl

7. Detailed description of teaching modes:

1) lectures:

- detailed programme's content:
 1. Basic concepts regarding the synthesis and architecture of macromolecules and materials derived from polymers with specific physicochemical properties.
 2. Polymeric carriers of active substances - preparation, pharmacokinetics, physicochemical properties, and cytotoxicity.
 3. Stochastic differential equations.
 4. Differential equations.
 5. Basics of organic electronics - types of organic electronic devices, mechanism of action, and application.
 6. Organic Compounds Used in Organic Electronics - types of organic compounds used in organic electronics, design methods, and planning of the target application.
- teaching methods, including distance learning:
 1. Multimedia presentation
- form and criteria for semester completion, including retake tests, as well as conditions for admission to the examination:
 1. Completion of the lecture will be based on a positive assessment with three multiple-choice written tests.
 2. A condition of positive evaluation is a minimum of 36 points. from 60 points to get.
 3. The test improvement is available twice by multiple-choice written tests.
- course organisation and rules of participation in the course, with an indication whether a student's attendance is obligatory

Attending lecture classes is not obligatory

2) description of other teaching modes:

Does not concern.

8. Description of the method for determining the final grade (rules and criteria for evaluation, as well as the final grade calculation method in the case of a course comprising more than one teaching mode, taking into account all teaching modes and all exam dates and credit tests including retake exams and tests):

The final grade in the subject is the average value obtained from three written tests from a given batch of material, under the forms of conducting classes and the conditions for passing set out in point 7 of this card.

9. Method and procedure for making up for

- student's absence from the course,

Depending on the form of abandoned classes, it is determined by the teacher during consultations in accordance with the forms of conducting classes and the conditions of getting credit set out in point 7 of this card.

- differences in study programmes for students changing their field of study, changing university or resuming studies at the Silesian University of Technology,

Depending on the form of abandoned classes, it is determined by the teacher during consultations in accordance with the forms of conducting classes and the conditions of getting credit set out in point 7 of this card.

10. Prerequisites and additional requirements, taking into account the course sequence:

The student should have a basic knowledge of chemistry, mathematics, and physics.

11. Recommended sources and teaching aids:

1. Z.Florjańczyk, S.Penczek, (red.) Chemia polimerów, tom 1, Makrocząsteczki i metody ich otrzymywania, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1995
2. A. Korytkowska-Wałach, M. Gibas, K. Kajewska-Kania, Chemia Makrocząsteczek. Materiały do ćwiczeń laboratoryjnych, Gliwice 2012
3. George Odian, Principles of Polymerization, 4th Edition, John Wiley & Sons, Inc. 2004
4. Filippo Rossi, Giuseppe Perale, Maurizio Masi, Controlled Drug Delivery Systems Toward New Frontiers in Patient Care, Springer 2016
5. Zeew, Schuss, Stochastyczne równania różniczkowe, PWN 1989
6. Sobczyk, Stochastyczne równania różniczkowe, WNT 1996
7. Kosztołowicz, Zastosowanie równań różniczkowych z pochodnymi ułamkowymi do opisu subdyfuzji, UJK 2008
8. Klafter, Metzler, The random walk's guide to anomalous diffusion, Phys. Rep. 339, 2000.
9. Shichiro Ogawa, Organic Electronics Materials and Devices, Springer, 2015
10. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications. Wiley 2006.

12. Description of teachers' competences (e.g. publications, professional experience, certificates, trainings etc. related to the programme contents implemented as a part of the course):

Przemysław Borys research relates to problems in statistical physics and physics of transport processes, like diffusion – therefore the interest in fractional diffusion process and the math required to describe it. Full list of publications available at scopus.org.

Anna Mielańczyk research includes the synthesis and physicochemical characteristics of polymers with potential coverage in the field of drug carriers. Projects related to lecture topics:

- Nature of participation - project manager: Preludium (NCN, 2013-2015), Sonata (NCN, 2017-2020)
- Nature of participation - main contractor: OPUS (NCN, 2018-2021), Sonata (NCN, 2018-2021), Leader (2015-2020)

In addition, an internship at the University of Hyogo, Japan (09.2018) and the summer school Nanosciences, Nanotechnologies and Nanomedicine (29.06-06.07.2019, Thessaloniki, Greece). Full list of publications available at scopus.org.

13. Other information:

Additional literature

1. William B. Liechty, David R. Kryscio, Brandon V. Slaughter, and Nicholas A. Peppas, Polymers for Drug Delivery Systems, Annu Rev Chem Biomol Eng. 2010, 1: 149–173.
2. Stephen Forrest, Mark Thompson, Organic Electronics and Optoelectronics, Chemical Review Volume 107, Issue 4, page 923-1386.
3. Oksana Ostroverkhova, Organic Optoelectronic Materials: Mechanism and Applications, Chemical Review 2016, 116, 13279-13412.