



## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                          |                                                                                                                                                                                                                                                                                   |                                     |                                                                                                   |            |     |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Supramolecular chemistry, PG_00066100                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                                                                                                                                                                                                                                                                                   |                                     |                                                                                                   |            |     |
| Field of study                              | Chemistry                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          |                                                                                                                                                                                                                                                                                   |                                     |                                                                                                   |            |     |
| Date of commencement of studies             | February 2026                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                          | Academic year of realisation of subject                                                                                                                                                                                                                                           |                                     | 2026/2027                                                                                         |            |     |
| Education level                             | second-cycle studies                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          | Subject group                                                                                                                                                                                                                                                                     |                                     | Specialty 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                                                                                                                                                                                                                                                                   |                                     | exam                                                                                              |            |     |
| Conducting unit                             | Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology                                                                                                                                                                                                                                                                                          |                                                          |                                                                                                                                                                                                                                                                                   |                                     |                                                                                                   |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          | prof. dr hab. inż. Ewa Wagner-Wysiecka                                                                                                                                                                                                                                            |                                     |                                                                                                   |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                          |                                                                                                                                                                                                                                                                                   |                                     |                                                                                                   |            |     |
| Lesson types                                | 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                          | To gain knowledge of the principles of supramolecular chemistry and their application in the design, preparation and characterization of functional materials. To understand the relationships between molecular structure, supramolecular interactions and material properties. To develop skills in experimental work, interpretation of research results, and critical analysis and presentation of scientific publications. |                                                          |                                                                                                                                                                                                                                                                                   |                                     |                                                                                                   |            |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | Subject outcome                                                                                                                                                                                                                                                                   |                                     | Method of verification                                                                            |            |     |
|                                             | [K7_U03] plans and performs the synthesis of chemical compounds with the required properties                                                                                                                                                                                                                                                                                                                                    |                                                          | Plans and carries out the synthesis of selected supramolecular systems, choosing components and preparation conditions suitable for obtaining materials with specified properties.                                                                                                |                                     | [SU1] Assessment of task fulfilment<br>[SU4] Assessment of ability to use methods and tools       |            |     |
|                                             | [K7_U04] develops and transmits technical information in the form of text documents, spreadsheets, graphs, technological diagrams and multimedia presentations, and prepares a speech including a multimedia presentation                                                                                                                                                                                                       |                                                          | Prepares and presents the results of investigations of supramolecular systems in reports, tables and graphs, and prepares and delivers an oral presentation supported by multimedia on supramolecular materials, using appropriate chemical terminology.                          |                                     | [SU1] Assessment of task fulfilment<br>[SU5] Assessment of ability to present the results of task |            |     |
|                                             | [K7_W01] recognizes problems of modern chemistry, including properties and obtaining chemical compounds, necessary for making calculations, including the dependence of the compound's structure and its reactivity                                                                                                                                                                                                             |                                                          | Has the knowledge necessary to explain the relationships between molecular receptor structure, the types of supramolecular interactions, and the stability and selectivity, and describes their significance in the preparation of materials and the control of their properties. |                                     | [SW1] Assessment of factual knowledge                                                             |            |     |
|                                             | [K7_W04] indicates methods for the synthesis of chemical compounds with defined properties                                                                                                                                                                                                                                                                                                                                      |                                                          | Has the knowledge to identify strategies for the synthesis of molecular receptors and preparing supramolecular materials with specified properties, considering, among others, the template effect, preorganization, the high-dilution method and self-assembly.                  |                                     | [SW1] Assessment of factual knowledge                                                             |            |     |

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| Subject contents                | Course content – lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
|                                 | Basic concepts of supramolecular chemistry: ligand, receptor, host, guest, supramolecular complex. Types of non-covalent interactions and their role in determining the structure and properties of materials. Molecular recognition, complementarity and preorganization. Chelate, macrocyclic and macrobicyclic effects. Selected classes of molecular receptors, including podands, coronands, cryptands, calixarenes and cyclodextrins. Relationships between receptor structure and the stability and selectivity of complexes with cations, anions and neutral molecules. Strategies for the synthesis of macrocyclic compounds and methods for investigating host–guest interactions. Self-assembly as a method for creating ordered structures and functional materials. Selected materials based on supramolecular interactions: inclusion systems, metal–organic frameworks (MOFs), supramolecular polymers and gels. Relationships between the structure, spatial organization and properties of materials. Stimuli-responsive materials, molecular switches and molecular machines. Selected applications of supramolecular systems. |  |  |
|                                 | Course content – laboratory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |
| Prerequisites and co-requisites | Knowledge and skills in organic, inorganic and physical chemistry, as well as the fundamentals of spectroscopic methods, at the undergraduate level. Ability to perform basic laboratory procedures in accordance with safety rules and to use scientific literature, including sources in English.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
|                                 | Course content – seminar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
|                                 | Current trends in supramolecular chemistry for the design of functional materials. Analysis of selected scientific publications on stimuli-responsive materials, self-healing systems, porous materials, molecular switches and molecular machines. Student presentations and discussions on the relationships between structure, supramolecular interactions, and the properties and applications of materials. Critical evaluation of proposed solutions, their potential and limitations. Presentation topics agreed upon with the instructor, taking students' interests into account.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
|                                 | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
|                                 | Percentage of the final grade                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
|                                 | Lecture - written exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |
| Recommended reading             | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
|                                 | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
|                                 | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |
|                                 | Example issues/<br>example questions/<br>tasks being completed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |

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| Practical activities within the subject | Not applicable |
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