Last update: 04-12-2018

250105 - FONMATEM - Mathematic Fundamentals

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering

Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering

Academic year: 2018

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: M. ROSA ESTELA CARBONELL

Others: ALBERT CREUS MIR, M. ROSA ESTELA CARBONELL, FRANCISCO JAVIER MARCOTE ORDAX, AGUSTIN MEDINA SIERRA

Opening hours

Timetable: Tuesday from 10:00 am to 12:00 am C2-205 module and hours to be arranged with individual teachers. eConsultes online

Degree competences to which the subject contributes

Specific:

3048. Ability to solve the types of mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives; numerical methods; numerical algorithms; statistics and optimisation.

Transversal:

591. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

597. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

600. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Last update: 04-12-2018

250105 - FONMATEM - Mathematic Fundamentals

Teaching methodology

The course consists of 7 hours per week of classroom activity from beginning of course to beginning of November.

In the course there are theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises and others with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The course uses the "flipped classroom" methodology where the student, by means of specific group-dynamics techniques, extends and consolidates the knowledge acquired during the out-of-class preparation, in advance, of basic elements corresponding the following classes. The out-of-class preparation is carried out by the student, supported by videos, transparencies, books and bibliographic material, provided on the website of the course, and according to the directions of the teacher. Then, the in-class group dynamics consists of providing the group of students the required additional knowledge, according to the possible weaknesses identified by the teacher, perform practical exercises, answer questions, deepen the students knowledge on the subject and promote teamwork.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Learning objectives of the subject

Students will learn to perform differential and integral calculus of a variable and to solve ordinary differential equations. Basic knowledge of elementary functions and trigonometry. They will also learn to analyse and solve mathematical problems encountered in engineering that involve these concepts.

On completion of the course, students will have acquired the ability to:
1. Analyse successions and series in engineering contexts and use, derive and integrate trigonometric functions;
2. Use differential calculus to solve maxima and minima problems related to simple engineering problems;
3. Solve integrals of one variable in relation to simple engineering problems.

Real numbers; Trigonometry; Successions and calculation of limits; Numerical series and convergence; Theory of functions, including analysis of continuity and limits; Differential calculus of functions of a real variable, including maxima and minima problems in simple engineering problems

Study load

Total learning time: 150h	Hours large group:	29h	19.33%
	Hours medium group:	17h	11.33%
	Hours small group:	14h	9.33%
	Guided activities:	6h	4.00%
	Self study:	84h	56.00%

Last update: 04-12-2018

250105 - FONMATEM - Mathematic Fundamentals

Content

Item 1. Basics

Learning time: 28h 47m

Theory classes: 7h
Practical classes: 4h
Laboratory classes: 1h
Self study : 16h 47m

Description:
Logic and set theory. Relations and applications
Algebraic structures
Proof methods
Topology Problems
Real numbers
Problems of real numbers
Complex numbers
Problems of complex numbers

Item 2. Vector Spaces

Learning time: 21h 36m

Theory classes: 5h
Practical classes: 3h
Laboratory classes: 1h
Self study : 12h 36m

Description:
Vector subspace and linear combination. System of generators. Sum of subspaces. Bases. Dimension. Coordinates. Range.
Problems

Item 3. Matrices and systems of linear equations

Learning time: 24h

Theory classes: 6h
Practical classes: 3h
Laboratory classes: 1h
Self study : 14h

Description:
Vector space structure. Reduction by rows. Calculation of range. Product of matrices. Reverse. Equivalent and similar matrices. The method of Gauss. Parametric and implicit equations of a vector subspace.
Problems
Definitions, notations and types. Compatible systems. Rouche-Frobenius theorem. Resolution methods.
Problems of systems of equations

Last update: 04-12-2018

250105 - FONMATEM - Mathematic Fundamentals

Item 4. Real functions of real variable

Learning time: 50h 24m

Theory classes: 11h
Practical classes: 7h
Laboratory classes: 3h
Self study : 29h 24m

Description:
Basic definitions. Elementary functions
Basic problems of real functions of real variable
Trigonometry
Trigonometry problems
Limit of a function at a point
Properties of finite limits
Infinite Limits
Problems functions limits
Continuity. Uniform continuity
Continuity theorems
Problems of continuity
Derivatives of elementary functions. Application of the calculation ends
Extreme Problems
Laboratory of elementary functions
Calculation of integrals
Calculation of integrals

Directed activities

Learning time: 19h 12m

Laboratory classes: 8h
Self study : 11h 12m

Description:
Directed activities

Last update: 04-12-2018

250105 - FONMATEM - Mathematic Fundamentals

Qualification system

50% of the final mark correspond to classroom activities. The other 50% is obtained from a global test.

The final mark is the sum of the following partial marks:

Nc: classroom activities
NPG: overall rating test

Nfinal = 0.5* Nc + 0.5 * NPG

Criteria for re-evaluation qualification and eligibility: Students who failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

Regulations for carrying out activities

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

Bibliography

Basic:

Estela, M.R.; Saà, J. Cálculo con soporte interactivo en Moodle. Madrid: Pearson Educación, 2008. ISBN 978-84-832-2480-9.

Estela, M.R. Fonaments de càlcul per a l'enginyeria. Barcelona: Edicions UPC, 2008. ISBN 978-84-8301-969-6.

Hernández, E.; Vázquez, M.J.; Zurro, M.A. Álgebra lineal y geometría. 3a ed. Madrid: Pearson, 2012. ISBN 978-84-7829-129-8.

Stoll, M. Introduction to real analysis. Reading, Mass.: Addison-Wesley, 1997. ISBN 0673995895.

Strang, G. Introduction to linear algebra. 5th ed. Wellesley: Cambridge Press, 2016. ISBN 9780980232776.

Complementary:

Pelayo, I.M.; Rubio, F. Álgebra lineal básica para ingeniería civil. Barcelona: Edicions UPC, 2008. ISBN 9788483019610.

Rojo, J. Álgebra lineal. 2a ed. Madrid: McGrawHill, 2007. ISBN 978-84-481-5635-0.

Sprecher, D.A. Elements of real analysis. New York: Dover Publications, 1987. ISBN 0486653854.

Shilov, G.E. Linear algebra. New York: Dover, 1977. ISBN 048663518X.