GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modern supramolecular chemistry, PG_00069292						
Field of study	Chemical Technology						
Date of commencement of studies	February 2025		Academic year of realisation of subject	2025/2026			
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Ewa Wagner-Wysiecka				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	15.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	45		5.0		25.0	75
Subject objectives	The aim of the course is to introduce students to the fundamentals of supramolecular chemistry and its applications in science, medicine, and technology. The course content illustrates the dynamic development of supramolecular chemistry from the first macrocyclic compounds to modern molecular machines.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K01] critically evaluates the content of cognitive and practical problems	The student is able to critically evaluate information related to supramolecular chemistry and its applications, both in scientific and popular contexts. The student recognizes the difference between evidence-based knowledge and beliefs circulating in the public sphere. The student understands the importance of forming well-reasoned judgments about the potential and limitations of this field.	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U02] carries out experiments using properly selected techniques and apparatus, taking advantage of new developments in technology and related fields	The student is able to design and carry out experiments involving supramolecular systems, using appropriate synthetic and analytical methods. The student is able to select suitable research techniques and instrumentation for characterizing the physicochemical properties of supramolecular systems. In laboratory work, the student takes into account current advances in chemistry, nanotechnology, and related fields.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K7_W04] recognises scientific, technological, organisational and economic opportunities and constraints in technology and related fields	The student is familiar with the potential and limitations of using supramolecular systems in science, medicine, technology, and environmental protection. The student understands the factors influencing the design, synthesis, and applications of supramolecular structures, including technological and economic considerations. The student has knowledge of typical applications of supramolecular systems and the factors that limit their practical use.	[SW1] Assessment of factual knowledge

Subject contents

Lecture: 15 hours

Historical aspects of the development of supramolecular chemistry. Fundamental concepts and definitions in supramolecular chemistry. Terms: ligand, substrate, receptor, host, guest. Types of interactions in supramolecular structures and methods for studying hostguest interactions. Pearsons Hard and Soft Acids and Bases (HSAB) theory. Naturally occurring supramolecular systems and their roles. Synthetic complexing agents: podands, crown ethers, cryptands, spherands, calixarenes, hetero- and homo-calixarenes, metalloporphyrins, and others. Strategies for the synthesis and preparation of supramolecular systems, including macrocyclic compounds (template effect, preorganization, dilution method, high-pressure method). Structure of selected supramolecular systems and the selectivity of interactions. Applications of supramolecular systems in science and technology and their connections to other disciplines (nanotechnology, medicine, pharmacy, environmental protection). Molecular machines.

Laboratory: 15 hours

1. Adsorptive properties of MOF-type networks case study: KOH/β-cyclodextrin system
2. Synthesis and characterization of quantum dots
3. Synthesis of urea and thiourea clathrates; investigation of their physicochemical properties
4. Optodes optical sensors supramolecular approach
5. Supramolecular complexes of organic compounds with cyclodextrins

Seminar: 15 hours

The seminar is conducted in the form of Oxford-style debates and student presentations. The topics reflect issues, questions, and inspirations arising from lectures and laboratory classes, as well as attempts to critically verify popular beliefs and myths present in the public discourse. Students have a real influence on the selection of topics discussed during the seminar sessions.

Prerequisites and co-requisites

Familiarity with topics covered in core courses: organic chemistry, inorganic chemistry, and physical chemistry.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Laboratory – completion of all practical exercises; passing written tests (short in-class tests)</td><td>51.0%</td><td>30.0%</td></tr>
<tr><td>Seminar – active participation in Oxford-style debate</td><td>51.0%</td><td>30.0%</td></tr>
<tr><td>Lecture – written test</td><td>51.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Jonathan W. Steed, David R. Turner, Karl Wallace: "Core Concepts in Supramolecular Chemistry and Nanochemistry", Willey 2009

2. Katsuhiko Ariga, Toyoki Kunitake: "Supramolecular Chemistry - Fundamentals and Applications: Advanced Textbook", Springer Science & Business Media, 2006

3. Wybrane aspekty chemii supramolekularnej, Praca zbiorowa pod redakcją Grzegorza Schroedera, BETAGRAF P.U.H. Poznań 2009

4. Kompleksy typu gość-gospodarz. red. Grzegorz Schroeder, SERIA: Chemia Supramolekularna, BETAGRAF Poznań, 2003

5. H. Dodziuk, Wstęp do chemii supramolekularnej, Wydawnictwo Uniwersytetu Warszawskiego, 2018

6. Materiały do ćwiczeń laboratoryjnych</td></tr>
<tr><td>Supplementary literature</td><td>J. W. Steed, J. L. Atwood, Supramolecular Chemistry, 3rd Edition, Wiley, 2022</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Discuss the relationship between the structure of crown ethers and their selectivity toward metal cations.

Challenges in anion coordination chemistry.

Discuss the synthetic strategy for macrocyclic compounds.

Provide examples of molecular machines inspired by nature.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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