Course unit title:	Computer Modelling and Simulation		
Course unit code:	CE 305		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	6 (Fall)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. Petros Christou		
Learning outcomes of the course unit:	1. Describe various structural systems and recognize the appropriate elements to be used for the analysis. 2. Review the principles of the direct stiffness method as that applies to the analysis of structures and explain the similarities and differences with the finite element method. 3. Construct structural models and use programming techniques to develop simple engineering algorithms to solve engineering problems. 4. Investigate the advantages and disadvantages of engineering software and select the most appropriate for the application to civil engineering problems. 5. Make use engineering software related to the analysis and design of structures including their foundations. Study the output and verify the results. 6. Analyze models of real structures and validate the results.		
Mode of delivery:	Face-to-face		
Prerequisites:	CE 300	Co-requisites:	None
Recommended optional program components:			
Course contents:	**Revision of Engineering Software:** Review the basics of structural engineering software and present the basic features of common commercial programs. Explain the different analyses options (linear vs nonlinear, static vs dynamic) and how are those implemented in the engineering software. **Direct Stiffness Method:** Setup systems of linear equations and solve using Gauss elimination. Create stiffness matrices and external load vectors of structural systems and solve to obtain displacements. Use the displacements to calculate element forces and draw shear and bending moment diagrams. **Computer Programming / Use of MATLAB:** Explain the important rules for the development of computer programs. State the importance of creating modular programs and use available MATLAB scripts that are applied to civil engineering applications. Take advantage of the MATLAB available commands and create simple script files and function files to solve specific problems. **Introduction to Finite Elements:** Present the basics of the finite element method (discretization, meshing, assembly of equations, applied loads) and discuss the similarities and differences with the direct stiffness method. Explain the behaviour of the most common finite elements (membrane, plate, shell, solid) and discuss their application. Discuss the assessment of mesh correctness. **Structural Modeling:** Explain the importance of creating correct structural models to predict the actual structural behaviour and present modelling techniques for various support conditions, applied loading, symmetry and antisymmetry. Discuss the behaviour of example structures, identify the appropriate elements and create structural models. **Use of Available Software (SAP):** Explain the procedure followed by commercial structural analysis programs. Discuss structural modelling and explain the use of		

	structural elements and supports. Use SAP to create models of structural systems and analyze. Assess the validity of the results based on hand calculations and enhance intuition.
Recommended and/or required reading:	
Textbooks:	“Structural Analysis: Using Structural and Matrix Methods”, Jack C. McCormac, Wiley, 2006.
References:	“Matrix Analysis of Structures”, Robert E. Sennett, Waveland Pr. Inc.; 2000. “Computer Assisted Structural Analysis and Modelling”, Marc Ira Hoit, Prentice Hall, 1995.
Planned learning activities and teaching methods:	The course will be presented through theoretical lectures in class. The lectures will present to the student the course content and allow for questions. Part of the material will be presented using visual aids. The aim is to familiarize the student with the different and faster pace of presentation and also allow the instructor to present related material (photographs etc.) that would otherwise be very difficult to do. The learning process will be enhanced with the requirement from the student to solve exercises. These include self evaluation exercises which will be solved in class. These exercises will not be graded. Exercises will also be given as homework (final project) which will be part of their assessment. Besides from the notes taken by students in class, all of the course material will be made available through the class website and also through the eLearning platform. Finally the instructor will be available to students during office hours or by appointment in order to provide any necessary tutoring.
Assessment methods and criteria:	• Course Work: 50% • Final Exam 50%
Language of instruction:	English
Work placement(s):	No