Calculus and Numeric Methods (21592)

Degree: Bachelor's degree in Computer Engineering, Bachelor's degree in Telecommunications Network Engineering and Bachelor's degree in Audiovisual Systems Engineering
Course: first
Trimester: first and second
Number of ECTS credits: 8
Hours of student dedication: 200 hours
Language or teaching languages: Catalan and Spanish
Teachers: Núria García i Glória Haro

1. Presentation of the subject

This subject, together with the subject of Linear Algebra and Discrete Mathematics, will provide students with the mathematical basis to work on the concepts of Engineering studies that will be introduced in subjects that are studied in parallel or later.

It is based on the concepts that students have worked on in the Baccalaureate's programming and consolidates them and expands them.

It consists of two large blocks.

In the first block, corresponding to the first trimester, a review of the numerical sets is made emphasizing the calculation with real numbers and the ability to work with algebraic inequality and the absolute value. The subject works the presentation of the concepts with the specific scientific notation of an engineering, and the analysis and the rigour at the resolution of problems and at the presentation of the response. The concepts related to real variable and real functions introduced in the Baccalaureate are consolidated and their scope is expanded: definition of function, domain, basic properties, limits, continuity study, derivability and integration. This first block ends up introducing sequences and series of real numbers and applying these concepts to the approximation of functions that are derivable through the series of powers (Taylor's developments).

The second block, corresponding to the second trimester, contains two differentiated parts: analysis in various variables and numerical methods. In the first part, the knowledge obtained for functions of a real variable will be extended and will expanded to functions of several real variables. Specifically, we will work on the following concepts: definition of the function of several real variables, domain, image, curves and trajectories, surfaces, derivation, tangential subspaces, local approximation. We will apply these knowledge to the study of conditional extremes by using Lagrange multipliers. In the second part we will introduce the numerical analysis and we will work on some numerical methods to solve linear systems and to calculate vectors and their own values. This part has a great practical content where we will practice computer practices applying the numerical methods studied in the resolution of real applications.

Consolidating the basic knowledge of mathematics, introducing scientific language and working with rigorous reasoning are basic objectives of the subject.

This subject presupposes a minimum mathematical base for Bachelor or vocational training. In particular, notions and basic procedures of calculation and geometry of the plan. As one of the two subjects (together with Linear Algebra and Discrete Mathematics) of Mathematics in the first year of the Degree studies, students who have shortcomings in elementary mathematics will be reinforced with complementary exercises in order to achieve a leveling with all students. For these students it is advisable that they have completed the introduction course to maths offered by the ESUP in September.

This subject is related to many other subjects of the Degree Programs Teaching Plan such as Linear Algebra and Discrete Mathematics, Probability and Stochastic Processes, Signal and Systems, Waves and Electromagnetism, Infography, Differential Equations, Signal Processing I, II and III, Computational Geometry or Workshops, Synthetic Image, Communication Systems, Data Transmission and Coding, Radiocommunication, Speech Processing, Image Processing, Voice and Audio Encoding Systems, Image and Video Coding Systems, Advanced Visualization, Video Processing, Audio Processing in Real Time, Acoustic Engineering, Optical Engineering, Audiovisual Perception and Cognition, Architectural Acoustics, Electronic Circuits and Transmission Media, Sound and Music Processing, Advanced Mathematical Methods, Pattern Recognition, 3D Audio, Three-Dimensional Vision, Synthetic Image.

Previous knowledge to make a correct follow-up of the subject:

The rollout of the course follows the Bologna model, centered on student learning, there is a minimum of classroom hours (72 hours) and a greater number of hours of learning outside the classroom (200 hours). The reduced number of face-to-face classes makes it impossible to include in the syllabus a revision of previous concepts that will be considered already achieved, worked on in the Baccalaureate format, and without which the new concepts developed in the classroom can be difficult to follow.

The faculty of the subject will make available to the student online material so that the student can self-evaluate their previous concepts and, if necessary, can revise, on his own account, those previous concepts that he considers that he has not achieved. However, ESUP gives a specific course during the first fortnight of September to review these concepts.

Previous concepts that you must have achieved for a good tracking of each block (see block description in section 4: Contents):

BLOCK 1

• Numeric sets: natural numbers, integers, rational numbers and real numbers. Divisibility. Differences between each set, basic properties and calculus skill by operating with fractions and radicals without the use of the calculator.

BLOCK 2

• Knowledge of the concept of function and related basic concepts: domain, path, algebraic expression of a function, graphical representation of a function in an Orthogonal Cartesian system; symmetry, growth and decrease in one point, basic operations with functions, composition of functions and reverse function.

• Knowledge of the following basic families of functions: identity function, constant function, polynomial functions (with special skill with the identification of lines and parabolas), rational functions, exponential function and logarithmic function; absolute value function; Periodic functions: sinus, cosine, tangent, arcsinus, arccosinus and arctangent. For each of these functions the knowledge of the previous section must be obtained as well as the basic operation that characterizes each family.

• An intuitive notion of the concept of limit and continuity of functions.

BLOCK 3

• Intuitive notion of the derivative concept. The table of immediate derivatives.

• Intuitive notion of the concept of integral. Know how to solve the immediate integrals.

2. Skills to be achieved

2.1 General competences

General competences	Specific competences
Instrumentals 1. Ability to understand and analyze mathematical statements. 2. Ability to identify the appropriate methodology to analyze a problem and find the solution.	1. Ability to identify and justify the application of the appropriate mathematical model to analyze a problem and find the solution 2. Ability to express ideas and mathematical concepts in an accurate and oral way. 3. Ability to understand direct demonstrations, by reduction to the absurd and by induction 4. Ability to operate real numbers with skill.

3. Ability to express ideas and mathematical concepts in an accurate and oral way. 4. Capacity of abstraction. 5. Systematization capacity. *Interpersonal* 6. Ability to work in teams, solving both problems raised as deepening in certain contents. 7. Ability to communicate ideas accurately, both orally and in writing. *Systemic* 8. Ability to work independently in solving problems. 9. Ability to learn from mistakes and others' mistakes. 10. Ability to find the most appropriate solutions according to the characteristics of each problem / situation / context. 11. Ability to infer mathematical notions. 12. Ability to make a prior discussion in the resolution of problems, to identify similarities and differences between different problems and to reformulate it if necessary. 13. Become familiar with the verification and interpretation of the solutions obtained in the context of the problem, not forgetting the study of particular cases.	5. Know how to identify regions of the real line defined by equality or inequality between algebraic expressions with real numbers and, where appropriate, absolute values. 7. Ability to recognize the graphs of the elemental families of real functions in a variable (polynomial, rational, exponential, logarithmic and trigonometric) and to know how to work them easily with their mathematical formulation (study of the domain, translation operations and compression / dilatation, limits, continuity, derivability and integration) applying definitions and basic properties 8. Ability to apply the concepts of derivation and integration and the theorems corresponding to the resolution of problems based on real models. 9. Calculation of derivatives and application of the corresponding theorems. 10. Know how to work with sequences of real numbers: from the descriptive definition, by its general or recurrent term. 11. Knowing to distinguish basic properties in the successions of real numbers: monotony, spades, convergent, … 11. Understand the concept of series of real numbers and convergent series. 12. Understand the behavior of some families of series of real numbers: geometric and functional series, series of powers. 13. Know how to approximate sufficiently derivable functions by series of powers, calculating the number of terms to obtain a given precision or correcting the error when the approach is given. 14. Knowledge of Taylor's theorem and its applications, both in a variable and in several variables. 15. Understanding the functions of several variables and theirs Geometric representation applied to the three-dimensional case. 16. Identify curve parameters and calculate the length, speed and acceleration of trajectories. 17. Identify surfaces by means of level curves and sections with plans parallel to the XY, YZ and ZX plans. 18. Understanding the concept of differential for functions of various variables as a first approximation (linear) and its geometric conceptualization. 19. Concept of extremes conditioned in functions of various variables and development of the corresponding operational capacity. 20. Ability to understand the specific problems of solving numerical problems. 21. Ability to transform numerical algorithms into programs. 22. Practical comprehension of different approaches to numerical analysis: exact and approximate (iterative) methods. 23. Practical comprehension of the qualitative aspects of numerical procedures: convergence of the iterative methods, efficiency, stability, ...

2.2 Grouping the specific competencies for concepts:

2.2.1 Understanding:

- Understand and differentiate the concepts of natural, enter, rational and real name.
- Understand the concept of absolute value.
- Understand the procedures of induction and direct reasoning and by reduction to the absurd.
- Domain of the representation of functions graphs.
- Understand the notions of limit.
- Understand the notions of continuous and derivative function.
- Understand the concept of defined integral and primitive.
- Understand the concept of the limit of a succession.
- Understand the concept of series and convergence series.
- Distinguish between different types of series.
- Knowledge of Taylor's theorem and its applications
- Understand the functions of several variables and their representation
- Identify functions that represent curves and surfaces
- Understands the concept of differential for functions of several variables
- Understanding the concept of constraints
- Practical comprehension of the exact and the iterative methods in the numerical analysis
- Understand the qualitative aspects of numerical procedures: convergence, efficiency, stability, errors, ...

2.2.2 Calculation:

- Demonstrations for induction procedures, direct reasoning and reduction to the absurd.
- Calculation of regions of the real line defined from algebraic expressions, including or not absolute values.
- Graphic recognition of elementary functions.
- Calculation of derivatives and application of the corresponding theorems.
- Knowledge of Taylor's theorem and its applications.
- Distinguish the different types of indefinite integrals and effective calculation of primitives.
- Know how to calculate areas of simple sets of the plan.
- Study of convergence of successions and calculation of limits
- Calculation of the speed, acceleration and tangent line for curves
- Calculation of the tangent plane on surfaces
- Know how to find level curves and sections with plans parallel to the XY, YZ and ZX plans.
- Calculation of constrained ends and ends.

2.2.3 Programming:

- Ability to transform numerical algorithms into programs
- Ability to understand programs and know how to identify what numerical algorithm is.
- Development of a set of tests suitable for the validation of a program

3. Content

3.1 First trimester

Block 1.
Topic 1. The names. Real numbers

Block 2.

Topic 2. Real functions of a real variable.
Topic 3. Limits and continuity of real functions of a real variable.

Block 3.

Topic 4. Function of derivability.
Topic 5. Integration of functions.

Block 4.

Topic 6. Successions and series. Power series. Developments by Taylor.

Block 5.

Topic 7. Functions of several real variables.

Block 6.

Topic 8. Derivation in several variables.
Topic 9. Extreme functions in several variables.

Block 7.

Topic 10. Introduction to numerical calculation. Resolution of linear systems.

Topic 11. Resolution of nonlinear systems and calculation of extremes.

3.2 Organization and content specification

Content block 1. The names. Real numbers

Concepts	Procedures	Attitudes
- The natural numbers; induction - The integers; divisibility - The rational numbers. - The real numbers; supreme and infimum	- Demonstrations by induction and complete induction. - Demonstrations for reduction to absurdity. - Calculation of supreme and infimum.	- Interest in knowing and extending information - Trend to the justification and scientific consistency of the elaborated work - Critical thinking

Content block 2. Real functions of real variable. Limits and continuity.

Concepts	Procedures	Attitudes
- Real functions. - Limits - Continuity.	- Representation of functions graphs. - Calculation of limits. - Continuity study	- Trend to justification and scientific consistency of the elaborated works - Constructive participation - Effort

Content block 3. Derivation and integration

Concepts	Procedures	Attitudes
- Derivation. - Integration of Riemann. - Fundamental theorem of integral calculation.	- Calculation of derivatives - Applications of the theorem average value - Calculation of limits using the L'Hôpital rule.	- Trend to justification and scientific consistency of the elaborated works - Constructive participation - Effort

Content block 4. Successions and series of real numbers. Developments by Taylor

Concepts	Procedures	Attitudes
- Successions - Series of positive numbers. - Alternate series - Series of powers - Taylor's theorem.	- General term of a succession - Calculation limits of some successions - Sum of some convergent series.	- Interest in knowing and extending information - Trend to the justification and

	- Approximation of functions by series of powers.	scientific consistency of the elaborated work - Constructive participation - Effort

Content block 5. Functions of several real variables

Concepts	Procedures	Attitudes
- Vectors, rules - Functions of several real variables - Curves and trajectories - Surfaces	- Study of the domain and the image - Important curves and surfaces - Graphic representation through level curves and projections - Parametrizations of curves	- Trend to the justification and scientific consistency of the elaborated works - Capacity of abstraction and generalization - Constructive participation - Effort

Content block 6. Derivation in various variables and applications

Concepts	Procedures	Attitudes
- Partial derivatives - Differential or derivative - Jacobiana and Hessiana gradient and matrices - Directional derivative - Tangent subspaces - Taylor's Formula - Critical points - Extras conditioned: Lagrange multipliers	- Calculation of partial derivatives - Graphic interpretation of the derivative in several variables - Local approach of functions - Calculation of critical points and study of typology - Optimization of functions with restrictions	- Trend to the justification and scientific consistency of the elaborated works - Capacity of abstraction and generalization. - Constructive participation - Effort. - Ability to translate a real problem in mathematical terms as an optimization problem

Bloc de contingut 7. Anàlisi numèrica

Concepts	Procedures	Attitudes
- Errors: types and fonts - Efficiency in calculations - Numerical resolution of linear systems: direct and iterative methods - Numerical calculation of ends - Numerical calculation of the roots of a function - Numerical resolution of nonlinear systems nonlinear systems	- Study and understanding of the iterative methods of Jacobi and Gauss-Seidel - Study and understanding of the gradient descent method - Study and understanding of the Newton method - Application of numerical methods worked on real problems	- Trend to the justification and scientific consistency of the elaborated works. - Constructive participation - Effort - Ability to translate numerical algorithms into programs and vice versa

4. Evaluation

4.1. General evaluation criteria

4.1.1 Ordinary notice

First trimester

The evaluation of the subject will be carried out from a continuous evaluation that consists of several scoring tests distributed throughout the trimester and of the realization of a Partial Exam, at the end of the first trimester, where it will have to solve exercises similar to those worked and a more theoretical test.

The **final grade of the first trimester (NT1)** will be obtained from the following weighting:

NT1 = 0,5 *NE*_PART1 **+ 0,4 *** *NEAC* **+ 0,1 *** *TO_AC* + **NOTA EXTRA (1)**

NT1: FINAL NOTE OF THE FIRST TRIMESTER

*NE*_PART1: PARTIAL EXAMINATION FIRST TRIMESTER NOTE (Exam Period of the first trimester: December 9 (Wed) - December 23 (Wed))

NEAC: AVERAGE OF THE TWO EXAMINATIONS OF INDIVIDUAL CONTINUOUS EVALUATION EXERCISES

TO_AC: AVERAGE OF THE FOUR BEST NOTES OF THE ONLINE EVALUATION TESTS CONTINUOUS

(1) EXTRA NOTE: The student can accumulate up to 0.5 extra points of note through the activities planned outside the classroom. These activities will be indicated in the course of the quarter and, mainly, will be online.

If NT1 is greater than or equal to 4, the obtained mark will do the average with the grade obtained in the second quarter NT2 (when NT2 "is greater than or equal to 4)

If NT1 is less than 4, it can be recovered at the end of the second quarter by submitting to an exam of the first part that will give an option to a new mark:

NE-PART1 with which the formula (1) will be applied again.

The ORIENTATIVE calendar set for individual tests is included in the following table in section 8.3

Second trimester

The evaluation of the subject will be carried out from a Continuous Evaluation that consists of several scoring tests distributed throughout the quarter and of the realization of a Partial Exam, at the end of the second trimester, where it will have to solve exercises similar to those worked.

The final grade of the second quarter (NT2) will be obtained from the following weighting:

NT2 = 0,5 * *NEP* + **0,3 *** NACI + ***0,2 *** *TG*

NT2: FINAL NOTE OF SECOND TRIMESTER

NEP: NOTE OF THE PARTIAL EXAM (Period of exams of the second trimester)

NACI: INDIVIDUAL CONTINUOUS EVALUATION NOTE. It will consist of the average of three exams distributed during the second trimester.

TG: GROUP WORK NOTE. It will consist of activities related to the laboratory practices and will be carried out in groups of two people. In practice, we will explore the concepts explained in theory and use the Octave program (for free distribution). This note is distributed as follows:

TG = **0.25 *** LS + **0.75 *** LP

Where LS indicates laboratory at the seminar hours and LP laboratory to the practical classes.

FINAL NOTE OF THE SUBJECT OF CALCULUS AND NUMERICAL METHODS

If NT1 is greater than or equal to 4 and NT2 is greater than or equal to 4:

Final Mark=0,5 * NT1 + 0,5 * NT2

If **Final Mark** is greater than or equal to 5, the subject is approved.

If **Final Mark** is less than 5, you can choose to submit to the extraordinary September call.

4.1.2 Extraordinary September call

There will be a final exam of the first part and a final exam of the second part.

If one of the two parts has been approved, only, it will be necessary to examine the suspended part and must approve it with a note greater or equal to 5. In this case the final mark of the subject will be the arithmetic mean of the notes of the two parts.

5. Bibliography and didactic resources

5.1. Basic bibliography

The basic bibliography includes those texts that broadly cover the content of the subject and therefore constitute a basic reference for consulting and extending the concepts included in the syllabus.

• M. SPIVAK, Calculus, Ed. Reverté, 1987.
• SALAS,S.L.; HILLE,E, ETGEN. Calculus Una y varias variables. Vol I i II, 4ª ed. Ed. Reverté, 2005
• J E MARSDEN, A J TROMBA: Cálculo Vectorial, 4ª Edición, Addison-Wesley Longman, México, 1998
• G. STRANG Calculus, Wellesley-Cambridge Press, Wellesley, MA, 1992.
• S LANG: Calculus of Several Variables, 3rd ed., Springer, New York, 1987.
• F GRANERO: Ejercicios y problemas de cálculo, Toms 1 i 2, Ed Tebar Flores, Madrid, 1991.

5.2. Complementary bibliography

In the supplementary bibliography the student can find other references that, although they do not include all the contents, are of interest to the peculiar vision that they offer of some specific subjects, due to their originality in the presentation and exposition of the concepts or by its eminently practical character (problem books).

• T.M. APOSTOL, Análisis Matemático, Ed. Reverté, 1976.
• G. BARTLE i S. SHERBERT, Introducción al Análisis Matemático de una variable, Ed. Limusa, 1986.
• G. STRANG, Calculus, Wellesley Cambridge Press, 1991 (disponible en línia a http://ocw.mit.edu/ans7870/resources/Strang/strangtext.htm)
• S. THOMPSON, Calculus Made Easy, Macmillan, 1914 (sense copyright, disponible arreu)
• R. COURANT and F. JOHN, Introducción al Cálculo y al Análisis Matemático, Ed. Limusa, 1990.
• S. LANG, Introducción al Análisis Matemático, Addison-Wesley Iberoamericana, 1990.
• DEMIDOVICH, B. Problemas y ejercicios de análisis matemático. Ed. Paraninfo 1993
• G.H. HARDY, A Course of Pure Mathematics, Cambridge University Press,1992.
• W. RUDIN, Principios de Análisis Matemático, McGraw-Hill, 1980.
• J.M. ARNAUDIES et H. FRAYSSE, Analyse, Dunod, 1988.
• C. MARTÍNEZ i M. SANZ, Análisis de una variable real, Ed. Reverté, 1992.
• J. ORTEGA, Introducció a l'Anàlisi Matemàtica, Manuals de la UAB, 1990.
• C. PERELLÓ. Càlcul infinitesimal, Biblioteca Universitària, 21. Enciclopèdia Catalana, 1994
• B LARROUTUROU, P L LIONS. Méthodes mathématiques pour les sciences de l'ingénieur: Optimisation et analyse numérique (Édition 1995), Département de Mathématiques Appliquées, École Polytechnique, Paris.
• R HORAUD, O MONGA. Vision par ordinateur. Outils fondamentaux, Hermès, Paris, 1993
• M.R. ESTELA; J. SAÀ Cálculo con soporte interactivo en Moodle. Pearson Educación, 2008

5.3. Didactic resources

• Each theoretical session will correspond to a didactic unit that the teacher will deliver the student through the Aula Global Moodle.
• For each session of problems there will be a collection of problems that the teacher will deliver the student through the Aula Global before the practice is carried out.
• In the Global Classroom Moodle the student will also find complementary material and various resources to review previous concepts (sections 5 and 6, respectively, of AG Moodle)

6. Methodology

6.1. Methodological focus of the subject

The teaching of the subject is taught, for each of the two trimesters, in 9 sessions of theory classes, 8 sessions of practical classes and 10 seminar sessions that are part of the classroom work hours in the classroom according to the EHEA-adapted planning of the studies. The distribution for each week is different.

The students of the subject are divided into four theory groups in the first quarter: Theory 1A, Theory 1B, Theory 2A, Theory 2B. In the second quarter there will be two theory groups: Theory 1 and Theory 2. There are 6 practice groups (P11, P12, P13, P21, P22 and P23) and each group of practices is divided into 2 seminar groups. Each student is assigned to a theory group, a group of internships and one of seminars.
Consult the website to know the theory group you are assigned and the Moodle classroom of the subject to know the group of internships and seminars where you have been assigned or assigned.

The theory sessions will be given to the whole group-class and will be devoted to the exhibition of the subject's subject: concepts, results, demonstrations and examples. Emphasis will be placed on the most procedural aspect. The most theoretical formalizations will be presented only as an additional knowledge, working the demonstrations when they contribute to the development of mathematical reasoning. The exhibition will be combined with slate, with powerpoint presentations and with the use of specific software to graphically visualize the most relevant aspects of the different theoretical concepts. Will the students find in the MOODLE CLASSROOM AND Numerical Methods classroom? Didactic Units the subject notes, by subjects, corresponding to the class expositions, generally extended with more examples or parts of reinforcement of previous concepts with the purpose of making available to the student a complete material for work on the agenda. However, it is advisable to consult any bibliography in a timely manner so that the student can speak to work with technical texts and enrich their capacity for self-learning by completing specific aspects of reinforcement or by extending others that have woke up a special interest

The sessions of first-trimesters practices will be devoted to the resolution of exercises related to the concepts of the syllabus. Most of these concepts will be introduced to the theory class, but some will be exposed in these classes by relating it to specific exercises. Previously, the statement will be given to the students so that they can develop their own resolution strategies and expose them or contrast them with the proposal that will be given in class. Students will have in advance a list of exercises proposed in the MOODLE Classroom of Calculation and Numerical Methods in the ACTIVITIES section.

The sessions of practices of the second quarter will be done in the classroom of laboratory with computer. It will work with Octave, a free distribution program that allows the manipulation of numbers, vectors, arrays and functions, both at the algebraic and graphical level, and also allows the programming of algorithms.

The seminar sessions will be devoted to solving and commenting on the doubts and difficulties that have arisen when working on the proposed exercises. Complementary exercises will also be considered in the lists. In four of these seminar sessions, short exams (20-30 min) will be evaluated for the continuous evaluation of the subject. See table 3 at the end of the document. In the second quarter two seminar sessions will be devoted to the introduction of the Octave and visualization of curves and surfaces.

Previous knowledge: Each subject will assume that the student has previous knowledge obtained from their pre-university studies. It will indicate which parts are known to be part of the Secondary curriculum and therefore will not be discussed in detail in the classes. Supplementary material will be provided to be able to review them.

6.2 Moodle classroom.

The Global Classroom will be the usual means of communication teacher-student.

The TEACHER'S TEACHER section collects the general information about the course: contents and dates of the continuous assessments, notes of the different evaluations and, in general, everything related to the course's deployment throughout the trimester.

The DIDACTIC UNITS section includes the notes that correspond to the theory of each subject Depending on the topic, all those exposed in class or only a part will be there, with indications of the most appropriate references to complete them

The section ACTIVITIES, subdivided Exercises, lists the exercises corresponding to each topic and its resolutions. The sub-group Activities is reserved for activities to be solved by groups. The guidelines for group

work and the work list will be published on October 9th. The sub-sections of the Laboratory will publish the corresponding statements for the seminars and practical sessions that will be held in the computer room.

Within the WEEKEND WORKSHOP, a document informing about the activities programmed for the current week and the contents of the sessions of the week is published weekly.

In the COMPLEMENTARY MATERIALS section, you will find various auxiliary materials, in general, a collection of notes related to the subject that can be found on the Internet and that can be consulted from the file that is available, or directly from the links. Its content complements different aspects of the subject: historical visions, mathematical anecdotal, mathematical curiosities, deepening certain concepts, exercises and practices to revise or revise previous concepts that the student has not achieved, ... we must insist on The complementary aspect of this material, the content that will be required in the evaluation will correspond to the deployment made to the classroom and to the work patterns set out in the Teacher's Board.

In the RESOURCES section, it collects diverse resources to reinforce or deepen the subject.

7. Programming of activities

Hours of student dedication First trimester

Content blocks	*Hours in the classroom*			*Hours outside the classroom*	
	Big group	Medium group	Small group		
B1	4	2	1	5	
B2	5	2	3	14	
B3	5	3	1	13	
B4	4	1	4	13	
B5			1	9	
Examen				10	
Total	18	8	10	64	ECTS * 25

Second trimester

Content blocks	*Hours in the classroom*			*Hours outside the classroom*	
	Big group	Medium group	Small group		
B6	3	0	3	13	
B7	7	0	7	17	
B8	8	8	0	24	

Examen				10	
Total	18	8	10	64	ECTS * 25

Class timetables, and the detail of whether each session will be in theory of practices or seminars is published in the "Calendar and Times" section of the ESUP website http://www.upf.edu/esup