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Course Guide 2019/2020

Introduction to the Laboratory Procedures

Introducción al Trabajo de Laboratorio

Bachelor in Pharmacy

Mode: On Campus

Índice

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Introduction to the Laboratory Procedures

Module: **Chemistry.**

Subject: **Introduction to the Laboratory Procedures.**

Level: **Formación Obligatoria.**

Nº of credits: **6 ECTS.**

Academic Sessions: **1er curso – 1er semestre.**

Course Professors: Dr. D. **Alfonso Pérez Garrido**

Email: **aperez@ucam.edu**

Office Hours: **Martes y Miércoles de 9:30 a 11:30.**

Professor coordinating the Module: **Alfonso Pérez Garrido**

Brief Description

Students in this subject should acquire basic knowledge of analytical chemistry necessary for their professional future. It also addressed the foundation for better understanding of other matters related of degree. These basic skills enable homogenize the knowledge level of students in the face of continuing with specific areas of the degree. In its development the student acquires the capacity for analysis and reasoning, become familiar with the new teaching methodology in addition to acquiring specific knowledge and skills in this field. Also delve into the classic methods of analysis used routinely in the laboratory.

A professional degree in Pharmacy must be in possession of non-negligible chemical analytical skills needed to understand the basic analytical methods based laboratory analysis of pharmaceutical formulations.

Prerequisites

None

Objectives

1. To acquire the basic knowledge for the initiation of work in a chemistry laboratory.
2. To acquire the skill in the handling of the instruments of measurement of volume, scales and in the preparation of solutions and standards.
3. To develop a neat and orderly way of working in the laboratory.
4. To acquire the basic knowledge related to the whole process of volumetric analysis, preparation of solutions and standard solutions, choice of titrant reagents, choice of indicator, exact measurement of volumes, application of the theoretical concepts of chemical equilibrium and stoichiometry of the reactions, calculation and presentation of the results.

5. To know how to apply quantitative, volumetric and gravimetric methods of chemical analysis.

Competencies and Learning Outcomes

Basic competencies

(MECES1) Students have demonstrated that they possess and understand the knowledge in an area of study that starts from the basis of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the forefront of their field of study.

(MECES2) Students know how to apply their knowledge to their work or vocation in a professional manner and they possess the skills that are usually demonstrated through the elaboration and defense of arguments and through problem-solving within their area of study.

(MECES3) Students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant issues of a social, scientific, or ethical nature.

(MECES4) Students can transmit information, ideas, problems, and solutions to a specialized and non-specialized public.

(MECES5) Students have developed the learning skills necessary to undertake later studies with a high degree of autonomy.

General competencies

(CG1) Identify, design, obtain, analyze, control and produce drugs and medicines, as well as other products and raw materials of sanitary interest for human or veterinary use.

(CG10) Design, apply and evaluate reagents, methods and clinical analytical techniques, knowing the basic fundamentals of clinical analysis and the characteristics and contents of laboratory diagnosis reports.

(CG11) Evaluate the toxicological effects of substances and design and apply the corresponding tests and analyzes.

(CG12) Develop hygienic-sanitary analysis, especially those related to food and the environment

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(CG15) Recognize one's limitations and the need to maintain and update professional competence, paying special attention to the self-learning of new knowledge based on scientific evidence.

Interdisciplinary competencies

(CT4). Incorporate into their behavior the ethical principles that govern research and professional practice.

(CT5). Acquire awareness of the risks and environmental problems associated with their professional practice.

(CT8). Defend personal points of view based on scientific knowledge.

(CT9). Integrate knowledge and apply them to solve problems using the scientific method.

(CT10). Acquire capacity for organization, planning and execution.

(CT11). Development of the ability to work independently or as a team in response to the specific needs of each situation.

(CT13). Progress in his ability to work in multidisciplinary groups.

(CT14). Pursue quality objectives in the development of their professional activity.

(CT15). Acquire capacity for decision making and management of human resources.

(CT16). Being able to show creativity, initiative and entrepreneurial spirit to face the challenges of his activity as a pharmacist.

Specific competencies

(CEM1.2). Select the appropriate techniques and procedures in the design, application and evaluation of reagents, methods and analytical techniques.

(CEM1.3). Conduct standard laboratory processes including the use of scientific synthesis and analysis equipment, appropriate instrumentation included.

(CEM1.4). Estimate the risks associated with the use of chemical substances and laboratory processes.

(CEM1.15). Know the laboratory material and its proper handling and maintenance.

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(CEM1.16). Learn the theoretical foundations of basic work operations.

(CEM1.18). Know the thermodynamic laws on which the formation of pure substances and in solution are based.

Metodology

Metodology	Hours	Hours of Classroom Work	Hours of Non-Classroom Work
Classroom sessions	12	60 (40 %)	
Academic Tutorials	12		
Laboratory sessions	24		
Seminars	6		
Classroom test	6		
Personal Study	54		90 (60%)
On-line Tutorials	9		
Resolution of Exercises and Practical Cases	18		
Project Completion and Oral Presentations	9		
TOTAL	**150**	**60**	**90**

Temario

Theoretical instructional program

Seminar 1. Resolution of titrations cases

Practical instructional program

Seminar 1. Resolution of titrations cases

Seminar 2. Resolution of titrations cases

Seminar 3. Resolution of titrations cases.

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Laboratory session 1. Laboratory material and preparation of solutions.

Laboratory session 2. Tools and basic laboratory operations: Filtration and centrifugation.

Laboratory session 3. Basic laboratory tools and operations: Crystallization.

Laboratory session 4. Thin Layer Chromatography.

Laboratory session 5. Liquid-liquid extractions.

Laboratory session 6. Acid-base titrations.

Laboratory session 7. Acid-base titrations.

Relationship to Other Courses of the Study Plan

The subject of Introduction to the Laboratory Procedures is mainly related to the following subjects in the syllabus: Analytical techniques, General Chemistry, Physico-chemistry, Inorganic Chemistry, Organic Chemistry I and II.

Sistema de evaluación

February Sessions:

- **Practical tests and seminars:** (60%). Practices will be assessed by means of a practical examination in the laboratory and they must pass with a grade of 5. The seminars will be evaluated through an examination that will consist in the resolution of exercises or practical cases that will include an exercise of dissolutions that must be overcome to pass the subject. The seminar tests will be evaluated together with the theoretical tests.

- **Theoretical tests:** (40%). Examinations (or evaluative tests) will be carried out with theoretical-practical questions and resolution of assumptions that gather the contents of the studied subject. The average of the theoretical tests and seminars must be equal or superior to 5 to pass the subject.

September Sessions:

- **Practical tests and seminars:** (60%). Practices will be assessed through a practical test in the laboratory that must be passed with a grade of 5 to pass the course. The seminars will be evaluated through an examination that will consist in the resolution of exercises or practical cases that will include an exercise of dissolutions that must be overcome to pass the subject. The seminar tests will be evaluated together with the theoretical tests.

- **Theoretical tests:** (40%). Examinations (or evaluative tests) will be carried out with theoretical-practical questions and resolution of assumptions that gather the contents of the studied subject. The average of the theoretical tests and seminars must be equal or superior to 5 to pass the subject

Pruebas prácticas y seminarios: (60% del total de la nota.). Se valorarán las prácticas mediante un examen práctico en el laboratorio que deberán superar con nota de 5 para aprobar la

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asignatura. Los seminarios se evaluarán mediante un examen que consistirá en la resolución de ejercicios o casos prácticos que incluirá un ejercicio de disoluciones que deberán superar para aprobar la asignatura. Las pruebas de seminarios se evaluarán conjuntamente con las pruebas teóricas.

- **Pruebas teóricas:** (40% del total de la nota.). Se realizarán exámenes (o pruebas evaluatorias) con cuestiones teórico-prácticas y resolución de supuestos que recojan los contenidos de la materia estudiada. La media de las pruebas teóricas y seminarios deberá superar el 5 para aprobar la asignatura.

The student shall pass the subject when the weighted average is equal to or greater than 5 points and all the parts that make up the grading system have been passed, with an overall weight equal to or greater than 20%.

If the student has less than 5 in any of the parts with a weight equal to or greater than 20%, the subject will be suspended, and the student must retake the part(s) in the next session within the same academic year. The suspended part(s) in official sessions (February/June) will be saved for successive sessions that are held in the same academic year.

In the event that the subject is not passed in the September session, the passed parts will not count for successive academic years.

The grading system (RD 1.125/2003. of September 5) shall be the following:0-4,9 Suspenso (SS) 5,0-6,9 Aprobado (AP) 7,0-8,9 Notable (NT) 9,0-10 Sobresaliente (SB)

Honorable mention may be granted to students who have earned a grade equal to or greater than 9.0. This number may not exceed 5% of the total number of students enrolled in a subject in the corresponding academic year, unless the number of students enrolled is less than 20, in which case only a single honorable mention may be granted.

Bibliography and Reference Sources

Basic Bibliography

- Harris, D.C. (2010). Análisis químico cuantitativo. Barcelona: Ediciones Grupo Reverté.
- Skoog, D.A., West, D.M., Holler, F.J. (2005). Fundamentos de química analítica. Madrid: Ediciones Thomson.
- Christian, G. D. (2009). Química Analítica (6ª edición), McGraw Hill, Méjico
- Harvey, D. (2000). Química Analítica Moderna, McGraw Hill

Additional Bibliography

- Petrucci, R.H. (2008). Química General. Madrid: Prentice Hall.
- Chang, R. (1998) Química. México: McGraw-Hill.
- Hansen, S., Pedersen-Bjergaard, S., Rasmussen, K. (2012). Introduction to Pharmaceutical Chemical Analysis. Hoboken:John Wiley & Sons Ltd

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- Watson, DG., (2012). Pharmaceutical analysis a textbook for pharmacy students and pharmaceutical chemists. Elsevier Churchill Livingstone, USA.
- Bermejo Martínez, F., Bermejo Barrera, P., Bermejo Barrera, A. (1991). Química analítica general cuantitativa e instrumental. Madrid: Ediciones Paraninfo.

Related Websites

http://www.aoac.org/iMIS15_Prod/AOAC *AOAC Internacional*

http://www.usp.org/ *Farmacopea de Estados unidos*

http://www.rseq.org/. *Real Sociedad Española de Química*

Scientific Journals

http://ees.elsevier.com/aca/ *Analytica Chimica Acta*

http://pubs.acs.org/journal/ancham?cookieSet=1 *Analytical Chemistry*

http://pubs.rsc.org/en/journals/journalissues/ay#!recentarticles&all *Analitical Methods*

http://www.ingentaconnect.com/content/aoac/jaoac *AOAC Internacional*

Study Recommendations

Continuous daily study of the subject.

Teaching Materials

Generals:

- PDF document related to the subject presentation.

Parte Teórica:

- PDF documents related to each lesson of the subject

Practical part:

- Lab coat, scientific calculator.
- PDF document with the Laboratory Practices Manual.
- PDF documents with the exercises of each lesson of the subject
- PDF documents with solved exercises of each lesson of the subject
- Computer software: Explorer, Microsoft Word, Power Point, Adobe Reader, Excel, chemaxon.

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Personal Tutorials

In academic tutorials, the focus will be to work on Decree No. 359/2009, of October 30th, which establishes and regulates the educational response to the diversity of students in the Autonomous Community of the Region of Murcia.

The activities that are carried out in the Academic Tutorials on this subject are:

− Personal orientation on the contents of the subject and the grading systems.

− Consolidation of knowledge, abilities, skills and attitudes of group work, and oral and written communication.

− Planning and promoting student learning through the provision of bibliographic and documentary sources.

− Advice on how to approach the activities of the practical seminars.

The University also has a Special Body of Tutors that conducts personal tutoring with students enrolled in the degree. The personal tutor accompanies the students throughout the university phase. You can check the following link:

http://www.ucam.edu/servicios/tutorias/preguntas-frecuentes/que-es-tutoria

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Course Guide 2019/2020

Inorganic Chemistry

Mode: On Campus

Index

Inorganic chemistry

Module: **Chemistry**

Subject: **Inorganic chemistry**

Level: **Basic**

No of credits: **6 ECTS.**

Course Professor: **Lucia Guardiola Garcia**

Email: **lguardiola@ucam.edu**

Office hours: **Tuesday de 10:00 a 12:00h**

Professor coordinating the Module: **Lucia Guardiola Garcia**

Academic Season: **1st Course – 2st Semester.**

Brief Description

Students in this subject should acquire basic knowledge of general inorganic chemistry necessary for their professional future. It also addressed the foundation for better understanding of other matters related to degree. These basic skills enable homogenize the knowledge level of students in the face of continuing with specific areas of the degree. In its development the student acquires the capacity for analysis and reasoning, become familiar with the new teaching methodology in addition to acquiring specific knowledge and skills in this field.

A professional degree in Pharmacy must be in possession of a non-negligible chemical knowledge needed to understand chemical and biochemical processes underlying the synthesis, metabolism and analysis of active principles that are part of the pharmaceutical formulations.

Prerequisites

None

Objetives

1. Acquire the basic knowledge of Organic and Inorganic Chemistry.
2. Integrate the necessary chemical bases for future professional development.
3. Understand the problems related to the transformation of chemical substances.
4. Know the acid-base, redox, complex formation and precipitation processes that take place in solution.
5. Perform the necessary calculations for the correct evaluation of the equilibria in solution.

Competences and Learning Outcomes

Basic competences

MECES1.- That students demonstrate to understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of its field of study.

MECES2.- That students know how to apply their knowledge to their work in a professional way and have the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

MECES3.- That students have the ability to gather and interpret relevant data in order to make judgments that include a reflection on relevant social, scientific or ethical issues.

MECES4.- That students transmit information, ideas, problems and solutions to a specialized and non-specialized public

MECES5.- That students develop those learning skills necessary to undertake further studies with a high degree of autonomy.

General Competences

(CG1).- Identify, design, obtain, analyze, control and produce drugs and medicines, as well as other products and raw materials of sanitary interest for human or veterinary use.

(CG10).- Design, apply and evaluate reagents, methods and clinical analytical techniques, knowing the basic fundamentals of clinical analysis and the characteristics and contents of laboratory diagnosis reports.

(CG11).- Evaluate the toxicological effects of substances and design and apply the corresponding tests and analyzes

(CG13).- To develop communication and information skills, both oral and written, to deal with patients and users related to their professional activity. To promote the capacities of work and collaboration in multidisciplinary teams and those related to other health professionals.

(CG15). - To recognize limitations and the need to maintain and update professional competence, paying special attention to the self-learning of new knowledge based on scientific evidence.

Interdisciplinary competences

CT1.- Prepare and write scientific reports.

CT2.- Demonstrate critical and self-critical reasoning.

CT4.- Incorporate into their behavior the ethical principles that govern research and professional practice.

CT5.- Acquire awareness of the risks and environmental problems associated with their professional practice

CT7.- Reading and listening comprehension, oral and written production that allows him to develop in a professional context in English. Interpretation of texts in technical and scientific English in the field of research. Communicate in Spanish and English using the usual audiovisual media.

CT8.- Defend personal points of view based on scientific knowledge.

CT9.- Integrate knowledge and apply it to solve problems using the scientific method.

CT10.- Acquire capacity for organization, planning and execution.

CT11.- Development of autonomous or team work capacity in response to the specific needs of each situation.

CT13.- Progress in his ability to work in multidisciplinary groups.

CT15.- Acquire capacity for decision making and management of human resources

Specific Competences

(CEM1.7). Know and understand the characteristic properties of the elements and their compounds, as well as their application in the pharmaceutical field.

Methodology

Methodology	Hours	Hours of classroom work	Hours of Non-Classroom Work
Classroom based Classes	18	60 (40 %)	
Seminars	12		
Academic Tutorials	6		
Classroom Evaluations	6		
Laboratory practices	18		

Personal Study	63		
On-line Tutorials	9		
Resolution of Exercises and Practical Cases	9		90 (60%)
Project Completion and Oral Presentations	9		
TOTAL	**150**	**60**	**90**

Syllabus

Theoretical program

Classes in the classroom (18 hours): Exhibition of contents by the teacher, analysis of skills, explanation and demonstration of skills, abilities and knowledge in the classroom or through audiovisual media. The presentations will be available to the students in the virtual campus on the date prior to the exhibition in class.

Tutorías académicas (6 hours): Individualized tutorials and small groups will be held to clarify doubts or problems raised in the learning process, direct work, review and discuss the materials and topics presented in the classes, guide students about the work, practical cases and readings to be made, consolidate knowledge, check the evolution of student learning, and provide feedback on the results of that process, using different IT tools such as forums, chats, or self-assessments.

Laboratory practices (18 hours): The nature of the degree and the competences associated with it make the development of laboratory practices and face-to-face sessions indispensable. These will be developed and distributed and organized in the form of practical workshops throughout the academic year.

Seminaries (12 hours): Four bioinorganic chemistry seminars will be held where the students will have to make presentations of works about the proposed topics (8hrs) The type problems of the collection of problems proposed students will be solved along the semester (2hrs).

Classroom assessment (6 hours): All the necessary activities will be carried out to evaluate the students through the learning results in which the competences acquired by the student in each subject are specified, encouraging if it is appropriate the self-assessment and group co-evaluation exercises. In these evaluations, the examination itself, the practices and the work carried out will be taken into account.

Personal study (63 horas): Its purpose is to assimilate the contents and competences presented in the classes and to prepare possible doubts to be solved in the tutorials, realization of learning activities and preparation of exams.

Resolution of exercises and case studies (9 horas). It consists in the resolution by students of problems and / or practical cases. All this will serve, to achieve a significant learning of the knowledge derived from the content of the subject.

Realization of works (9 horas). Realization of practical and / or theoretical works proposed by the responsible teacher individually or in a group.

On-line Tutorías (9 horas): Use of the virtual classroom to favor the contact of the students with the subject through the forum, outside the classroom, as well as facilitate their access to selected information and useful for their work not present.

Temario

Programa de la enseñanza teórica

Topic 1. Hydrogen. Hydrides

Topic 2. Noble gases

Topic 3. Study of relevance metals of blocks

Topic 4. Most important elements and compounds of the p block (groups 17 to 13)

Topic 5. Study of relevance metals of blocks s and d. Coordination compounds. Nomenclature. Ligands Link.

Unit 6. Complex formation equilibria. General considerations.- Types of ligands.- Complex formation constants.- Chelate complexes.- Ion masking.- Stability of the complexes as a function of the pH.- Areas of predominance of the different species.- Graphical representations.

Topic 7 Precipitation reactions. Precipitation reactions.- Solubility and Product of solubility.- Separations by precipitation.- Properties of precipitates.- Precipitation in homogeneous media.- Thermal behavior of precipitates.- Solubility as a function of pH.- Solubility of precipitates by formation of complexes

Topic 8 Oxidation-reduction equilibria. Oxidation - reduction balances.- Review of fundamental concepts.- Redox systems of water.- Dismutation.- Formal potentials.- Variation of the potential of a system as a function of pH.- Influence of the formation of complexes and precipitates on the potential of a system. Fundamentals of electroanalytical chemistry.Tema 1. Hidrógeno. Hidruros

Tema 2. Gases nobles

Practical teaching program

Seminarios

Seminar 1. Bioinorganic chemistry of some of the most relevant elements, Fe, Cu, Zn.

Seminar 2. Bioinorganic chemistry of some of the most relevant elements, Co. Mo, Cr

Seminar 3. Bioinorganic chemistry of some of the most important non-metallic elements

Seminar 4. Bioinorganic compounds with pharmacological activity.

Seminar 5. Complexity and precipitation equilibria.

Seminar 6. Redox balances.

Practicas laboratorio

Practice 1.- Lead chemistry.

Practice 2.- Manganese chemistry.

Practice 3.- Chromium chemistry.

Practice 4.- Precipitation of nickel hydroxide. Preparation of Ni (II) complexes. a) Preparation of [Ni $(NH_3)_6$] Cl_2. b) Preparation of [Ni (en) $_2$] $Cl_2 \cdot H_2O$.

Practice 5.-. Preparation of copper sulphate pentahydrate and copper sulfate and ammonium

Practice 6.- Preparation of potassium chromate (III) trioxalate.

Practice 7. Complex formation equilibria.

Practice 8. Precipitation equilibrium

Practice 9. Balances redox balances.

Relationship to Other Courses of the Study Plan

The subject of Q. Inorganic is mainly related to the following subjects of the curriculum: Analytical techniques, Introduction to work in the laboratory, Pharmaceutical Chemistry I and II, Physico-chemistry, General Chemistry, Q. Organic I and II.

Grading System

June/September Sessions

- **Practical tests and seminars:** (60%.). Students must pass the practices to pass the course. Practices will be assessed through a deliverable that will be developed the same day of the practice. The seminars will be evaluated through a test type test or through the resolution of exercises or practical cases and that will average with the theoretical tests

- Theoretical tests: (40% del total de la nota.). Tests (or evaluative tests) will be carried out with theoretical-practical questions type test, resolution of exercises or practical cases

The student shall pass the subject when the weighted average is equal to or greater than 5 points and all the parts that make up the grading system have been passed, with an overall weight equal to or greater than 20%.

If the student has less than 5 in any of the parts with a weight equal to or greater than 20%, the subject will be suspended, and the student must retake the part(s) in the next session within the same academic year. The suspended part(s) in official sessions (February/June) will be saved for successive sessions that are held in the same academic year.

In the event that the subject is not passed in the September session, the passed parts will not count for successive academic years.

The grading system (RD 1.125/2003. of September 5) shall be the following:

- 0-4.9 Suspended
- 5.0-6.9 Passed
- 7.0-8.9 Excellent
- 9.0-10 Outstanding (SB)

Honorable mention may be granted to students who have earned a grade equal to or greater than 9.0. This number may not exceed 5% of the total number of students enrolled in a subject in the corresponding academic year, unless the number of students enrolled is less than 20, in which case only a single honorable mention may be granted.

Bibliography and Reference Sources

Basic Bibliography

- Petrucci, R.H. (2008). Química General. Madrid: Prentice Hall.
- Chang, R. (2010) Química. México: McGraw-Hill.
- Sharpe. A.G.Sharpe. 1991. Editorial Reverté.

Additional Bibliography.

Related websites

www.modelscience.com/PeriodicTableSp.html. *Programas de química*

www.monografias.com/trabajos11/nomecom/nomecom.shtml. *Nomenclatura de compuestos*

http://www.librosite.net/data/glosarios/petrucci/videos/contenidos.htm. *Animaciones de química*

http://phet.colorado.edu/en/simulations/translated/es. *Simulaciones químicas de la Universidad de Colorado*

http://www.quimicaweb.net/. *Temas de química*

http://www.rseq.org/. *Real Sociedad Española de Química*

http://ees.elsevier.com/aca/*AnalyticaChimica Acta*

http://pubs.acs.org/journal/ancham?cookieSet=1*Analytical Chemistry*

Study recommendations

Daily continuous study of the subject.

Teaching materials

General:

- PDF document of Presentation of the subject.

Theoretical Part:

- PDF documents related to each subject of the subject

Practical part:

- Lab coat, scientific calculator.

- PDF document with the Laboratory Practices Manual.

- PDF documents with the exercises of each subject of the subject

- PDF documents with solved exercises of each subject of the subject

- Computer software: Explorer, Microsoft Word, Power Point, Adobe Reader, Excel, Geogebra, chemaxon.

Tutorials

The academic tutoring will have among its objectives to guide students on the contents of the subject, study methods and evaluation system. The doubts about the taught subject will be solved and basic concepts will be reinforced for an adequate follow-up of the syllabus, in those students that require it. In addition, it will be advisable to read different articles and monographs to expand the knowledge of the subject.

The University also has a Special Body of Tutors that conducts personal tutoring with the students enrolled in the degree. The personal tutor accompanies the students throughout the university stage. You can check the following link:

https://www.ucam.edu/servicios/tutorias

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Course Guide 2019/2020

Fundamentals of Applied Mathematics and Statistics

Mode: On Campus

Indez

Fundamentals of Applied Mathematics

Module: **Physics and Mathematics**

Subject: **Statistics**

Level: **Basic**

No of credits: **6 ECTS.**

Course Professor: **Santiago López-Miranda González.**

Email: **slmiranda@ucam.edu**

Office hours: **Tuesday de 10:00 a 12:00h y Thursday de 16:30 a 18:30h.**

Professor coordinating the Module: **Santiago López-Miranda González**

Academic Season: **1st Course – 1st Semester.**

Brief Description

Fundamentals of Applied Mathematics and Statistics is a necessary subject for the subsequent compression of physical, chemical and scientists needed for proper training as Pharmaceuticals. Its main objective is to acquire basic knowledge in mathematics and statistics to achieve the specific objectives of this Grade.

Prerequisites

None

Objetives

1. Master the principles of basic mathematical calculation.
2. Know the usefulness and practical application of the various mathematical and statistical functions and tools.
3. Encourage mathematical reasoning and the ability to solve complex problems.
4. Develop the ability to interpret mathematical results both numerically and graphically.
5. Become familiar with the use of technologies at the service of mathematics.

Competences and Learning Outcomes

Basic competences

MECES1.- That students demonstrate to understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of its field of study.

MECES2.- That students know how to apply their knowledge to their work in a professional way and have the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

MECES3.- That students have the ability to gather and interpret relevant data in order to make judgments that include a reflection on relevant social, scientific or ethical issues.

MECES4.- That students transmit information, ideas, problems and solutions to a specialized and non-specialized public

MECES5.- That students develop those learning skills necessary to undertake further studies with a high degree of autonomy.

General Competences

CG3.- To know how to apply the scientific method and to acquire skills in the handling of legislation, sources of information, bibliography, elaboration of protocols and other aspects that are considered necessary for the design and critical evaluation of preclinical and clinical trials.

CG13.- To develop communication and information skills, both oral and written, to deal with patients and users related to their professional activity. To promote the capacities of work and collaboration in multidisciplinary teams and those related to other health professionals.

CG15.- To recognize limitations and the need to maintain and update professional competence, paying special attention to the self-learning of new knowledge based on scientific evidence.

Interdisciplinary competences

CT1.- Prepare and write scientific reports.

CT2.- Demonstrate critical and self-critical reasoning.

CT4.- Incorporate into their behavior the ethical principles that govern research and professional practice.

CT7.- Reading and listening comprehension, oral and written production that allows him to develop in a professional context in English. Interpretation of texts in technical and scientific English in the field of research. Communicate in Spanish and English using the usual audiovisual media.

CT8.- Defend personal points of view based on scientific knowledge.

CT9.- Integrate knowledge and apply it to solve problems using the scientific method.

CT10.- Acquire capacity for organization, planning and execution.

CT11.- Development of autonomous or team work capacity in response to the specific needs of each situation.

CT13.- Progress in his ability to work in multidisciplinary groups.

CT16.- Being able to show creativity, initiative and entrepreneurial spirit to face the challenges of his activity as a pharmacist.

Specific Competences

CEM2.1.- Apply the knowledge of Physics and Mathematics to the pharmaceutical sciences.

CEM2.3.- Design experiments based on statistical criteria.

CEM2.4.- Evaluate scientific data related to medicines and health products.

CEM2.5.- Use statistical analysis applied to pharmaceutical sciences.

Methodology

Methodology	Hours	Hours of classroom work	Hours of Non-Classroom Work
Classroom based Classes	24	60 (40 %)	
Seminars	18		
Academic Tutorials	12		
Classroom Evaluations	6		
Personal Study	63		90 (60%)
On-line Tutorials	9		
Resolution of Exercises and Practical	9		

Cases			
Project Completion and Oral Presentations	9		
TOTAL	**150**	**60**	**90**

Syllabus

Theoretical program

Part I: Mathematics

Topic 1. Resolution of equations and non-algebraic equations

1. Algebraic equations
2. Non-Algebraic Equations

Topic 2. Differential calculus and derivatives application

1. Introduction to differential calculus
2. Derivation
3. Derivatives application

Topic 3. Integration and integrals application

1. Introduction
2. Rules of integration
3. Integrals application

Part II: Statistics

Topic 4. Statistics in Health Sciences

1. Introduction
2. Basic concepts of statistics
3. Samples, sampling, design of experiments and clinical trials

Topic 5. Descriptive statistics (Frequencies)

1. Introduction
2. Data Grouping
3. Frequency distribution.
4. Frequency graphic representation

Topic 6. Descriptive statistics

1. Introduction

2. Central tendency measurements
3. Variability or dispersion measurements
4. Estimation

Topic 7. Introduction to the calculation of probabilities

1. Introduction
2. Confidence intervals
3. Level of significance and power of an experiment. Hypothesis contrast
4. Analysis of variance. Comparison of means between groups

Practical program

General use of spreadsheets (Excel)

Advanced calculations and graphic management with spreadsheets.

Computer tools for statistics.

Resolution of practical cases.

Relationship to Other Courses of the Study Plan

Fundamentals of Applied Mathematics and Statistics is part of the basic subjects necessary to provide a solid base of knowledge in which to sustain the teaching and learning of the specific subjects that will subsequently be studied.

Fundamentals of Applied Mathematics and Statistics will provide the student with the tools and knowledge necessary to solve all the problems that require mathematical calculations, and statistical interpretation such as chemical physics, experimental studies, scientific analysis, etc.

Grading System

For de February/September Sessions

- Practical exams and seminars (50%). Practices and/or seminars will be evaluated through the realization and later correction of practical cases that collect the contents worked on in the practical classes and seminars. It is mandatory to approve the part of seminars to approve the subject. The cut-off note for this part is 5.

Theoretical exams (50%). Exams or tests) will be carried out with theoretical-practical questions and problem solving that gather the contents of the studied subject. It is mandatory to approve the theory part to pass the subject. The cut-off note for this part is 5.

The student shall pass the subject when the weighted average is equal to or greater than 5 points and all the parts that make up the grading system have been passed, with an overall weight equal to or greater than 20%.

If the student has less than 5 in any of the parts with a weight equal to or greater than 20%, the subject will be suspended, and the student must retake the part(s) in the next session within the same academic year. The suspended part(s) in official sessions (February/June) will be saved for successive sessions that are held in the same academic year.

In the event that the subject is not passed in the September session, the passed parts will not count for successive academic years.

The grading system (RD 1.125/2003. of September 5) shall be the following:

- 0-4.9 Suspended
- 5.0-6.9 Passed
- 7.0-8.9 Excellent
- 9.0-10 Outstanding (SB)

Honorable mention may be granted to students who have earned a grade equal to or greater than 9.0. This number may not exceed 5% of the total number of students enrolled in a subject in the corresponding academic year, unless the number of students enrolled is less than 20, in which case only a single honorable mention may be granted.

Bibliography and Reference Sources

Basic Bibliography

- Martín, A. (2004). *Bioestadística para las Ciencias de la Salud*. Madrid: Norma.
- Milton, J.S. (1987). *Estadística para biología y ciencias de la salud*. Madrid: McGraw–Hill.
- Spiegel, M.R. (1976). *Probabilidad y estadística*. México: McGraw–Hill.
- Viedman, J.A. (1981). *Exposición intuitiva y problemas resueltos de métodos estadísticos*. Madrid: del Castillo.
- Rius-Díaz, F., Barón-López, F.J. (2005). *Bioestadística*. Madrid: Thomson Editores.
- Sentís, J. (2001). *Manual de bioestadística*. Barcelona: Masson.
- Solka, R. (1999). *Introducción a la Bioestadística*. Barcelona: Reverté.

Additional Bibliography

- Bovas, A. (1983). *Statistical methods for forecasting*. New York: John Wiley & Son.
- Abascal, E. (2005). *Análisis de encuestas*. Madrid: ESIC.
- Saínz, M. (1999). *Estadística*. Bilbao: Universidad de Deusto.
- Azorín, F. (1994). *Métodos y aplicaciones del muestreo*. Madrid: Alianza Editorial.
- Box, G.E.P. (2001). *Estadística para investigadores: introducción al diseño de experimentos, ánalisis de datos y construcción de modelos*. México: Reverté.
- Canavos, G.C. (1988). *Probabilidad y estadística: aplicaciones y métodos*. México: McGraw-Hill.
- Carrasco de la Peña, J.L. (1995). *El método estadístico en la investigación médica*. Madrid: Ciencia 3.

Related websites

www.rsme.es. *Real Sociedad Matemática Española*

http://www.ine.es/ *Instituto Nacional de Estadística*

http://biostatistics.oxfordjournals.org/content/by/year *Oxford journals*

http://e-stadistica.bio.ucm.es/ *Aula virtual de bioestadística*

http://www.hrc.es/bioest/M_docente.html *Unidad de Bioestadística Clínica (Hospital Universitario Ramón y Cajal)*

Study recommendations

Daily continuous study of the subject.

Teaching materials

For a correct development of the subject, the student must have:

- Scientific calculator
- Computer with Microsoft Excel program. If you do not have it, you can perform the tasks and jobs in the University's API classroom.

Tutorials

The academic tutoring will have among its objectives to guide students on the contents of the subject, study methods and evaluation system. The doubts about the taught subject will be solved and basic concepts will be reinforced for an adequate follow-up of the syllabus, in those students that require it. In addition, it will be advisable to read different articles and monographs to expand the knowledge of the subject.

The University also has a Special Body of Tutors that conducts personal tutoring with the students enrolled in the degree. The personal tutor accompanies the students throughout the university stage. You can check the following link:

https://www.ucam.edu/servicios/tutorias