Last update: 06-05-2019

230455 - CAL2 - Calculus 2

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: Spanish

Teaching staff

Coordinator: JOSE ANTONIO LUBARY MARTINEZ

Others: Andrés M. Encinas Bachiller

Prior skills

Knowledge of notions and methods of one-variable-calculus and linear algebra

Degree competences to which the subject contributes

Specific:

4. Ability to select numerical and optimization methods suitable for solving physical and engineering problems. Ability to apply the knowledge of numerical algorithms and optimization.
3. Ability to solve math problems that may arise in engineering. Ability to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, ordinary and partial differential equations, probability and statistics.

Generical:

2. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

Transversal:

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

Teaching methodology

· Presentiality: 2.6 ECTS
Showroom (theory + problems) with student participation.
Practical work individually or in teams. Tutoring

Do not presentiality: 3.4 ECTS
Exercises and theoretical or practical projects outside the classroom
Preparation and measurable activities.

Learning objectives of the subject

The first objective of this course is extending to functions of several variables the concepts learned in the course of Calculus I, for one variable functions. In particular we study the concepts of differentiability of functions of several variables, multiple integration, and integration on curves and surfaces and their applications to physics and engineering. It also introduces basic concepts of geometry such as curves and surfaces, with the aim of studying the fundamental theorems of vector analysis, theorems of Green, Stokes and Gauss. These theorems are the theoretical study of

230455 - CAL2 - Calculus 2

electromagnetic fields.

Learning Outcome:
- Domain solving math problems that may arise in physics, and the ability to apply their knowledge of geometry, vector analysis, differential and integral calculus (several variables).
- Use the resources and services available to run simple searches. Classifies and summarizes the information gathered.
- Carries out the tasks on schedule, according to the guidelines set by the teacher or tutor.
- It raises the problem correctly from the proposed language and identify options for resolution.
- Apply the appropriate solution method and identifies the correct solution.
- Identify, model and poses problems from open situations. Explore and implement alternatives for resolution. Known approximations.

Study load

Total learning time: 150h	Hours large group:	65h	43.33%
	Self study:	85h	56.67%

Last update: 06-05-2019

230455 - CAL2 - Calculus 2

Content

Topology. Limits and continuity of functions of several variables.

Learning time: 11h 30m

Theory classes: 3h 30m
Practical classes: 2h 15m
Self study : 5h 45m

Description:
Open sets. Closed sets. Closure. Compact sets.
Vector sequences.
Functions of several variables. Level sets. Limits. Continuity.

Differentiability of functions of several variables.

Learning time: 32h 20m

Theory classes: 7h 45m
Practical classes: 5h 35m
Self study : 19h

Description:
Partial derivatives and directional derivatives. Differentiability. Differential properties of functions. Chain rule.
Implicit function theorem and inverse function

Taylor's formula.

Learning time: 12h 55m

Theory classes: 4h 05m
Practical classes: 2h 10m
Self study : 6h 40m

Description:
Higher-order derivatives. Taylor's theorem. Applications.

Applications of differential calculus: Extremals. Differental operators. Curves and surfaces.

Learning time: 23h

Theory classes: 5h 50m
Practical classes: 4h 25m
Self study : 12h 45m

Description:
Critical points. Local extremes. Sufficient conditions of extremals.
Extreme conditions. Lagrange multipliers.
Absolute extremals.
Gradient. Curl. Divergence. Laplacian.
Curves and surfaces. Parametrizations.

Last update: 06-05-2019

230455 - CAL2 - Calculus 2

Multiple integrals.	Learning time: 27h 30m Theory classes: 6h 05m Practical classes: 4h 55m Self study : 16h 30m

Description:
Double and triple integrals. Definition of integral (Riemann). Fubini theorem. Change of variable.
Functions defined by integrals and derivation under the integral sign.
Improper integrals.
Applications.

Integrals along curves and integrals on surfaces.	Learning time: 16h 10m Theory classes: 4h 40m Practical classes: 3h 10m Self study : 8h 20m

Description:
Line and surface integrals of scalar fields. Calculating lengths and areas. Applications.
Line and surface integrals of vector fields: circulations and flows. Applications.
Conservative and solenoidal fields.

Theorems of vector calculus.	Learning time: 26h 35m Theory classes: 7h 05m Practical classes: 4h 30m Self study : 15h

Description:
Theorems of Green, Stokes and Gauss-Ostrogadski. Applications.

Qualification system

The rating will consist of a final exam (FE) and an evaluation along the course that will take into account the implementation of a mid-term exam (EP).
The final rating will be given by
max {EF, 0.65 *EF + 0,35 * EP}

Last update: 06-05-2019

230455 - CAL2 - Calculus 2

Bibliography

Basic:

Compta, A.; Bonet, C.; Consul, N.; Ollé, M.; Roig, A.; Pascual, P. Càlcul integral per a enginyers [on line]. Barcelona: Universitat Politècnica de Catalunya, 2002 [Consultation: 21/09/2018]. Available on: <http://hdl.handle.net/2099.3/36742>. ISBN 8483016273.

Burgos, J. Cálculo infinitesimal de varias variables. 2a ed. Madrid: McGraw-Hill, 2008. ISBN 9788448161088.

Complementary:

Marsden; J.E.; Tromba; A.J. Cálculo vectorial [on line]. 6a ed. Madrid: Pearson, 2018 [Consultation: 21/09/2018]. Available on: <http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=7634>. ISBN 9788490355787.