

### CES565 - Marine Geotechnical Engineering

Course Title	MARINE GEOTECHNICAL ENGINEERING				
Course Code	CES565				
Course Type	Technical Elective				
Level	MSc (Level 2)				
Year / Semester	1 <sup>st</sup> or 2 <sup>nd</sup> Year / 2 <sup>nd</sup> or 3 <sup>rd</sup> Semester				
Teacher's Name	Dr. Panagiotis Papadopoulos / Dr. Christakis Onisiphorou				
ECTS	7	Lectures / week	3	Laboratories / week	0
Course Purpose and Objectives	<p>The purpose of the course is to teach the students about the classification and behaviour of marine soils and also about geotechnical engineering applications in marine conditions. This is met through the following objectives: Students will be able to classify marine soils, understand the phenomenon of liquefaction, apply methods for calculating the lateral resistance of piles, assess the stability of marine slopes, perform design checks for seabed anchors and also perform design calculations for marine and offshore structures.</p>				
Learning Outcomes	<ol style="list-style-type: none"> <li>1. Classify marine soils according to their origin and behavior, and plan the main phases of a marine site investigation.</li> <li>2. Describe the cyclic behaviour of soils under drained and undrained conditions and recognize the importance of liquefaction phenomena.</li> <li>3. Apply simplified and complex methods of analyses for calculating the ultimate lateral resistance and deflection of single piles and pile groups.</li> <li>4. Assess the stability of drained, undrained and partially submerged marine soil slopes.</li> <li>5. Calculate the pull-out capacity of seabed anchors for different loading conditions.</li> <li>6. Compute the bearing capacity, settlement and rotation for different types of marine and offshore foundations.</li> <li>7. Develop skills for relating geotechnical applications in marine and offshore engineering to oil and gas exploration in seas and oceans.</li> </ol>				
Prerequisites		Corequisites			
Course Content	<ul style="list-style-type: none"> <li>• Marine Soils: Introduction to marine soils and sediments. Topographical features of seafloor. Origin, classification and behaviour of marine soils. Typical geotechnical profiles. Shear strength and consolidation properties. Scour and erosion.</li> <li>• Marine Site Investigations: Phases and Planning of a marine site investigation. Geophysical surveys, bathymetry and seafloor</li> </ul>				

	<p>topography. Drilling and sampling procedure. In-situ testing and on-board testing.</p> <ul style="list-style-type: none"> <li>• Soil behaviour under cyclic loading: Cyclic behaviour of soils. Drained and Undrained cyclic loading. Effects of drainage. Constitutive modelling. Liquefaction phenomena. Liquefaction potential and analysis.</li> <li>• Lateral loading of piles: Driven and Bored piles. Pile behaviour under lateral load. Essential soil and pile parameters. Ultimate lateral resistance and deflection of single piles and pile groups. Design recommendations using Eurocode 7. Simplified and complex methods of analyses.</li> <li>• Marine slope stability and seabed anchors: Seafloor stability and mechanisms of instability. Stability analysis of drained, undrained and partially submerged soil slopes. Analysis under gravity and wave effects. Earthquake effects and liquefaction hazard. Types and load capacity of anchors.</li> <li>• Types of Foundations for Marine and Offshore Structures: Foundations for gravity platforms and jack up rigs. Offshore pile foundations. Design loads and design considerations. Calculation of bearing capacity and settlement. Construction and installation techniques. Prediction of performance.</li> </ul>				
Teaching Methodology	<p>The course will be presented through formal lectures in class and practical design examples. The lectures will present to the student the course content and allow time for questions and discussion. Part of the material will be presented using visual aids such as PowerPoint slides. Other parts of the course will involve solved examples on the board. Notes shall be taken by the students in class during lectures. In addition, all of the course material will be made available through the course e-learning platform. Finally, the instructor will be available to students during office hours or by appointment in order to provide any necessary tutoring.</p>				
Bibliography	<ul style="list-style-type: none"> <li>• Poulos, H.G., Marine Geotechnics, Spon Press, 1988.</li> <li>• Reese, L.C. &amp; Van Impe, W.F., Single Piles and Pile Groups under lateral loading, Taylor &amp; Francis, 2000.</li> <li>• Gerwick, B.C., Jr, Construction of Marine and Offshore Structures, 3rd ed., CRC Press, 2007.</li> </ul>				
Assessment	<p>The course is assessed through mid-term examinations, assignments and a final examination. The criteria for assessment can be found on the individual assignments and exams. The weights of the course assessment are as follows:</p> <table data-bbox="491 1659 1046 1749"> <tr> <td>Midterm Exams</td> <td>40%</td> </tr> <tr> <td>Final Exam</td> <td>60%</td> </tr> </table>	Midterm Exams	40%	Final Exam	60%
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Language	English				