Course guide
240022 - 240022 - Calculus II

Last modified: 12/04/2024

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: YURY FEDOROV KUZMIN

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

TEACHING METHODOLOGY

The classes consists of a theoretical part, where the more conceptual contents of the module will be introduced, also some basic examples related to these contents will be shown. In addition, some demonstrations, that will help us to understand the core of these concepts will be given.

In the same classes, the practical contents of the module will be developed. On the one hand, more elaborated examples, coming from the basic concepts already seen will be presented. On the other hand, some practical calculus methods and tools, related to the different theoretical contents, will be discussed. Students participation will be encouraged.

It will be intended that the collections of the exercises would be extensive enough for the students to complete their learning process in the autonomous way.

LEARNING OBJECTIVES OF THE SUBJECT

This subject's main objectives are, on the one hand, to provide the student with a sufficient solvency when using calculus tools in several variables and, on the other hand, give an introduction to Differential Equations and Laplace Transform. Likewise, it is an objective that this solvency is not only manifested in the contents conceptual comprehension and in the ability to identify which tools are appropriate in each of the problems, but also in acquiring a certain calculus "fluency" and a good comprehension of the interaction of these theoretic concepts and the mathematical modelling of science and technology problems.

Specific skills: ability to address the mathematical problems that arise in the engineering. Ability to apply their knowledge on: Linear Algebra, Geometry, Differential and Integral Calculus, etc.

STUDY LOAD

Type	Hours	Percentage
Hours large group	60,0	40.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1.- Continuity and derivatives of functions with several variables

Description:
Domain. Limit. Continuity. Derivatives. Rule of the Chain. Taylor Expansion. Theorem of the inverse and implicit function. Extremes.

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

Full-or-part-time: 80h
Theory classes: 32h
Self study : 48h

2.- Integration functions with several variables

Description:
Riemann's integral. Calculation of integrals. Cavalieri's principle. Fubini's theorem. Variable changes. Areas and volumes. Approximate integration. Applications

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

Full-or-part-time: 50h
Theory classes: 20h
Self study : 30h

3.- Introduction to Differential Equations and to the Laplace Transform

Description:
Introduction to Ordinary Differential Equations. Laplace Transform. Applications to the calculus of some improper integrals and to the solution of some problems in physics.

Related competencies :
CE1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

Full-or-part-time: 20h
Theory classes: 8h
Self study : 12h

GRADING SYSTEM

The evaluation consists of the following activities:

- A partial exam in the middle of the semester (EP1) in the timetable set by the School for its realization.
- A partial exam in the second part of the course (EP2) on the date the School establishes for the final exams.
- An exam related with the practical works with MATLAB developed along the course (P).

The final mark (NF) is:

NF = 0.4*EP1 + 0.5*EP2 + 0.1*P.

All the students who do pass the course in any of the two semesters, no mater if they have a mark of any exam or did not show in some of the exams, can access to a global assessment (the "reevaluation"), that consists of:
- An exam where all the program of the course will be assessed (ER) on the day established by the School.
The part corresponding to the MATLAB practices will not be evaluated in that exam. That is, if a student accesses the reevaluation exam (ER), his/her final mark (NR) would be:
NR =max(NF,ER)

EXAMINATION RULES.

In the 1st midterm exam (EP1) it will not be allowed to use neither a list of formulas (exam form) nor a calculator.
In the 2nd midterm exam (EP1) it will be allowed to use an exam form (A4 size), additionally the table of Laplace transformations.
In the exam of the MATLAB practices (P) it will be permitted to use an exam form (A4 size).
In the reevaluation exam (ER) it is permitted to use an exam form (A4 size) on all the parts of the subject.

Note: only students who have answered the 1st Questionnaire (Quiz 1) of the first practice of MATLAB will be admitted to the exam of the MATLAB practices.

BIBLIOGRAPHY

Basic:
- Burgos Román, Juan de. Cálculo infinitesimal de varias variables [on line]. 2a ed. Madrid: McGraw-Hill, 2008 [Consultation: 13/10/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=3974. ISBN 9788448161088.
- Pascual, Pere [ed.]. Càlcul integral per a enginyers [on line]. Barcelona: Edicions UPC, 2002 [Consultation: 08/09/2020]. Available on: http://hdl.handle.net/2099.3/36742. ISBN 8483016273.
- Zill, Dennis G.. Ecuaciones diferenciales con aplicaciones de modelado [on line]. 11ª ed. México: Cengage, 2018Available on: https://discovery.upc.edu/permalink/34CSUC_UPC/rdgucl/alma991004174909706711. ISBN 9786075266312.
- Stewart, James. Cálculo multivariable. 4ª ed. México: International Thomson, 2001. ISBN 9706861238.

Complementary:
- Borrelli, Robert L. ; Coleman, Courtney S. Ecuaciones diferenciales: una perspectiva de modelación [on line]. México: Oxford University Press, 2002Available on: https://discovery.upc.edu/permalink/34CSUC_UPC/rdgucl/alma991002451889706711. ISBN 9706136118.
- Marsden, Jerrold ; Tromba, Anthony J. Cálculo vectorial. 6ª ed. Madrid: Pearson, 2018. ISBN 9788490355787.

RESOURCES

Other resources:
Students will be able to access to the subject's Intranet and also to its webpage, where all the necessary material considered suitable for autonomous learning will be uploaded.