



## Subject card

|                                             |                                                                                                                                                                                                                                                                                                                                           |                                                          |                                         |                                     |                                                                                                                         |            |     |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------|-----|
| Subject name and code                       | Rubber Chemistry and Technology, PG_00064345                                                                                                                                                                                                                                                                                              |                                                          |                                         |                                     |                                                                                                                         |            |     |
| Field of study                              | CHEMIA I TECHNOLOGIA GUMY                                                                                                                                                                                                                                                                                                                 |                                                          |                                         |                                     |                                                                                                                         |            |     |
| Date of commencement of studies             | February 2026                                                                                                                                                                                                                                                                                                                             |                                                          | Academic year of realisation of subject |                                     | 2026/2027                                                                                                               |            |     |
| Education level                             | second-cycle studies                                                                                                                                                                                                                                                                                                                      |                                                          | Subject group                           |                                     | Optional subject group<br>Specialty subject group<br>Subject group related to scientific research in the field of study |            |     |
| 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 Polymer Technology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology                                                                                                                                                                                                                                  |                                                          |                                         |                                     |                                                                                                                         |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                        |                                                          | dr hab. inż. Justyna Kucińska-Lipka     |                                     |                                                                                                                         |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                  |                                                          |                                         |                                     |                                                                                                                         |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                               | Lecture                                                  | Tutorial                                | Laboratory                          | Project                                                                                                                 | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                     | 15.0                                                     | 0.0                                     | 30.0                                | 0.0                                                                                                                     | 0.0        | 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 familiarize students with issues related to rubber chemistry and technology, including the raw materials used, methods of obtaining rubber mixtures and their vulcanization, research techniques used to characterize rubber mixtures and vulcanizates, and machines and devices used in the rubber industry. |                                                          |                                         |                                     |                                                                                                                         |            |     |

| Learning outcomes               | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Subject outcome                                                                                                                                                                                                                                                                                                                              | Method of verification                                                                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | [K7_K04] is aware of his/her responsibility for making decisions, respecting and developing principles of professional ethics and taking action to uphold these principles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | The student is aware of responsibility for their decisions and adheres to the principles of professional ethics. The student is able to identify hazards occurring in the workplace and caused by the materials used and produced in the rubber industry.                                                                                    | [SK2] Ocena postępów pracy<br>[SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce                                                                  |
|                                 | [K7_W04] recognises scientific, technological, organisational and economic opportunities and constraints in technology and related fields                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Students will gain knowledge of the raw materials and processing technologies used in the rubber industry. Students will recognize the scientific, technological, organizational, and economic opportunities and limitations in rubber chemistry and technology.                                                                             | [SW1] Ocena wiedzy faktograficznej                                                                                                                                       |
|                                 | [K7_U04] predicts the properties of the materials obtained and the course of processes involving them, based on knowledge of technology and related fields and computer methods of data analysis, modelling and simulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | The student is able to predict and shape the properties of rubber materials based on natural rubber and/or synthetic rubbers based on the selection of appropriate raw materials and process parameters used in the production of rubber mixtures.                                                                                           | [SU1] Ocena realizacji zadania<br>[SU2] Ocena umiejętności analizy informacji<br>[SU4] Ocena umiejętności korzystania z metod i narzędzi                                 |
|                                 | [K7_U02] carries out experiments using properly selected techniques and apparatus, taking advantage of new developments in technology and related fields                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Students understand the principles of use and are able to operate selected equipment, devices, and machines used to prepare rubber mixtures, their vulcanization, and characterize the resulting rubber materials. Students are able to analyze and interpret the results obtained from research related to rubber chemistry and technology. | [SU1] Ocena realizacji zadania<br>[SU4] Ocena umiejętności korzystania z metod i narzędzi<br>[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu |
| Subject contents                | Course content – lecture <ul style="list-style-type: none"> <li>• Introduction to rubber chemistry and technology: basic concepts</li> <li>• Rubbers in rubber technology: types, preparation/synthesis, properties, and applications</li> <li>• Auxiliary raw materials used in rubber technology: activators, accelerators, vulcanizing/crosslinking agents, plasticizers, fillers, anti-aging agents, and more. Vulcanization.</li> <li>• Theoretical fundamentals and properties of rubber materials: Highly elastic state. Theory of rubber elasticity. statistical thermodynamics of rubber elasticity. Mooney-Rivlin and Flory-Rehner equations. Static mechanical properties of elastomers. Stress relaxation and creep</li> <li>• Machinery and equipment used in the processing of rubbers/rubber compounds</li> <li>• Recycling of rubber materials</li> </ul> |                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                          |
|                                 | Course content – laboratory <ul style="list-style-type: none"> <li>• Preparation of rubber mixtures and their vulcanization</li> <li>• Characterization of rubber mixture properties: determination of the optimum vulcanization and Mooney viscosity</li> <li>• Characterization of rubber vulcanizates properties: Shore hardness, Schob rebound elasticity, Schooper-Schlobach abrasion, and static tensile properties</li> <li>• Equilibrium swelling test and determination of crosslink density</li> <li>• Change of properties during accelerated thermal aging</li> <li>• Thermoplastic elastomers</li> <li>• Recycling of rubber materials: preparation of rubber mixtures with rubber powder</li> </ul>                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                          |
| Prerequisites and co-requisites | Basic knowledge of polymer chemistry and technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                          |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Passing threshold                                                                                                                                                                                                                                                                                                                            | Percentage of the final grade                                                                                                                                            |
|                                 | lecture: test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50.0%                                                                                                                                                                                                                                                                                                                                        | 50.0%                                                                                                                                                                    |
|                                 | laboratory: attendance, class work and reports                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 100.0%                                                                                                                                                                                                                                                                                                                                       | 50.0%                                                                                                                                                                    |
| Recommended reading             | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• J. Datta, M. Włoch: Inżynieria Elastomerów, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2018</li> <li>• J. R. White: Poradnik Technologa Gum, Rapra Technology Ltd, 2003</li> </ul>                                                                                                                  |                                                                                                                                                                          |
|                                 | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• J.E. Mark, B. Erman, M. Roland (Eds): The Science and Technology of Rubber, Academic Press, 2013</li> </ul>                                                                                                                                                                                         |                                                                                                                                                                          |
|                                 | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                          |

|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example issues/<br>example questions/<br>tasks being completed | <ul style="list-style-type: none"> <li>• List three characteristics of elastomers.</li> <li>• List the components of the vulcanizing system.</li> <li>• List the types of accelerators used in the rubber industry.</li> <li>• Give examples of active and inactive fillers used in the rubber industry.</li> <li>• What is the physical state of elastomers at room temperature?</li> <li>• List the machines and equipment used in the production of car tires.</li> <li>• List the machines and equipment used in the recycling of car tires.</li> </ul> |
| Practical activities within<br>the subject                     | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

Document generated electronically. Does not require a seal or signature.