REM master basic syllabus

Title:
CE6040 Civil Engineering Systems

Credit value:
5 ECTS

Mandatory/Optional:
Optional

Semester:
1

Lecturer/s:
Yong Song Fan, Paul Leahy

University:
University College Cork

Department:
School of Engineering

Rationale:
To introduce students to the methods and techniques of Applied Systems Analysis. To develop students' skills in using Applied System Analysis in the design and planning of complex and large-scale engineering systems.

Objectives:
On successful completion of this module, students should be able to:

- Describe relevant parts of the Applied Systems Analysis method for system engineering planning and design, and technology evaluation, of relevance to engineering practice in its social and business context.
- Identify, formulate, analyse and solve problems drawn from engineering practice in their technical, social and business context using the relevant parts of Applied Systems Analysis method and techniques, particularly NPV and IRR methods.
- Derive and apply selected techniques of Applied System Analysis, Optimization, and Evaluation to
- examples (e.g. Information Gathering, Information Analysis, Economic and Social Benefits Analysis (incl. risk analysis), and project evaluation.
- Complement examples for Applied Systems Analysis with relevant technical analysis of complex
- engineering systems
- Use a computer to solve an Engineering Optimisation problem and interpret the solution.

Skills: *(according to the list of skills provided)*

Subject skills	REM Master Skills						
	L2.1	**L2.2**	**L2.3**	**L2.4**	**L2.5**	**L2.6**	**L2.7**
L3.1. Apply NPV and IRR methods to evaluate Engineering projects	X	X					
L3.2. Carry out risk analysis of Engineering projects	X	X					
L3.3. Analyse and develop models of Engineering systems which may be used with Engineering Optimisation Methods		X					
L3.4 Apply Engineering Optimisation to identify optimal solutions to problems, interpret the results and carry out sensitivity analysis	X	X					

Teaching and learning methods:

The teaching method is based on a series of lectures where the lecturer explains the main concepts through in the classroom including worked out examples on the board.
The students are given an assignment featuring a set of problems drawn from Civil Engineering topics where Systems Analysis techniques can be applied.
A second assignment requires the students to interpret an optimisation problem in Energy Engineering or Civil Engineering, formulate it in a way that allows a computer optimisation tool to be used to solve the problem. Students are required to interpret the results of the computer optimisation.

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	30 hours	10 hours
Tutorials	2 hours	0 hours
Assignment	2 hours	4 hours
Private study		41 hours

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Assessment:

Numerical problems assignment, computer application assignment, final written exam to test students' achievements of the learning outcomes.

Assessment Matrix:

Subject skills	**Assessment method**					
	Exam	**Class test**	**Coursework**	**Report**	**…**	**…**
All	80%	-	20%	-		

Programme:

Lesson 1	***Introduction to Project Economic Evaluation*** ***3h***
Lesson 2	***Net Present Value Methods*** ***3h***
Lesson 3	***Annualised Costs and Capital Recovery*** ***3h***
Lesson 4	***Internal Rate of Return*** ***3h***
Lesson 5	***Applications in Civil Engineering I*** ***3h***
Lesson 6	***Applications in Civil Engineering II*** ***3h***
Lesson 7	***Introduction to Numerical Optimisation in Engineering*** ***3h***

Lesson 8	***Systems Analysis / Linear Programming*** ***3h***
Lesson 9	***Solution of Linear Programming Problems*** ***3h***
Lesson 10	***Dynamic Programming*** ***3h***
Lesson 11	***Applications in Renewable Energy*** ***3h***
Lesson 12	***Sensitivity Analysis*** ***3h***

Resources:

A classroom, equipped with a blackboard and audio-visual resources (laptop/computer and Internet connection + projector), for the lectures.
For computer tutorial: a room with computer workstations, internet access and Microsoft Excel.

Bibliography:

Applied Systems Analysis: Engineering Planning and Technology Management
by Richard De Neufville Publisher: McGraw-Hill (1990) ISBN-10: 0070163723

Practical Optimization: A Gentle Introduction. John W. Chinneck (2018)
Systems and Computer Engineering, Carleton University. Available online at
http://www.sce.carleton.ca/faculty/chinneck/po.html

Further comments: