COURSE DESCRIPTION

1. **Course title:** GEOMECHANICS (PART II STRATA MECHANICS)  
2. **Course code:** SI-GIG/25

3. **Validity of course description:** 2016/2017

4. **Level of studies:** Undergraduate course

5. **Mode of studies:** intramural studies

6. **Field of study:** Mining and Geology  
   (FACULTY SYMBOL) RG

7. **Profile of studies:** general academic

8. **Programme:**  
   **Specialization:** Engineering Geology and Geotechnics

9. **Semester:** V

10. **Faculty teaching the course:** Faculty of Mining and Geology, Department of Geomechanics, Underground Construction and Management of Mining Areas Surface Protection

11. **Course instructor:** Grzegorz Smolnik, PhD

12. **Course classification:** specialty items

13. **Course status:** compulsory

14. **Language of instruction:** English

15. **Pre-requisite qualifications:** Geomechanics part I, Computer Science, English

16. **Course objectives:**  
   The course is designed to educate future mining engineers and geoengineers in the field of strata mechanics in accordance with the educational standards required for the discipline of Mining and Geology. Students graduating from this course should be competent to perform basic tasks as mine ground control engineers. They should be able to select and apply an appropriate combination of empirical, analytical and numerical methods, and to plan and control the geomechanical aspects of mining works.

17. **Description of learning outcomes:**

<table>
<thead>
<tr>
<th>Nr</th>
<th>Learning outcomes description</th>
<th>Method of assessment</th>
<th>Teaching methods</th>
<th>Learning outcomes reference code</th>
</tr>
</thead>
</table>
| 1. | Student is familiar with basics of rock and strata mechanics and geotechnics which covers:  
   - laboratory determination of intact rock properties,  
   - strengths failure criteria and determination of factor of safety,  
   - initial stress state in virgin rock masses and its changes due to geological factors and mining activities. | Written tests of lecture contents and a written test on the theoretical background of the 6 assigned laboratory practicals. | Lecture, Laboratory | K_W16+++ |
| 2. | Student is familiar with computer methods used for solving engineering tasks | Written exams (during lectures), project report | Lecture, Project | K_W11+++ |
| 3. | Student is able to acquire information from the literature, databases, data sheets of manufacturers and other properly selected sources, also in English language. Can integrate the obtained information, perform its interpretation as well as draw conclusions, formulate and justify opinions. | Written tests of lecture contents and assessment of quality of preparation, presentation and defense of written reports on the laboratory practicals. | Lecture, Laboratory | K_U01++ |
| 4. | Student can play a role as a part of a team and is able to take different tasks in a teamwork | Evaluation during laboratory tests | Laboratory | K_U02++  
   K_K03++ |
| 5. | Student is able to plan and carry out experiments, interpret the obtained results and draw the conclusions. | Quality of preparation, presentation and defense of written reports on the laboratory practicals. | Laboratory | K_U08++  
   K_U09++  
   K_U18+++ |

18. **Teaching modes and hours**

   Lecture 30h  
   Laboratory 15h  
   Project 15h
19. Syllabus description:

Lecture:
1. Primary state of stress in rock masses; theory and measurement results. (2 hours)
2. State of stress in rock masses in the vicinity of circular, elliptical and rectangular tunnels. (3 hours)
3. Methods of calculation of static rock pressure on the support/lining of mine galleries and shafts. (2 hours)
4. Theories of deformational rock pressure on the support of underground roadways. Mechanism of rock-support interaction. (2 hours)
5. Rock mass classifications: Rock Mass Rating (RMR) system, Q-system, Geological Strength Index (GSI) system. (3 hours)
6. General slope stability concepts. Factors governing the stability of rock and soil slopes. (planar block slides, wedge slides, circular and non-circular failure surfaces, toppling and buckling of rock slopes) (2 hours)
7. Soil slope stability analysis using the limit equilibrium method (2 hours)
8. Selection of the ways and means available for mitigating rock hazards in underground workings. Rationale for the selection of the ways and measures available for the improvement of safety against slope failure in rock and soil environments. (2 hours)
13. Modelling procedures in Distinct Element Method (UDEC and 3DEC codes). Initial and boundary conditions. Simulation and results. Strain, stress, displacement changes in a rock mass due to mining activities. (3 hours)

Laboratory:
Three laboratory sessions to be selected from the following list of four practicals suggested and available at the Rock Mechanics Laboratory:
1. Post-failure behavior of rocks.
2. Shear strength of rocks.
3. Strength of rocks under triaxial compression conditions.

Each session consists of a 2-hour theoretical introduction and a 2-hour laboratory practical.

The practicals are aimed not at parameter measurement only, but also at illustrating the factors which affect rock strength and deformability in order to impart an understanding of rock mechanics principles.

Project:
Tunnels in jointed rock masses
1. Initial stress state in layered rock mass (1 hour)
2. Introduction to modelling in UDEC. (2 hours)
4. Simulation of tunnels excavation. Strain, stress, displacement changes in a rock mass due to excavation of blocks. Instability of blocks around tunnels. Simulation of local water flow and its impact on the stability of service tunnel (4 hours)
5. Shotcrete and cables reinforcement. Impact of the support on the behavior of blocks around tunnels' periphery. (3 hours)

20. Examination: - The course is examined through a written test, written laboratory and project reports and an oral examination (for details see the section below).
21. Primary sources:

22. Secondary sources:

23. Total workload required to achieve learning outcomes

<table>
<thead>
<tr>
<th>Lp.</th>
<th>Teaching mode</th>
<th>Contact hours / Student workload hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>30 / 39</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>15 / 33</td>
</tr>
<tr>
<td>4</td>
<td>Project</td>
<td>15 / 23</td>
</tr>
<tr>
<td>5</td>
<td>BA/ MA Seminar</td>
<td></td>
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<tr>
<td>6</td>
<td>Other</td>
<td></td>
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<tr>
<td></td>
<td>Total number of hours</td>
<td>60 / 95</td>
</tr>
</tbody>
</table>

24. Total hours: 155

25. Number of ECTS credits: 5

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 3

26. Comments: Minimum requirements for course credit
   1. Regular attendance at the course lectures (Let the instructor know if you will have to miss a class. Credit cannot be given if there are more than 3 absences for a course.).
   2. Passing a written test on the theoretical background of the 3 assigned laboratory practicals.
   3. Attendance and successful completion of the laboratory and computer practicals.
   4. Preparation, presentation and defense of written reports on the laboratory and computer practicals completed.
   5. Passing the final oral examination on topics presented within the 15 lectures of the course.

Approved:

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(date, Instructor’s signature) (date, the Director of the Faculty Unit signature)