Course guide
240EI016 - 240EI016 - Theory of Structures

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 737 - RMEE - Department of Strength of Materials and Structural Engineering.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Frederic Marimon Carvajal

Others: González Puig, Manuel
González Pina, Ignacio
Marimon Carvajal, Frederic
Pons Poblet, Josep Maria

PRIOR SKILLS

Knowledge of Solid Mechanics and/or Strength of Materials

TEACHING METHODOLOGY

MD01. Lectures. The teacher exposes the practical and theoretical contents of the syllabus of the course, with the active participation of students
MD03. Project Based Learning. During the evolution of the projects will be introduced additional practical issues that are directly related to the subject contents. Two realistic projects to be solved by students in small groups (2 or 3 people) and they will be evaluated: Case Study I and II. There are two structural analysis sessions with professional software.

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DISABILITY SUPPORT PROGRAME (PAD)

The course Theory of Structures is fully subscribed to action undertaken by the UPC in the Disability Support Programme (PAD) to support students who their problems are recognized in the program; physical, sensory, and especially those related to learning difficulties, considering their specific educational needs and assessment. For more information please contact the teacher responsible for the course frederic.marimon@upc.edu

LEARNING OBJECTIVES OF THE SUBJECT

SPECIFIC SKILLS
CE17- Ability to design, construction and operation of industrial plants.
CE19- Knowledge and skills for the calculation and design of structures.
CE23- Knowledge and skills for certifications, audits, inspections, tests and reports.

STUDY LOAD

Type	Hours	Percentage
Hours large group	36,0	32.00
Self study	72,0	64.00
Hours small group	4,5	4.00

Total learning time: 112.5 h

CONTENTS

TEMA I - Structural Analysis

Description:
I. 1 Actions and structural safety
I. 2 Global structural analysis
I. 3 Moment distribution method or Cross Method. Application to plane frames. Symmetry and antimmetry
I. 4 Matrix structural analysis. Application to 2D and 3D structures
I. 5 Simplified calculation methods. Predimensioning. Trusses
I. 6 Theory of plates and shells. Tanks. Pressure vessels
I. 7 Using the finite element method

Full-or-part-time: 42h
Theory classes: 18h
Self study : 24h

TEMA II - Steel Structures

Description:
II. 1 Elements calculations. Beams. Columns. European buckling curves
II. 2 Steel Connection Design

Full-or-part-time: 21h
Theory classes: 9h
Self study : 12h

TEMA III - Concrete Structures

Description:
III. 1 Basis of calculations. Theory of limit states.
III. 2 Calculations of elements. Beams. Columns. Foundations.
III. 3 Prestressed concrete and post-tensioned

Full-or-part-time: 21h
Theory classes: 9h
Self study : 12h

Case Study

Description:
Case Study I
Case Study II

Full-or-part-time: 24h
Practical classes: 4h 30m
Self study : 19h 30m

GRADING SYSTEM

SE01. Final Written Exam. A multidisciplinary exercise with a formulae sheet for support
SE02. Case Study I and Case Study II. Both are mandatory.
SE03. Active attendance at computer classroom sessions
The final mark will be the average of Final Exam and all the Case Study in the subject:
FINAL MARK= 50% SE01+ 40% SE02 + 10% SE03
The possibility to revaluate provided by ETSEIB during the month July is limited to Final Written Exam, i.e. the note SE01.

EXAMINATION RULES.

FINAL EXAM: Final Written Exam. A multidisciplinary exercise with a formulae sheet for support.
CASE STUDY: Team of 2 or 3 students. Oral defense of the projects against the questions formulated by the evaluating professor.

BIBLIOGRAPHY

Basic:
- Fornons, José-María. Teoría de las estructuras Tomo I. Barcelona: ETSEIB. Imatge, 2014. ISBN 848934969X.
- Professors de l'assignatura. Formulari d'Estructures. 2022.
- Professors de l'assignatura. Transparències de classe. Barcelona: Serveis Copisteria ETSEIB, 2022.

Complementary:
- Argüelles Álvarez, R. i altres. Estructuras de acero. Cálculo - Tomo I. 3a ed. Madrid: Editorial Bellisco, 2013. ISBN 9788492970520.
- Fornons, José-María. El método de los elementos finitos en la ingeniería de estructuras. Barcelona: Marcombo, 1982. ISBN 8460026477.
- Argüelles Álvarez, R. i altres. Estructuras de acero. Cálculo. - Tomo II. 2a ed. Madrid: Editorial Bellisco, 2005. ISBN 9788496486539.
- Jiménez Montoya, P. Hormigón armado [on line]. 15a ed. Barcelona: Gustavo Gili, 2009 [Consultation: 29/09/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3209549. ISBN 9788425223075.

RESOURCES

Computer material:
- Diamonds / PowerConnect / ConcretPlus V.2022. Resource
- ESTRUWIN 3D. Software
- FTool. Software