

**The Hong Kong University of Science and Technology**

**UG Course Syllabus Template**

|                  |                                                     |
|------------------|-----------------------------------------------------|
| [Course Title]   | <b>Numerical Solutions to Geotechnical Problems</b> |
| [Course Code]    | CIVL 4750                                           |
| [No. of Credits] | 3 Credits [3-0-0:3]                                 |

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**Course Description**

This course aims to provide students with the necessary knowledge and numerical skills to solve practical geotechnical problems. The students will be taught to use knowledge of soil mechanics and geotechnical engineering alongside general-purpose computer software packages to solve practical problems associated with seepage, slope stability, consolidation, and piles. Commonly available computer programs based on the limit equilibrium method, finite difference method (FDM), and finite element method (FEM) will be the focus of the course. Ample tutorial examples will be practiced, offering students hands-on experiences in using popular geotechnical software, establishing technical judgments, selecting model parameters, setting up models, and verifying numerical solutions.

**Intended Learning Outcomes (ILOs)**

By the end of this course, students should be able to:

1. Understand fundamental principles of major numerical methods for engineering solution.
2. Apply knowledge of numerical methods to treat a practical geotechnical problem.
3. Gain hands-on experience of using major numerical software packages to solve geotechnical problems.
4. Develop practical experiences and knowledge in analyzing and interpreting numerical results for practical geotechnical design.

**Assessment and Grading**

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

**Assessments:**

| Assessment Task            | Contribution to Overall Course grade (%) | Due date                                 |
|----------------------------|------------------------------------------|------------------------------------------|
| Assignments (5 tasks)      | 50%                                      | To be determined (distributed bi-weekly) |
| Group Term Project         | 40%                                      | To be determined (end of semester)       |
| Group Project Presentation | 10%                                      | To be determined (Week 13-14)            |

**Mapping of Course ILOs to Assessment Tasks**

| Assessed Task              | Mapped ILOs      | Explanation                                                                                                                                                                                                                                                                                                            |
|----------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assignments (5 tasks)      | ILO1, ILO2, ILO3 | These tasks assess students' ability to understand fundamental numerical principles (ILO 1), apply them to practical geotechnical problems such as seepage or slope stability (ILO 2), and gain hands-on proficiency with software like SEEP/W and FLAC to obtain solutions (ILO 3).                                   |
| Group Term Project         | ILO2, ILO3, ILO4 | The project requires students to apply numerical methods to a comprehensive real-world geotechnical scenario (ILO 2), use appropriate software packages to build models and run analyses (ILO 3), critically interpret the results to support design decisions, and effective communication and collaboration (ILO 4). |
| Group Project Presentation | ILO4             | The presentation assesses students' ability to effectively communicate their project findings, clearly articulate the engineering implications of their numerical results, and demonstrate higher-order critical thinking in interpreting outcomes (ILO 4).                                                            |

**Grading Rubrics**

Detailed rubrics for each assignment, project, and presentation will be provided on Canvas. These rubrics clearly outline the criteria used for evaluation (e.g., correctness of approach, software proficiency, quality of interpretation, and clarity of presentation). Students can refer to these rubrics to understand how their work will be assessed.

**Final Grade Descriptors:**

| Grades | Short Description        | Elaboration on subject grading description                                                                                                                                                                                                                               |
|--------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A      | Excellent Performance    | Demonstrates a comprehensive grasp of numerical methods, expertise in problem-solving, and significant creativity in modeling. Exhibits a high capacity for critical interpretation of results, going beyond core requirements to achieve learning goals.                |
| B      | Good Performance         | Shows good knowledge and understanding of the main numerical techniques, competence in applying software to familiar problems, and the ability to analyze and evaluate results. Displays high motivation and effective collaboration in group work.                      |
| C      | Satisfactory Performance | Possesses adequate knowledge of core numerical principles, competence in dealing with standard geotechnical modeling tasks, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.                |
| D      | Marginal Pass            | Has threshold knowledge of fundamental numerical methods, potential to use key software tools, and the ability to make basic judgments on results. Benefits from the course and has the potential to develop further in the discipline.                                  |
| F      | Fail                     | Demonstrates insufficient understanding of numerical principles and lacks the necessary problem-solving skills. Shows limited ability to use software or interpret outcomes critically. Does not meet the threshold requirements for professional practice in this area. |

**Course AI Policy**

Generative AI tools (e.g., ChatGPT, Copilot) may be used for general coding assistance, conceptual clarification, or error-check support. However, all submitted assignments, project reports, and presentation materials must be the student's own original work. Students must clearly cite any AI-generated content or code snippets used. Unauthorized use of AI to directly solve specific numerical problems, generate complete deliverables, or bypass the learning process will be treated as academic misconduct.

**Communication and Feedback**

Assessment marks for individual assessed tasks will be communicated via Canvas within two to three weeks of submission. Where possible, we would provide feedback on assignments with specific details regarding strengths, areas for improvement, and suggestions for better modeling practices. Students who have further questions about the feedback, including marks, should consult the instructor within five working days after the feedback is received.

**Resubmission Policy**

No resubmission of assignments or projects will be permitted after the deadline. Late submission is only permitted under exceptional circumstances (e.g., medical emergencies with official documentation) with approval by the instructor.

## Required Texts and Materials

- Zhao, J.D., 2026. *CIVL 4750 Lecture Notes for Numerical Solutions to Geotechnical Problems*, HKUST.
- Seequent Limited (The Bentley Subsurface Company). *Stability Modelling with GeoStudio*, 2025. Available at: <https://www.geoslope.support/>
- Itasca Consulting Group, Inc. 2024. *FLAC 2D Geomechanical Software for Analyzing and Simulating Dynamics in 2D*. Available at: [www.itascacg.com](http://www.itascacg.com)
- *PLAXIS 2D/3D 2024 Manual*. Available at: [www.plaxis.com](http://www.plaxis.com)
- Additional reading materials and tutorial handouts will be provided on Canvas.

## Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to [Academic Integrity | HKUST – Academic Registry](#) for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

## [Optional] Additional Resources

- Canvas Learning Management System (for lecture notes, tutorial datasets, and announcements).
- Computer Lab Rm 3207 (reserved for tutorials and software access). Specific tutorial arrangements will be announced on Canvas based on the learning progress during the semester.