



Course guide

220012 - AM - Further Mathematics

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

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

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: - RAMON QUINTANILLA DE LATORRE

Others: ANTONIO MAGAÑA NIETO - M. DEL CARMEN LESEDUARTE MILAN

PRIOR SKILLS

The study of this subject requires a good knowledge of the subjects Calculus I, Linear Algebra and Calculus II.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. The ability to solve mathematical problems that may arise in an engineering context. The ability to apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation

Basic:

CB05. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

TEACHING METHODOLOGY

Theory sessions

Problems sessions

Independent work

The theory sessions will introduce the basic concepts and results of each topic, as well as examples and case studies. In the problems sessions, the students have to solve exercises and problems to help them understanding the concepts studied and to acquire the ability to express themselves properly, using concepts and tools of the course.

Each teacher has a fixed office hours where students can answer any questions regarding theory and problems lessons.

LEARNING OBJECTIVES OF THE SUBJECT

- Learning to solve ODE and PDE.
- To solve engineering problems using models of the concerned phenomena.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	28,0	18.67
Hours large group	32,0	21.33
Self study	90,0	60.00



Total learning time: 150 h

CONTENTS

Generalities about ODE

Description:

Differential equations. Solutions of differential equations. Cauchy problem or initial values. Existence and uniqueness of solutions. EDO of a family or beam of curves. Orthogonal trajectories

Related activities:

Theory classes and solving problems of varying difficulty (individual and in groups). Study and individual work.

Full-or-part-time: 12h 30m

Theory classes: 3h

Practical classes: 2h

Self study : 7h 30m

First order equations

Description:

Equations with separable variables. Homogeneous equations. Exact equations. Integrating factor and equations that can be reduced to exact. First order linear equations. Equations reducible to equations of first order.

Related activities:

Theory classes and solving problems of varying difficulty (individual and in groups). Study and individual work.

Full-or-part-time: 30h

Theory classes: 7h

Practical classes: 5h

Self study : 18h

Applications

Description:

Mechanical and engineering problems that can be studied and modeled with the help of differential equations: population growth, disintegration of substances, emptying of tanks, heating and cooling, mixtures, vibrations, electrical circuits ...

Related activities:

Theory classes and solving problems of varying difficulty (individual and in groups). Study and individual work.

Full-or-part-time: 10h

Theory classes: 2h

Practical classes: 2h

Self study : 6h



Linear differential equations of orden n

Description:

Linear differential equations. Dependence and linear independence of functions. Solutions of linear equations. Homogeneous linear equations with constant coefficients. Non-homogeneous.

Related activities:

Theory classes and solving problems of varying difficulty (individual and in groups). Study and individual work.

Full-or-part-time: 35h

Theory classes: 7h

Practical classes: 7h

Self study : 21h

Laplace transform

Description:

Definition and examples. The inverse Laplace transform. Theorem of translation and simple fractions. Applications to differential equations. Derivatives of a transform. Unit jump function. Impulse function. Dirac Delta. Convolution. Transformed from a periodic function.

Related activities:

Theory classes and solving problems of varying difficulty (individual and in groups). Study and individual work.

Full-or-part-time: 30h

Theory classes: 6h

Practical classes: 6h

Self study : 18h

Generalities about EDP

Description:

Introduction. D'Alembert's solution Fourier series. Series of sinus and cosine. Vibrating strings. Conduction of heat. Laplace equation. Multiple Fourier Series.

Related activities:

Theory classes and solving problems of varying difficulty (individual and in groups). Study and individual work.

Full-or-part-time: 32h 30m

Theory classes: 7h

Practical classes: 6h

Self study : 19h 30m



ACTIVITIES

PARTIAL EXAMINATION

Description:

Realization of the examination of the contents of the subject given until then.

Specific objectives:

Develop the knowledge acquired in theoretical and practical sessions. Write clearly and concisely the problems and issues raised.

Full-or-part-time: 12h

Theory classes: 2h

Self study: 10h

FINAL EXAM

Description:

Completion of the final exam of all the contents of the subject.

Specific objectives:

Develop the knowledge acquired in theoretical and practical sessions. Write clearly and concisely the problems and issues raised.

Full-or-part-time: 12h

Theory classes: 2h

Self study: 10h

SESSIONS LARGE GROUPS / THEORY

Description:

Preparation of theory and attendance sessions before and after them.

Specific objectives:

Specific objectives: To transfer the knowledge necessary for the correct interpretation of the contents developed in large group sessions, resolution of doubts regarding the subject of the subject and development of generic skills.

Full-or-part-time: 56h

Theory classes: 26h

Self study: 30h

SESSIONS MEDIUM GROUPS / PROBLEMS

Description:

Preparation before and after the problem sessions and practice sessions and their attendance.

Specific objectives:

Acquire the skills necessary for a correct interpretation of the problems of the subject, as well as a satisfactory solution of them. Preparation for the practical part of the exams of the subject. Development of generic skills.

Material:

Notes on the Athena platform.

General bibliography of the subject.

Exercises on the Athena platform.

Collection of problems of the subject.

Full-or-part-time: 62h

Practical classes: 28h

Self study: 34h



CONTROL 1

Full-or-part-time: 4h

Theory classes: 1h

Self study: 3h

CONTROL 2

Full-or-part-time: 4h

Theory classes: 1h

Self study: 3h

GRADING SYSTEM

Midterm Exam Weigh: 30%

Final Exam Weigh: 50%

Test 1 Weigh 10%

Test 2 Weigh 10%

The midterm exam and final exams will be scheduled by the School. Test 1 and 2 will be during two different lessons. Unsatisfactory results of the partial examination may be re-conducted by a written test to be carried out on the day of the final examination. Students with a score of less than 5 in the partial exam can be admitted to this test. If the grade of this test is greater than or equal to five the grade of the partial exam is replaced by a grade of five.

EXAMINATION RULES.

Exams and controls should be done individually. Teachers can request student identification.

BIBLIOGRAPHY

Basic:

- Leseduarte Milán, M.C. [et al.]. Equacions diferencials: problemes resolts [on line]. Barcelona: Iniciativa Digital Politècnica, 2012 [Consultation: 19/05/2020]. Available on: <http://hdl.handle.net/2099.3/36607>. ISBN 9788476539330.
- Simmons, George F. Ecuaciones diferenciales: teoría, técnica y práctica [on line]. Mèxic: McGraw-Hill, 2007 [Consultation: 17/06/2022]. Available on: https://www-ingobook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4312. ISBN 9780072863154.
- Boyce, William E. Introducción a las ecuaciones diferenciales. México: Limusa, 1972. ISBN 9681806360.
- Zill, Dennis G. Ecuaciones diferenciales con aplicaciones de modelado. 9a ed. México: International Thomson, 2009. ISBN 9789708300551.