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<tr><td colspan="2">Academic Year: 2023-2024</td><td>Semester: Fall</td><td>Starting Date: 15-10-2023</td></tr>
<tr><td>Course Name</td><td colspan="3">Ground Improvement techniques</td></tr>
<tr><td>Module Language</td><td colspan="3">English</td></tr>
<tr><td>Instructor</td><td colspan="3">Professor Dr. Yousif Ismael Mawlood</td></tr>
<tr><td>Teaching Assistance(s)</td><td colspan="3">None</td></tr>
<tr><td>College/University</td><td colspan="3">College of Engineering – Salahaddin University-Erbil</td></tr>
<tr><td>Department</td><td colspan="3">Civil Engineering</td></tr>
<tr><td>Semester Duration</td><td colspan="3">15 weeks</td></tr>
<tr><td>Course Overview</td><td colspan="3">The soils at construction sites are not always totally suitable for supporting physical infrastructure such as buildings, bridges, highways, tunnels and dams. Under these conditions, soil needs to be treated using ground improvement techniques. Similarly specific types of soil improvement techniques are required in the case of expansive soils and collapsible soil and in the case of earthquake prone areas.
The course addresses various ground improvement techniques along with principles, design issues and construction procedures.
This is the course of ground improvement techniques for marginal and problematic soil. Various techniques for improving soil are used to:
o Reduce the settlement of structures
o Improve the shear strength of soil and thus increase the bearing capacity of shallow foundations
o Increase the factor of safety against possible slope failure of embankments and earth dams
o Reduce the shrinkage and swelling of soils</td></tr>
<tr><td>Course Objectives</td><td colspan="3">The objective of this course is to provide students with
1. Understand the principles, applications, and design procedures for various ground improvement techniques.
2. Use analytical/theoretical/numerical calculations to assess the effectiveness of a ground improvement technique.
3. Gain competence in properly evaluating alternative solutions, and the effectiveness before, during and after using ground improvement.
4. Application of physical and chemical ground improvement techniques using grouting, shotcrete technology</td></tr>
<tr><td>Course Contents</td><td colspan="3">Week Lecture
<table><tr><td>1st</td><td>Introduction</td></tr><tr><td>2nd</td><td>Problematic Geomaterials and Conditions</td></tr><tr><td>3rd</td><td>Selection Of Ground Improvement Method</td></tr><tr><td>4th</td><td>Shallow and Deep Compaction; Densification Principles</td></tr><tr><td>5th</td><td>Design Considerations</td></tr><tr><td>6th</td><td>Design Parameters and Procedure: Design Example</td></tr><tr><td>7th</td><td>Vibroflotation, Blasting</td></tr><tr><td>8th</td><td>Precompression, Sand Drains</td></tr></table></td></tr>
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9th	Midterm Exam
10th	Prefabricated Vertical Drains, Lime Stabilization
11th	Fly-Ash Stabilization, Cement Stabilization
12th	Stone Columns, Sand Compaction Piles
13th	Dynamic Compaction, Jet Grouting, Deep Mixing
14th	Seminar Presentation
15th	Final Exam

Textbooks and References	1. Jie Han, Principles and Practice of Ground Improv, John Wiley & Sons, 2015. 2. Peter G Nicholson "Soil improvement and ground modification methods" 2015. 3. Huat, B. B., Prasad, A., Kazemian, S., & Anggraini, V. (2019). *Ground improvement techniques*. CRC Press. 4. Ni, P. (2023). Fundamentals of Ground Improvement Engineering: by Jeffrey Evans, 5. Daniel Ruffing, David Elton, 5. Nicholson, P. G. (2014). *Soil improvement and ground modification methods*. Butterworth-Heinemann. 6. Patel, A. (2019). *Geotechnical investigations and improvement of ground conditions*. Woodhead Publishing.
Teaching Style	3 hrs. in Class
Requirements for credit points	For the award of credit points, it is necessary to pass the module exam. It contains: An examination during the academic semester, Quizzes, Assignments, Article review, and Final examination. **Student's attendance is required in all classes**.
Credit ECTS	6
Grade Distribution	The following grade system is used for the evaluation of the module exam: The module exam is based on the summation of two categories of evaluations: **First: (50%)** of the mark is based on the academic semester effort which includes 1. without Article Review - Midterm Exam = 20%. - Quiz = 15% - Seminar = 15% 2. with Article Review - Midterm Exam = 20%. - Quiz = 5% - Seminar = 10% - Review Article = 15% **Second: (50%)** of the mark is based on the final examination that is comprehensive for the whole of the study materials reviewed during the academic semester.
Workload	Workload 10hrs/w (150hrs/s): Contact face-to-face 3hrs/w (45hrs/s) and Non-Contact Self learning 7hrs/w (105hrs/s)