

## 。 GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

| Subject name and code                          | Chemical apparatus, PG_00060845   |  |   |  |                        |  |         |     |  |
|--|---|--|---|--|------------------------|--|---------|-----|--|
| Field of study                                 | Chemical Technology   |  |   |  |                        |  |         |     |  |
| Date of commencement of studies                | October 2023  |  | Academic year of<br>realisation of subject  |  |                        | 2023/2024  |         |     |  |
| Education level                                | first-cycle studies   |  | Subject group   |  |                        | Obligatory subject group in the field of study   |         |     |  |
|  |   |  |   |  |                        | 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  |  |                        | 4.0  |         |     |  |
| Learning profile                               | general academic profile  |  | Assessment form   |  |                        | exam   |         |     |  |
| Conducting unit                                | Department of Energy  | Conversion a   | nd Storage -> I   | Faculty of Cher                        | nistry                 |  |         |     |  |
| Name and surname<br>of lecturer (lecturers)    | Subject supervisor  |  | dr hab. inż. Monika Wilamowska-Zawłocka   |  |                        |  |         |     |  |
|  | Teachers  | dr hab. inż. Monika Wilamowska-Zawłocka                        |   |  |                        |  |         |     |  |
| Lesson types and methods                       | Lesson type   | Lecture  | Tutorial Laboratory Project   |  | Project                | t  | Seminar | SUM |  |
| of instruction                                 | Number of study hours   | 30.0   | 0.0   | 0.0                                    | 15.0                   |  | 0.0     | 45  |  |
|  | E-learning hours inclu  | ded: 0.0   |   | 1                                      |                        |  |         |     |  |
| Learning activity<br>and number of study hours | Learning activity   | Participation in didactic<br>classes included in study<br>plan |   | Participation in<br>consultation hours |                        | Self-study   |         | SUM |  |
|  | Number of study hours   | 45   |   | 5.0                                    |                        | 50.0   |         | 100 |  |
| Subject objectives                             | This course teaches students about the classification of industrial processes, including mechanical, thermal, and diffusion processes, as well as the construction and operation of the corresponding apparatus. The course covers equations that describe fluid dynamics, such as Bernoulli's equation and the calculation of flow resistance, as well as the construction and function of machines and apparatus, such as pumps, pipelines, tanks, conveyors, grinding, separation and mixing equipment, heat exchangers, drying equipment, distillation, rectification, and mass exchange equipment. |  |   |  |                        |  |         |     |  |
| Learning outcomes                              | Course outcome  |  | Subject outcome   |  | Method of verification |  |         |     |  |
|  | [K6_U04] performs basic design<br>calculations of selected processes<br>and unit operations, is able to<br>calculate and select the basic<br>apparatus of chemical industry in<br>a process line  |  | Students have knowledge of<br>technological and industrial<br>processes and installations. They<br>are capable of selecting<br>appropriate equipment and<br>construction materials for various<br>chemical substances based on<br>calculations and assumptions.   |  |                        | [SU3] Assessment of ability to<br>use knowledge gained from the<br>subject<br>[SU1] Assessment of task<br>fulfilment   |         |     |  |
|  | [Ko_WU4] understands processes<br>occurring in the life cycle of<br>equipment and facilities and has<br>knowledge of mechanical<br>engineering, chemical apparatus,<br>technical thermodynamics and<br>chemical engineering and<br>chemical reactor engineering<br>necessary to analyse<br>technological processes and<br>correctly design installations and<br>systems in the chemical industry<br>[K6_K01] understands the need<br>for continuing education, and is<br>aware of the opportunities to<br>improve professional, personal<br>and social competences                                      |  | The students are familiar with the<br>construction and operation of<br>fundamental equipment used in<br>chemical technology. Based on<br>calculations, they are able to<br>design an industrial installation<br>and select suitable equipment for<br>it.<br>The student understands the role<br>of an engineer, taking into account<br>social, economic, and ethical<br>aspects. They also recognize the<br>importance of improving their<br>professional competencies. |  |                        | [SW3] Assessment of knowledge<br>contained in written work and<br>projects<br>[SW1] Assessment of factual<br>knowledge |         |     |  |

| Subject contents   | <ul> <li>Fluid dynamics - equations describing fluid dynamics, resistance to flow in pipelines.</li> <li>Pipelines and auxiliary fittings for chemical processes</li> <li>Pumps - standard and special pumps, their construction and use, pump seals</li> <li>Compressors and fans</li> <li>Bulk material handling - conveyors</li> <li>Storage tanks - materials and construction elements of tanks depending on the type of substance stored</li> <li>Mixing processes in the chemical industry, construction of mixers, types of mixers, mixing efficiency mixing efficiency and ways of eliminating whirls</li> <li>Grinding processes - construction of equipment and energy consumption of processes depending on the required degree of comminution</li> <li>Separation of heterogeneous systems</li> <li>Heat transfer - coefficients of heat penetration, conduction and transfer, heat exchangers, evaporators, crystallisers</li> <li>evaporators, crystallisers, dryers.</li> <li>Mass transfer - adsorption and absorption columns</li> <li>Distillation and rectification</li> </ul> |   |                               |  |  |  |
|--|--|---|-------------------------------|--|--|--|
| Prerequisites<br>and co-requisites                             | Basic knowledge of mathematics, physics, chemistry, technical drawing, mechanical engineering, computer skills.  |   |                               |  |  |  |
| Assessment methods   | Subject passing criteria   | Passing threshold   | Percentage of the final grade |  |  |  |
| and criteria   | Project  | 60.0%   | 40.0%                         |  |  |  |
|  | Lectures   | 60.0%   | 60.0%                         |  |  |  |
| Recommended reading  | Basic literature   | <ul> <li>Błasiński H., Młodziński B., - Aparatura przemysłu chemicznego,<br/>VNT 1983,</li> <li>Pikoń J., - Aparatura chemiczna, PWN 1978,</li> <li>J. Warych, Aparatura Chemiczna i Procesowa, Oficyna Wydawnicza<br/>Politechniki Warszawskiej, Warszawa 1996</li> <li>Bieszk H., Urządzenia do realizacji procesów mechanicznych w<br/>echnologii chemicznej, Wyd. PG. 2001,</li> <li>Bieszk H., Urządzenia do realizacji procesów cieplnych w technologii<br/>chemicznej, Wyd. PG. 2010,</li> <li>Pawłow K.F.,Romankow P.G.,Noskow A.A Przykłady i zadania z<br/>zakresu aparatury i inżynierii chemicznej, WNT 1981</li> </ul> |                               |  |  |  |
|  | Supplementary literature   | <ol> <li>Goździecki M., Świątkiewicz H., Przenośniki. WNT, Warszawa 1979,</li> <li>Koch R., Noworyta A.: Procesy mechaniczne w inżynierii<br/>chemicznej. WNT, Warszawa 1992,</li> <li>Leszczyński S.: Filtracja w przemyśle chemicznym. WNT, Warszawa<br/>1972,</li> <li>Stępniewski M.: Pompy. WNT, Warszawa 1985</li> </ol>  |                               |  |  |  |
|  | eResources addresses   | Adresy na platformie eNauczanie:  |                               |  |  |  |
|  |  | Aparatura Chemiczna - 2024 - Moodle ID: 38116<br>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38116   |                               |  |  |  |
| Example issues/<br>example questions/<br>tasks being completed | Sample questions:<br>List and describe the differences between positive displacement pumps and centrifugal pumps.<br>Why are pumps connected in series/parallel?<br>How can the capacity of a centrifugal/piston pump be adjusted?<br>Give examples of special purpose fittings in pipelines.<br>List the methods of cleaning pipelines.<br>How do you reduce/eliminate circular motion in mixers?<br>State the device(s) best suited for separating a liquid-liquid-solid three-phase system.<br>solid.<br>Why are heat exchangers combined in a series/parallel system?<br>Why are evaporative apparatuses combined into batteries?<br>What is the role of the overflow on the shelf of the rectification column?  |   |                               |  |  |  |
| Work placement   | Not applicable   | Not applicable  |                               |  |  |  |

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