Structural Engineering (250725)

General information

School:	ETSECCPB
Departments:	751 - Departament d'Enginyeria Civil i Ambiental
Credits:	6.0 ECTS
Programs:	1140 - MÀSTER UNIVERSITARI EN ENGINYERIA ESTRUCTURAL I DE LA CONSTRUCCIÓ (pla 2015)
Course:	2015/2016
Course language:	Castellano

Faculty

Responsible faculty: Gabriel Bugeda Castelltort

Teachers: Gabriel Bugeda Castelltort, Pooyan Dadvand

Generic objectives

Skills

Specific skills

Mathematically modelling structural engineering problems.

To apply methods and advanced design software and structural calculations, based on knowledge and understanding of forces and their application to the structural types of civil engineering.

Generic skills of subject

To conceive, design, analyze and manage structures or structural elements of civil engineering or building, encouraging innovation and the advance of knowledge.

To develop, improve and use conventional materials and new construction techniques to ensure the safety requirements, functionality, durability and sustainability.

ECTS credits: total hours of student work

		Dedication	
		Hours	**Percent**
Supervised Learning	**Theory**	38.00	70.4%
	Assignments	10.00	18.5%

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	Laboratory	4.00	7.4%
	Supervised activities	2.00	3.7%
Self-Learning		96.00	

Contents

Introduction

Dedication

2.0h. Theory

Description

Introudccion and discrete systems

Objectives

Describe the course and present the analogy with discrete and bar systems.

2D Solids

Dedication

8.0h. Theory + 4.0h. Assignments

Description

Structural analysis in plane stress and strain assumtions as well in axisimetric 3D structures.

Introduction to Programming the FEM in MAT LAB

Learning a finite element program

Solution of two-dimensional structures using FEM

Objectives

Present the finite element method in two-dimensional elasticity problems

Learn to programming and solve with the program the finite element method

Consolidate the use of computers for solving problems using FEM

3D Solid

Dedication

2.0h. Theory + 2.0h. Assignments

Description

Define the finite element method in three-dimensional elasticity problems.

solution of 3D structures using the FEM

Objectives

consolidate the MEF study by its matrix formulation.

Consolidate the use of computers to solve problems by the FEM

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Beams

Dedication

6.0h. Theory

Description

Study the theories of Timoshenko and Euler_Bernulli for solving bending beams.

Objectives

Studying higher-order elements and know the complications that can present the numerical solution of a problem by the FEM

Evaluation

Dedication

4.0h. Laboratory

Plates

Dedication

6.0h. Theory + 2.0h. Assignments

Description

Further application of FEM for thin and thick plates analysis using theKirchhoff and Reissner-Mindlin theories. Analyse the application to composite materials.

Solving plate structures using the FEM

Objectives

Extending theories of beams to two-dimensional case

Consolidate the use of computers to solve problems by the FEM

Shells

Dedication

8.0h. Theory + 2.0h. Assignments

Description

Develop the FEM to the analysis of thin and thick shells extending Kirchoff theories and Reissner-Mindlin as well as the 2D plane stress to the 3D flat shells analysis.

Shells structures solution using the FEM

Objectives

Expanding and combining elasticity theories applied to the FEM

Consolidate the use of computers to solve problems using the FEM

real examples

Dedication

2.0h. Theory

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Description

Presentation of real studies conducted by engineering firms.

Objectives

Knowing the actual use of the method and its scope.

Introduction to dynamic analysis

Dedication

2.0h. Theory

Description

Introduction to dynamic analysis of structures using the FEM

Objectives

show the scope of the FEM in the structures design.

Introduction to nonlinear problems

Dedication

2.0h. Theory

Description

Introduction to nonlinear analysis and coupled problems, using the FEM

Objectives

show the scope of the FEM in structural design.

Activities

Programming practices

Dedication

2.0 h. Supervised activities

Description

Solve linear elasticity problems using the finite element method

Grading rules (*)

(*) The evaluation calendar and grading rules will be approved before the start of the course.

The mark will be obtained from continuous assessment (40%) and the average of two exams (60%).

Continuous assessment involves solving individual exercises. These exercises will be graded with a maximum score of four (4) points: One (1) point for the practical exercises solved at class time and three (3) points for the finite element method applied to a practical case.

The exams consist of a questionnaire to be answer individually, without the help of any literature. Each questionnaire adheres to the concepts taught in the course. This exams have a maximum mark of six (6) points.

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Test rules

If there is any exam or continuous assessment within the scheduled period, a zero score will be considered.

Teaching methodology

The course consists of 2.7 hours a week of classes in the classroom where the teacher presents the concepts and basics of the course.

Also 0.9 hours per week is spending in a middle group format, to problem solving with more interaction with the student. Practical exercises are solved to consolidate the general and specific learning objectives.

Support material is used in the form of detailed teaching plan stored at the Virtual Center http://www.cimne.com/cdl1/ctrhome/2: content, programming and evaluation activities directed learning and literature.

Office hours

The student consultancy service is two hours per week, intensifying to four hours per week at the exam period. The schedule will be announced at the beginning of each course.

Basic bibliography

- Oñate. E. **Cálculo de estructuras por el método de los elementos finitos. Análisis estático linea**. SPRINGER - CIMNE . Barcelona. 1995. ISBN 84-87867-00-6.
- Oñate. E. **Structural analysis with the finite element method. Linear statics volume i : basis and solids**. SPRINGER - CIMNE. Barcelona. 2008. ISBN 978-1-4020-8732-5.
- Oñate. E. **Structural analysis with the finite element method. Linear statics volume ii : beams plates and shells Barcelona**. SPRINGER - CIMNE. Barcelona. 2010. ISBN 978-84-96736-18-4.

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