

Course unit title:	Systems Analysis		
Course unit code:	CE460		
Type of course unit:	Technical Elective		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	N/A		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. Christos Anastasiou		
Learning outcomes of the course unit:	<ol style="list-style-type: none"> 1. Identify the various applications of systems analysis and solution methods. 2. Provide an introduction into the nature and rules of modelling, as well as the forms of mathematical programs. 3. Recognize the variables to be considered in decision-making. 4. Build a basic linear, an integer, a dynamic, or a nonlinear program 5. Assess how different search methods are applied in different civil engineering systems (i.e. water resources, transportation, construction, structures, and environmental). 6. Use the analytical techniques used in developing management strategies and scenarios (i.e. Sensitivity analysis, Multi-objective methods, Alternatives generation, Uncertainty analysis). 7. Appreciate the strengths and limitations of decision support tools and how these may enhance the development of resource management strategies to provide opportunities for considerations of alternative strategies in a civil engineering project). 		
Mode of delivery:	Face-to-face		
Prerequisites:		Co-requisites:	None
Recommended optional program components:	None		
Course contents:	<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ The “systems” approach <ul style="list-style-type: none"> ▪ Building models ▪ Systems optimization ▪ Rules of modelling ○ The form of a mathematical program <ul style="list-style-type: none"> ▪ Example mathematical programs • Search methods <ul style="list-style-type: none"> ○ Manual ○ Graphical ○ Mathematical programming [e.g. Linear programming (LP), Nonlinear programming (NLP), Integer programming (IP), Global search methods overview] • Analysis <ul style="list-style-type: none"> ○ Sensitivity analysis ○ Multi-objective methods (e.g. Generating trade-off curves) ○ Alternatives generation (i.e. Modelling to generate alternatives) ○ Uncertainty analysis (i.e. Monte Carlo methods) • Systems to be examined <ul style="list-style-type: none"> ○ Engineered systems, (e.g. Water resources planning, Wastewater treatment plant operation, transportation engineering, construction management, structures, and environmental engineering) • Overview of decision support tools 		
Recommended			

and/or required reading:	
Textbooks:	<ul style="list-style-type: none"> • Revelle, C., Whitlatch, E.E., and J. R. Wright (2004). "Civil and Environmental Systems Engineering". Prentice Hall.
References:	<ul style="list-style-type: none"> • Winston, W.L. (1997). "Operations Research Applications and Algorithms", Duxbury Press. • Journal Papers
Planned learning activities and teaching methods:	<p>The course will be presented through theoretical lectures in class. The lectures will present to the student the course content and allow for questions. The material will be presented using visual aids (i.e. PowerPoint presentation slides, documentaries, etc.). The aim is to familiarize the student with the different and faster pace of presentation and also allow the instructor to present related material that would otherwise be very difficult to do. The learning process will be enhanced with the requirement from the student to carry in-class discussions and tackling of hypothetical scenarios in small-group exercises. In-class problem-solving as well as homework exercises (mostly numerical) will allow students to practice their design skills in a controlled setting. A final project, which will be required as part of the students assessment for the course, will allow students the opportunity to carry out independent research, synthesize basic concepts presented in class, as well as hone their writing and presentation skills. Besides from the notes taken by students in class, all of the course material will be made available through the class website which will be available through the University's E-learning platform. The instructor will be available to students during office hours or by appointment in order to provide necessary guidance.</p>
Assessment methods and criteria:	<ul style="list-style-type: none"> • Assignments 20% • Tests: 30% • Final Exam 50%
Language of instruction:	English
Work placement(s):	No