Course guides
250501 - MECMEDCON - Continuum Mechanics

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: MASTER'S DEGREE IN GEOLOGICAL AND MINING ENGINEERING (Syllabus 2013). (Compulsory subject).
Academic year: 2015 ECTS Credits: 7.5 Languages: Catalan, English, Spanish

LECTURER
Coordinating lecturer: FRANCISCO JAVIER OLIVER OLIVELLA
Others: ESTER COMELLAS SANFELIU, ORIOL LLOBERAS VALLS, FRANCISCO JAVIER OLIVER OLIVELLA

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
8211. The ability to address and solve advanced mathematical problems in engineering, from the scope and context of the problem to its statement and implementation in a computer program. In particular, the ability to formulate, program and apply advanced analytical and numerical calculation models to the design, planning and management of a project, as well as the ability to interpret the results obtained in the mining engineering.
8212. Adequate knowledge of scientific and technological aspects of fluid mechanics, continuum mechanics, structural design, geotechnical engineering, and carbochemical and petrochemical technology.

TEACHING METHODOLOGY
The course consists of 6 hours a week of on-campus classes taught in two-hour lectures. These lectures will combine theory and problems. Additionally, students will be given assignments they must perform on their own to consolidate the general and specific learning objectives.

LEARNING OBJECTIVES OF THE SUBJECT

Ability to address and solve advanced mathematical engineering problems, from problem statement to formulation development and its implementation in a computer program. Specifically, ability to formulate, plan and implement advanced analytical and numerical models, project planning and management, as well as the ability to interpret the results in the context of mining engineering.

Adequate knowledge of scientific and technological aspects of fluid mechanics, continuum mechanics, structural design, geotechnical engineering, and carbochemical and petrochemical technology.

Ability to apply the description of motion, strains and stresses.
Ability to apply conservation equations to engineering problems such as solid mechanics, fluid mechanics and mechanics of porous media.
Ability to develop and understand constitutive models associated with both solid and fluid materials as well as porous media.

Fundamental concepts of constitutive equations. Knowledge of the theory of elasticity, plasticity, and viscoplasticity failure criteria.
## STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes</td>
<td>32.5</td>
<td>17.32</td>
</tr>
<tr>
<td>Laboratory classes</td>
<td>16.3</td>
<td>8.69</td>
</tr>
<tr>
<td>Self study</td>
<td>120.0</td>
<td>63.97</td>
</tr>
<tr>
<td>Practical classes</td>
<td>16.3</td>
<td>8.69</td>
</tr>
<tr>
<td>Guided activities</td>
<td>2.5</td>
<td>1.33</td>
</tr>
</tbody>
</table>

**Total learning time:** 187.6 h

## CONTENTS

### Introduction

**Description:**
Introduction to the course and review of tensor algebra.

**Full-or-part-time:** 3 h
- Theory classes: 1h 30m
- Self study: 2h 05m

### Description of Motion

**Description:**
- Theory
- Problems

**Full-or-part-time:** 12 h
- Theory classes: 3h
- Practical classes: 2h
- Self study: 7h

### Deformation and Strain

**Description:**
- Theory
- Problems

**Full-or-part-time:** 19 h
- Theory classes: 6h 30m
- Practical classes: 2h
- Self study: 11h 54m
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Full-or-part-time</th>
<th>Theory classes</th>
<th>Practical classes</th>
<th>Laboratory classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility Equations</td>
<td>Theory and problems</td>
<td>5 h</td>
<td>1h 30m</td>
<td>1h</td>
<td>3h 30m</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>Theory</td>
<td>18 h</td>
<td>6h 30m</td>
<td>1h 30m</td>
<td>11h 12m</td>
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</tr>
<tr>
<td>Conservation and Balance Equations</td>
<td>Theory</td>
<td>25 h</td>
<td>7h 30m</td>
<td>2h 30m</td>
<td>1h 15h 24m</td>
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</tr>
<tr>
<td>Linear Elasticity</td>
<td>Theory</td>
<td>22 h</td>
<td>6h 30m</td>
<td>3h</td>
<td>13h 18m</td>
<td></td>
</tr>
<tr>
<td>Plane Linear Elasticity</td>
<td>Theory</td>
<td>3 h</td>
<td>1h 30m</td>
<td></td>
<td>2h 05m</td>
<td></td>
</tr>
</tbody>
</table>
Plasticity

**Description:** Theory
Problems

**Full-or-part-time:** 17 h
Theory classes: 4h
Practical classes: 2h 30m
Laboratory classes: 1h
Self study : 10h 30m

Constitutive Equations in Fluids

**Description:** Theory

**Full-or-part-time:** 3 h
Theory classes: 1h 30m
Self study : 2h 05m

Fluid Mechanics

**Description:** Theory
Problems

**Full-or-part-time:** 15 h
Theory classes: 4h
Practical classes: 2h 30m
Self study : 9h 06m

Variational Principles

**Description:** Theory and problems

**Full-or-part-time:** 4 h
Theory classes: 1h
Laboratory classes: 1h
Self study : 2h 48m

**GRADING SYSTEM**

The assessment of the course will be based on four individual partial tests containing different groups of topics. One hour will be given to answer each of these tests. The tests will take place throughout the course and during class hours. The final mark of the evaluation will be obtained as a combination of the arithmetic mean (with a weight of 0.9) and the geometric mean (with a weight of 0.1) of the partial assessments over 10 points. The result will be rounded to the inferior multiple of 0.1 to obtain the final mark of the course (NF). To pass the course, one must achieve a NF greater than or equal to 5.
**EXAMINATION RULES.**

If any of the ongoing evaluation activities are not performed in the scheduled period a zero mark will be assigned to that activity.

In case of failure to attend an assessment test due to a justifiable reason, the student must notify the professor in charge of the course BEFORE OR IMMEDIATELY AFTER THE TEST and hand in an official certificate excusing his absence. In this case, the student will be allowed to take the test another day, ALWAYS BEFORE THE FOLLOWING ASSESSMENT.

**BIBLIOGRAPHY**

**Basic:**

**Complementary:**