



## Subject card

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|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------|-------------------|------------|-----|
| Subject name and code                       | Foundation Engineering, PG_00064178                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                         |                                     |                   |            |     |
| Field of study                              | Civil Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          |                                         |                                     |                   |            |     |
| Date of commencement of studies             | October 2024                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                          | Academic year of realisation of subject |                                     | 2026/2027         |            |     |
| Education level                             | first-cycle studies                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          | Subject group                           |                                     |                   |            |     |
| Mode of study                               | Full-time studies                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | Mode of delivery                        |                                     | at the university |            |     |
| Year of study                               | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | Language of instruction                 |                                     | Polish            |            |     |
| Semester of study                           | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                          | ECTS credits                            |                                     | 5.0               |            |     |
| Learning profile                            | general academic profile                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          | Assessment form                         |                                     | exam              |            |     |
| Conducting unit                             | Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology                                                                                                                                                                                                                                                                                             |                                                          |                                         |                                     |                   |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                          | dr hab. inż. Adam Krasieński            |                                     |                   |            |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                          |                                         |                                     |                   |            |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                                                                                                                                                                                                                                        | Lecture                                                  | Tutorial                                | Laboratory                          | Project           | Seminar    | SUM |
|                                             | Number of study hours                                                                                                                                                                                                                                                                                                                                                                                                                              | 30.0                                                     | 0.0                                     | 0.0                                 | 30.0              | 0.0        | 60  |
|                                             | 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                                                                                                                                                                                                                                                                                                                                                                                                                              | 60                                                       |                                         | 0.0                                 |                   | 0.0        | 60  |
| Subject objectives                          | Acquiring knowledge in the field of construction and design of shallow and deep foundations, retaining structures and other selected geotechnical structures. Learning modern methods of calculating and designing foundations, also by using computer methods. Acquiring skills in identifying important geotechnical problems and solving them. Preparation for independent work as civil engineer and education at the second level of studies. |                                                          |                                         |                                     |                   |            |     |

| Learning outcomes | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Subject outcome                                                                                                                                                                                                                                                                                                                                                        | Method of verification                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | [K6_U03] Design engineering objects and details, processes and engineering systems by applying appropriate standards and methods of design.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Is able to design typical shallow and deep foundations and geotechnical structures for civil, industrial and infrastructure constructions. Knows and uses the appropriate standards, instructions and guidelines as well as appropriate calculation methods for this purpose.                                                                                          | [SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools<br>[SU5] Assessment of ability to present the results of task |
|                   | [K6_W06] Demonstrates practical knowledge and understanding of materials, devices and tools, processes and technologies in the field of civil engineering (and their limitations).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Has knowledge in the field of analyzing and using geotechnical documentation for the purposes of designing and constructing foundations of buildings. Knows the basic technical solutions of foundations and technologies for their construction. Is able to select geotechnical solutions and technologies appropriate to the needs and to soil and water conditions. | [SW3] Assessment of knowledge contained in written work and projects<br>[SW1] Assessment of factual knowledge                                                                              |
|                   | [K6_W03] Demonstrate knowledge and understanding of the processes, established standards and design methods in the civil engineering subject area and of their limitations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Demonstrates knowledge and understanding of the processes and established standards and design methods for foundation, ground improvement and other geotechnical works and is aware of their limitations.                                                                                                                                                              | [SW3] Assessment of knowledge contained in written work and projects<br>[SW1] Assessment of factual knowledge                                                                              |
|                   | [K6_U06] Conduct engineering activities in civil engineering subject area, using and applying practical knowledge and understanding of materials, equipment and tools, processes and technologies.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Carries out engineering activities in the field of foundations and geotechnical works in civil engineering, using his knowledge and understanding of the issues and mechanisms of interaction between structures and the subsoil.                                                                                                                                      | [SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools<br>[SU2] Assessment of ability to analyse information         |
| Subject contents  | <p>Course content – lecture</p> <p>Lectures:</p> <ol style="list-style-type: none"> <li>1. Classification of subsoils and geotechnical categories of buildings.</li> <li>2. Field tests of soils and geotechnical documentation</li> <li>3. Principles of geotechnical design according to EC7.4. Application and classification of shallow foundations</li> <li>5. Calculation, construction and design of shallow foundations</li> <li>6. Gravity retaining walls - structures, principles of calculation, design and construction</li> <li>7. Foundation piles - application, classification and types of construction technologies</li> <li>8. Pile and pile foundations - calculation, design and testing</li> <li>9. Other deep foundations - wells, caissons, barrettes</li> <li>10. Sheet piles - construction schemes, calculation and design</li> <li>11. Diaphragm walls and other technologies of deep excavation support</li> <li>12. Ground anchorages - structures and calculation</li> <li>13. Drainage of foundation excavations</li> <li>14. Ground improvement - technologies</li> <li>15. Use of geosynthetics in foundations and strengthening of existing foundations</li> </ol> <p>Design</p> <ol style="list-style-type: none"> <li>1. Examples of calculation tasks for the design of shallow foundations</li> <li>2. Project 1a - retaining wall shallowly founded</li> <li>3. Examples of calculation tasks for the design of pile foundations</li> <li>4. Project 1b - retaining wall supported on piles</li> <li>5. Examples of calculation tasks for designing sheet pile walls</li> <li>6. Examples of calculation tasks for designing ground anchorages</li> <li>7. Project 2 - anchored or strutted sheet pile wall</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                            |

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| Prerequisites and co-requisites | Completion of first-degree courses:<br>- soil mechanics<br>- basics of general construction<br>- building materials<br>- general mechanics and strength of materials<br>- technical drawing<br>- basics of concrete and metal structures |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |
| Assessment methods and criteria | Subject passing criteria                                                                                                                                                                                                                 | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Percentage of the final grade |
|                                 | Passing projects 1 and 2                                                                                                                                                                                                                 | 60.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 40.0%                         |
|                                 | Activity during lectures                                                                                                                                                                                                                 | 0.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10.0%                         |
|                                 | Lecture exam                                                                                                                                                                                                                             | 55.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 30.0%                         |
|                                 | Colloquium on design tasks                                                                                                                                                                                                               | 55.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 20.0%                         |
| Recommended reading             | Basic literature                                                                                                                                                                                                                         | 1. Z. Wiłun: Zarys geotechniki WKŁ, Warszawa, 2004<br>2. E. Dembicki i inni: Fundamentowanie, t. I i II. Arkady, Warszawa 1988.<br>3. E. Dembicki, A. Tejchman: Wybrane zagadnienia fundamentowania budowli hydrotechnicznych. PWN, Warszawa 1981.<br>4. B. Rosiński: Fundamentowanie. Arkady, Warszawa 1978.<br>5. K. Biernatowski: Fundamentowanie. PWN, Warszawa 1984.<br>6. E. Motak: Fundamenty bezpośrednie. Wzory, tablice, przykłady. Arkady, Warszawa 1988.<br>7. K. Gwizdała: "Fundamenty palowe" Tom 1 i 2. PWN, Warszawa, 2011, 2013.<br>8. A. Krasiński: "Materiały dydaktyczne do przedmiotu Fundamentowanie" E-Nauczanie PG |                               |
|                                 | Supplementary literature                                                                                                                                                                                                                 | 1. Puła O., Rybak C., Sarniak W.: Fundamentowanie. Projektowanie posadowień. DWE, Wrocław 1999<br>2. A. Jarominiak: Lekkie konstrukcje oporowe. WKŁ, Warszawa 2000.<br>3. J. Kobiak, W. Stachurski: Konstrukcje żelbetowe. Arkady, Warszawa 1989.<br>4. Starosolski W., Konstrukcje żelbetowe, T2., PWN, Warszawa 1996<br>5. Czasopisma: Inżynieria Morska i Geotechnika, Geinżynieria, Inżynieria i Budownictwo                                                                                                                                                                                                                           |                               |
|                                 | eResources addresses                                                                                                                                                                                                                     | Basic<br><a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27359">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27359</a> - A. Krasiński: Teaching materials for the subject Foundations<br>Supplementary<br><a href="https://www.inzynieriaibudownictwo.pl/">https://www.inzynieriaibudownictwo.pl/</a> - Magazine: Engineering and Construction<br><a href="https://inzynieria.com/czasopisma/wydania/gdmt">https://inzynieria.com/czasopisma/wydania/gdmt</a> - Magazine: Geoengineering<br><a href="https://imig.pl/">https://imig.pl/</a> - Magazine: Marine Engineering and Geotechnics                       |                               |

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| <p>Example issues/<br/>example questions/<br/>tasks being completed</p> | <p>Exam:</p> <ol style="list-style-type: none"> <li>1. List and describe the types of soil subgrades and geotechnical categories of buildings.</li> <li>2. What is soil subgrade testing documentation and what basic elements should it consist of?</li> <li>3. What is dynamic probing and what is static probing? Sketch sample graphs of both probings.</li> <li>4. Sketch the pressure distributions on the ground under the foundation strip at different values of the eB eccentricity.</li> <li>5. Sketch possible calculation schemes for foundation grids.</li> <li>6. What are the differences in the technologies of construction and applications of Vibro, SDP and CFA piles?</li> <li>7. Explain the mechanism and causes of negative friction in piles.</li> <li>8. Sketch and describe two sample structures of pile load tests.</li> <li>9. What are the differences in the construction of foundation wells and caissons?</li> <li>10. Draw approximate bending moment diagrams in a diaphragm wall: a) cantilever, b) single anchored at the bottom, freely supported, c) single anchored at the bottom, fixed in the ground.</li> <li>11. Sketch the stages of construction of a diaphragm wall.</li> <li>12. What is the difference between soil replacement and vibroreplacement? (sketches)</li> <li>13. List the methods of strengthening the soil subgrade made of cohesive and organic soils and briefly describe two of them.</li> <li>14. Principle of operation of deep wells and wellpoints. When do we use one and when the other?</li> <li>15. Give the definitions of: geotextile, geotextile, geogrid and geomembrane and state for what purposes they are used?</li> </ol> <p>Project:</p> <ol style="list-style-type: none"> <li>1. Determine the loads on the foundation of a retaining wall.</li> <li>2. Describe the issue of earth pressure on a retaining wall.</li> <li>3. Calculate the load eccentricity and the pressure distribution on the ground under an example of a foundation footing.</li> <li>4. Calculate the load-bearing capacity of the subsoil under an example of a shallow foundation.</li> <li>5. The load-bearing capacity of the subsoil in conditions without drainage and with drainage of water from the ground.</li> <li>6. Calculate the settlement of the subsoil under an example of a shallow foundation.</li> <li>7. Provide the procedure for calculating and designing a retaining wall.</li> <li>8. Calculate the forces in the piles in an example of a pile foundation.</li> <li>9. Calculate the load-bearing capacity of an example of a pile.</li> <li>10. Check the penetration of an example of a sheet pile wall.</li> <li>11. Calculate the bending moment and the force in the anchorage of the sheet pile wall.</li> <li>12. Calculate or check the load-bearing capacity of the plate (block) anchorage of the sheet pile wall.</li> <li>13. Provide the procedure for calculating and designing a sheet pile wall.</li> </ol> |
| <p>Practical activities within<br/>the subject</p>                      | <p>Not applicable</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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