

**Course: MS&E 402**

## **MECHANICAL PROPERTIES OF MATERIALS, PROCESSING AND DESIGN**

### **GENERAL INFORMATION**

**1st semester**

**Credits:** 4CU-6UC

**Lectures:** T 09:30-11:30; R 10:30-11:30; F 09:30-10:30

### **INSTRUCTOR(S)**

FEDERICO GUTIÉRREZ-SOLANA

Catedrático de Universidad. Departamento de Ciencia e Ingeniería del Terreno y de los Materiales.

JOSÉ ALBERTO ÁLVAREZ

Profesora Titular de Universidad. Departamento de Ciencia e Ingeniería del Terreno y de los Materiales.

JOSÉ ANTONIO CASADO DEL PRADO

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SERGIO CICERO GONZÁLEZ

Profesor Asociado. Departamento de Ciencia e Ingeniería del Terreno y de los Materiales.

### **COURSE OBJECTIVE**

The course presents the basis to understand the mechanical behaviour of materials used for structural purposes, the different elastic, plastic and viscous models. It also defines the application of fracture mechanics and failure analysis to be used in structural integrity assessments. Finally, it includes the experimental work that supports the previous areas.

### **TEXTBOOK**

**Mechanical Behaviour of Materials**

Gutierrez-Solana, F and Alvarez, J .A.

Publisher: Serv. Publicaciones ETS Ingenieros de Caminos

Published 2007

### **REFERENCES**

Mechanical behaviour of materials; N.E. Dowling, Prentice-Hall (1993)

Mechanical behaviour of materials; T. H. Courtney, McGraw-Hall (1990)

Fracture Mechanics: Fundamentals and Applications; T.L. Anderson (2005)

### **GRADING**

|                                       |     |
|---------------------------------------|-----|
| <b>Exercises during the semester:</b> | 20% |
| <b>Lab practices:</b>                 | 20% |
| <b>Course Project:</b>                | 20% |
| <b>Final Exam:</b>                    | 40% |

**COURSE SYLLABUS**

| WEEK             | ACTIVIDADES/ACTIVITIES |        |           |   |                                     |
|------------------|------------------------|--------|-----------|---|-------------------------------------|
|                  | CONTENTS               | THEORY | EXERCISES | LAB PRACTICES                                   | OTHER                               |
| 1                | T1                     | 2 h    | 1h        | 1h (SCANNING ELECTRON MICROSCOPY test)          |                                     |
| 2                | T1                     | 2 h    | 1h        | 1h (METALLOGRAPHY AND OPTICAL MICROSCOPY tests) | APLICACIONES: PRESTRESSED CONCRETE  |
| 3                | T2                     | 2 h    | 1h        | 1h (COMPRESSION and BEND tests)                 |                                     |
| 4                | T2                     | 2 h    | 1h        | 1h  |                                     |
| 5                | T2                     | 2 h    | 1h        | 1h  |                                     |
| 6                | T2                     | 2 h    | 1h        | 1h (TENSILE test)                               | APLICACIONES: PLASTICITY CRITERIA   |
| 7                | T3                     | 2 h    | 1h        | 1h (HARDNESS and MICROHARDNESS tests)           |                                     |
| 8                | T3                     | 2 h    | 1h        | 1h (CREEP and RELAXATION tests)                 | APLICACIONES: BEHAVIOUR MODELS      |
| PRELIMINARY EXAM |                        |        |           |   |                                     |
| 9                | T4                     | 2 h    | 1h        | 1h  |                                     |
| 10               | T4                     | 2 h    | 1h        | 1h  |                                     |
| 11               | T4                     | 2 h    | 1h        | 1h (CHARPY and $K_{Ic}$ tests)                  | APLICACIONES: ASSESSMENT PROCEDURES |
| 12               | T5                     | 2 h    | 1h        | 1h  |                                     |
| 13               | T5                     | 2 h    | 1h        | 1h  |                                     |
| 14               | T5                     | 2 h    | 1h        | 1h (FATIGUE test)                               |                                     |
| 15               | T6                     | 2 h    | 1h        | 1h  |                                     |
| FINAL EXAM       |                        |        |           |   |                                     |

- T1. ELASTIC BEHAVIOUR OF MATERIALS
- T2. PLASTIC BEHAVIOUR OF MATERIALS
- T3. VISCOELASTIC AND VISCOPLASTIC BEHAVIOUR OF MATERIALS
- T4. FRACTURE MECHANICS
- T5. FATIGUE
- T6. STRESS CORROSION CRACKING.

Each topic comprises theory, practical exercises, laboratory tests and support seminars.