Course guide
200006 - CI - Integral Calculus

Last modified: 01/06/2023

Unit in charge: School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 7.5 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: ANDRES MARCOS ENCINAS BACHILLER

Others: Primer quadrimestre:
ANGELES CARMONA MEJIAS - CFIS, M-A
ANDRES MARCOS ENCINAS BACHILLER - CFIS, M-A, M-B
JAIME FRANCH BULLICH - M-B

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
2. CE-3. Have the knowledge of specific programming languages and software.
3. CE-4. Have the ability to use computational tools as an aid to mathematical processes.

Generical:
4. CB-1. Demonstrate knowledge and understanding in Mathematics that is founded upon and extends that typically associated with Bachelor's level, and that provides a basis for originality in developing and applying ideas, often within a research context.
5. CB-2. Know how to apply their mathematical knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader or multidisciplinary contexts related to Mathematics.
6. CB-3. Have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements.
7. CG-1. Show knowledge and proficiency in the use of mathematical language.
8. CG-2. Construct rigorous proofs of some classical theorems in a variety of fields of Mathematics.
9. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
10. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
12. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

Transversal:
11. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

TEACHING METHODOLOGY

(Section not available)

LEARNING OBJECTIVES OF THE SUBJECT

(Section not available)

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	16.00
Hours large group	45,0	24.00
Self study	112,5	60.00

Total learning time: 187.5 h

CONTENTS

1. Improper Integrals and Numerical Series

Description:
Basic Definitions. Convergence Criteria for Numerical Series and Improper Integrals. Relationship between Improper Integrals and Series. Improper Integrals depending on a Parameter.

Full-or-part-time: 37h
Theory classes: 6h
Practical classes: 6h
Self study : 25h

2. Multiple Integrals

Description:
The Riemann Integral of Several Variables Functions. The Lebesgue Criterion for Riemannian Integrability. Fubini's Theorem. Change of Variable Theorem. Applications. Improper Integrals.

Full-or-part-time: 60h 30m
Theory classes: 12h
Practical classes: 8h
Self study : 40h 30m

3. Line and Surface Integrals

Description:
Parametrized Curves. Line Integrals of Functions and Vector Fields. Integration and Equivalent Curves. Parametrized Surfaces. Surface Integrals of Functions and Vector Fields. Integration and Equivalent Surfaces.

Full-or-part-time: 24h
Theory classes: 5h
Practical classes: 3h
Self study : 16h

4. Integral Theorems

Description:
Gradient, Divergence and Curl. Green's Theorem, Stokes' Theorem and Gauss' Theorem. Applications: conservative and solenoidal vector fields.

Full-or-part-time: 37h 30m
Theory classes: 7h 30m
Practical classes: 5h
Guided activities: 25h

5. Differential Forms

Description:
Review of Multilinear Algebra. Differential Forms in R^n and in submanifolds. Exterior Derivative. Integration of Forms. Green, Stokes and Gauss' Theorems.

Full-or-part-time: 28h 30m
Theory classes: 6h 30m
Practical classes: 3h
Self study : 19h

GRADING SYSTEM

A midterm exam (P) and a final exam (F).

The final course result will be calculated as follows:
Max {0'3 * P + 0'7 * F; F}

An extra exam will take place on July for students that failed during the regular semester.

BIBLIOGRAPHY

Basic:
- Spivak, Michael. Cálculo en variedades. Barcelona: Reverté, 1970. ISBN 8429151427.
- Cerdà Martín, J. L. Càlcul integral. Barcelona: Edicions de la Universitat de Barcelona, 2001. ISBN 848338261X.
- Marsden, Jerrold E.; Hoffman, Michael J. Elementary classical analysis. 2nd ed. New York: W.H. Freeman and Company, 1993. ISBN 0716721058.
- Pascual Gainza, Pere (ed.). Càlcul integral per a enginyers [on line]. Barcelona: Universitat Politècnica de Catalunya, 2002 [Consultation: 21/05/2020]. Available on: http://hdl.handle.net/2099.3/36742. ISBN 8483016273.
- Zorich, Vladimir A. Mathematical analysis II. Berlin: Springer, 2004. ISBN 3540406336.

Complementary:
- Wade, William R. An Introduction to analysis. 4th ed. Englewood Cliffs: Prentice-Hall, 2010. ISBN 0321656849.
- Marsden, Jerrold E.; Tromba, Anthony J. Cálculo vectorial [on line]. 5a ed. Madrid: Addison Wesley, 2004 [Consultation: 26/06/2023]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=7634. ISBN 8478290699.
- Bombal Gordon, F.; Rodríguez Marín, L.; Vera Botí, G. Problemas de análisis matemático. Vol. 3. 2a ed. Madrid: AC, 1987. ISBN 8472881024.
- Bressoud, David M. Second year calculus : from celestial mechanics to special relativity. New York: Springer-Verlag, 1991. ISBN 038797606X.
- Greenberg, Michael D. Foundations of applied mathematics. Englewood Cliffs: Prentice-Hall, 1978. ISBN 0133296237.