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| **Course code** | CC5 |
| **Type and description** |  |
| **ECTS credit** | 1 |
| **Course name** | **Advanced mechanics of soils I** |
| **Course name in Polish** | **Pogłębiony wykład mechaniki gruntów I** |
| **Language of instruction** | English |
| **Course level** | 8 PRK |
| **Course coordinator** | **Marek Lefik** |
| **Course instructors** | **Marek Lefik, Marek Wojciechowski** |
| **Delivery methods and course duration** | |  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** | | --- | --- | --- | --- | --- | --- | --- | --- | | Contact hours | 10 |  |  | 5 |  | 0 | 15 | | E-learning | No | No | No | No | No | No |  | | Assessment criteria (weightage) | 0,5 |  |  | 0,5 |  |  |  | |
| **Course objective** | The purpose of lectures is not only to describe the behaviour of the soil but also to show the various ways of its scientific idealization. The lecture will present experimental sources of knowledge about soils behaviour. Soil mechanics will be presented as a set of interpretations of these experiments within the adopted mathematical model of the soil.  The objective of the course is also a presentation of different analytical and numerical solution of physically nonlinear problems appearing in mechanics of soils. |
| **Learning outcomes** | Advanced knowledge of soils behaviour  Advanced knowledge of water saturated soils behaviour  Advanced knowledge of analitycal modelling of soils  Advanced knowledge of numerical modelling of soils |
| **Assessment methods** | Verification of the lecture's outcome by means of a written test. (50% of the final note)  Presentation of a solution of an engineering problem individually solved in frame of the project. (50% of the final note) |
| **Prerequisites** | Basics of theory of elasticity and plasticity of solids |
| **Course content with delivery methods** | Subjects of the lecture:  Soil as a three-phase material. Concept of stress in soils. Fundamental equations via volume averaging. Fundamental phenomenological information concerning constitutive behaviour of soils: oedometric test, in situ tests. Strength of soils: triaxial tests and shear tests. Review of constitutive models of soils: Coulomb-Mohr, Cam-Clay and its variations, Drucker-Prager, hypoplasticity. Analytical solutions. Numerical solutions strategies. Water in soils. Groundwater flow. Darcy’s law via asymptotic homogenisation. Flows in soils. Local stability and bearing capacity of soils. Solutions by lines of characteristics. Slope stability.  Subject of the project:  Individual, guided solution of one of the following problems and presentation of the results:   1. Bearing capacity of direct foundation – numerical solutions versus engineering approach. 2. Bearing capacity of direct foundation – various constitutive models. 3. Numerical solution of flow toward wells – various models of flow. 4. Slope stability – comparison of various numerical and analytical results. |
| **Basic reference materials** | Arnold Verruijt, SOIL MECHANICS, Delft University of Technology, 2001, 2004  [Robert V. Whitman T. William Lambe](https://www.amazon.com/s/ref=dp_byline_sr_book_1?ie=UTF8&text=Robert+V.+Whitman+T.+William+Lambe&search-alias=books&field-author=Robert+V.+Whitman+T.+William+Lambe&sort=relevancerank), Soil Mechanics, Wiley, 2012 |
| **Other reference materials** | D. Kolymbas, Elements of hypoplasticity. In Constitutive Modelling of Geomaterials, B. Cambou, C. Di Prisco (Eds), Revue Francaise de Geotechnique  Karl Terzaghi, Theoretical Soil Mechanics, Print ISBN:9780471853053 |Online ISBN:9780470172766 |DOI:10.1002/9780470172766, Copyright © 1943 John Wiley & Sons, Inc. |
| **Average student workload outside classroom** | 10 h |
| **Comments** |  |
| **Last update** |  |