COURSE DESCRIPTION

COURSE DETAILS

Title (of the course): **ENZIMOLOGÍA**
Code: 101846
Degree/Master: **GRADO DE BIOQUÍMICA** Year: 2
Name of the module to which it belongs: BIOQUÍMICA Y BIOLOGÍA MOLECULAR
Field: ENZIMOLOGÍA
Character: OBLIGATORIA Duration: FIRST TERM
ECTS Credits: 6 Classroom hours: 60
Face-to-face classroom percentage: 40% Study hours: 90
Online platform:

LECTURER INFORMATION

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PREREQUISITES AND RECOMMENDATIONS

Prerequisites established in the study plan

None.

Recommendations

Knowledge in thermodynamics and kinetics of chemical reactions, chemical gunctional groups, reactivity and types of reactions.
Handling simple algebraic equations, integrals and derivatives. Statistical analysis.
This knowledge is taught in Physics-Chemistry, Organic Chemistry, Mathematics and other subjects of the first year.

INTENDED LEARNING OUTCOMES

COURSE DESCRIPTION

CB7	Capable of using basic IT tools for communication, research, and data processing in professional life.
CB1	Capable of thinking critically and being self-critical.
CB4	Possess the capacity to learn andPossess the capacity to learn and work independently.
CB8	Be able to read scientific texts in English.
CE3	Understand the basic principles that determine molecular structure and the chemical reactivation of simple biomolecules.
CE5	Understand the chemical principles and thermodynamics of molecular recognition and of biocatalysis, as well as the roll of enzymes and other proteins in determining the working of cells and organisms.
CE17	Know the methodological principles for the testing of biological activity of celular components, especially of enzymes, both in vitro and in vivo.
CE21	Possess the quantitative ability for work in a biochemical laboratory, including the capacity to prepare reagents for experiments in an precise and reproducible manner.
CE23	Know how to apply experimental protocols in laboratories in the area of Biochemistery and Molecular Biology.
CE24	Possess the mathematical, statistical and IT abilities to obtain, anaylse and interpret data, and to understand simple models of biological systems and processes at a molecular and cellular level.

OBJECTIVES

The development of the capacities related to the skills established for the course.
To understand and learn the basic principles of the Enzymology as a science, its historical evolution, current state and future direction and challenges. Empahisis will be put on both practical and theoretical aspects. From the study of the enzymes it is pretended to deep into the knowledge of the living organisms, to understand the cell metabolism, how does it work, is integrated and regulated. Also how to exploit its biotechnological potential in the biomedicine, agrifood and analytical fields. Enzymology is a complex discipline whose body of teaching results from an integration of mathematics, physics, chemistry, and biology, hence giving and integrated view of the biochemistry. The course is organized in lectures, lab experiments and practical sessions in which questions and exercises will be proposed and solved. From the basic principles developed during the lectures the student should be able to prepare a writing manuscript, present, defend and discuss it critically. At the end of the course he/she should be familiarzed with the current literature in the field, the employed scientific terminology, to design an experiment on enzymes, to interprete the experimental results and also to know why and how the enzymes can be used in disease diagnosis and treatments, in food quality improvement and for analytical purposes, just as a few examples. It is pretended not only to present a classical view of the discipline but a modern one, trying to conect it to molecular biology, -omics approaches, and systems biology. It can be done through the attendance of the lectures and the reading of general text books, but, more importantly, of classical historical papers, the Nobel Prize lectures, and the most recent ones appearing in relevant journals such as Nature and Science. The use of the modern informatic and bioinformatic tools, databases and specialized web pages is also included as an important objective.

CONTENT

1. Theory contents

INTRODUCTION. Definitions. Enzymes as catalysts. History of Enzymology. Enzyme biotechnology. Nomenclature and classification of enzymes.
ENZYME INVESTIGATION. Methods and techniques. Experimental design. Extraction of enzymes. Enzyme activity assays. Enzyme purification and structural and kinetic characterization. Enzyme immovilization. Enzymology in the Molecular Biology and -omics era. In silico analysis, algorithms and databases.
STRUCTURAL ENZYMOLOGY. Simple and conjugated enzyms. Apoenzyme, coenzymes, and prosthetic groups. Structure and enzyme function relationship. Enzyme evolution. Active and ligand centres. The active site.
ENZYME CATALYSIS. The mechanisms of enzyme action.
RIBOZMES and SYNTHETIC ENZYMES. Catalytic RNA. Abzymes. Sinzymes. Enzyme engineering.
ENZYME KINETICS, MODELS AND LAWS. Single-substrate reactions. Michaelis-Menten theory. Steady-state theory. Determination of kinetic parameters. Kinetic mechanisms and models.
EFFECT OF PHYSICO-CHEMICAL PARAMETERS ON ENZYME ACTIVITY. Effect of pH. Effect of temperatura. Effect of ionic strenght. Enzyme activity in hydrophobic solvents.
MODULATORS OF ENZYME ACTIVITY. Enzyme inhibitors. Inactivators. Reversible inhibitors. Pseudoirreversible inhibitors. Suicide substrates. Substrate and product inhibition. Enzyme activators. Metal activation.
REACTIONS INVOLVING TWO O MORE SUBSTRATES. Mechanisms and models. Reaction rate equations.
ENZYME CONTROL AND REGULATION. Enzymes and metabolic control. Conformational mechanisms, allosterism. Covalent modification. Protein synthesis and degradation. Protein complexes.

2. Practical contents

COURSE DESCRIPTION

Search for information on enzymes. Scientific literature. Portals and databases on enzymes.
How to prepare and write a scientific manuscript. How to present and discuss it.
Exercises on enzyme classification and nomenclature.
Excercises and problems on enzyme kinetics.
LAB PRACTICES
Invertase as a model enzyme.Chemical and enzymatic assays used to determine invertase activity.
Inhibition of invertase
Invertase inmovilization in alginate gels. The effect of temperature on the activity of the inmovilized enzyme.
Invertase reactors for the production of sugar inverted syrups from sucrose.
The use of mathematics, statistics, and bioinformatic tools in the treatment of the experimental data. Presentation and discussion of the results.

METHODOLOGY

General clarifications on the methodology. (optional)

Assessment activities include class questions and weekly exercises (problems)
Bibliographic consultations include the preparation of oral (seminar) and
written work.
Seminars will be presented by the students themselves.

Methodological adaptations for part-time students and students with disabilities and special educational needs

The methodological strategies and evaluation system contemplated in this Guide will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required "
For part-time students it is mandatory to assist to the "Lab practices"

Face-to-face activities

Activity	Large group	Medium group	Total
Assessment activities	3	2	*5*
Case study	-	8	*8*
Lab practice	-	13	*13*
Lectures	20	-	*20*
Seminar	10	4	*14*
Total hours:	***33***	***27***	***60***

Off-site activities

Activity	Total
Exercises	*20*
Information search	*15*
Reference search	*15*
Self-study	*40*
Total hours:	**90**

WORK MATERIALS FOR STUDENTS

Placement booklet
Exercises and activities
Oral presentations
References

Clarifications:

The material will be supplied to the students through the Moodle platform or by email

COURSE DESCRIPTION

EVALUATION

Intended learnig outcomes	Tools			
	Assignments and projects	Exams	Placement reports	Seminars
CB1	x	x	x	x
CB4	x	x	x	x
CB7	x		x	x
CB8	x			x
CE17	x		x	x
CE21	x		x	x
CE23	x		x	
CE24		x		
CE3		x		
CE5	x	x		x
Total (100%)	**30%**	**35%**	**20%**	**15%**
Minimum grade.(*)	**5**	**5**	**5**	**5**

(*) Minimum grade necessary to pass the course

Valora la asistencia?: *No*

General clarifications on instruments for evaluation:
Exams: it include class questions and weekly exercises.
Assignments and Projects: it includes the written work on an enzyme and on the contents of the lectures.

Clarifications on the methodology for part-time students and students with disabilities and special educational needs:
Final exam, 80%, and lab practices report, 20%

Qualifying criteria for obtaining honors: *La nota sea igual o superior a 9,0. El numero de MH que se podra otorgar debera estar de acuerdo con los condicionantes indicados en el articulo 30.3del Reglamento de Regimen Academico de la UCO*

BIBLIOGRAPHY

1. Basic Bibliography:

NUÑEZ DE CASTRO I. Enzimología. Ediciones Pirámide, Madrid, 2001.
CÁRDENAS J., FERNÁNDEZ E., GALVÁN F., MÁRQUEZ A.J., VEGA J.M. Problemas de Bioquímica. Editorial Alhambra, Madrid, 1988.
IUBBM. Enzyme Nomenclature. Academic Press, New York, 1992.
http://www.chem.qmul.as.uk/iubm/enzyme/).
DIXON M, WEBB EC. 1979. Enymes. Longman, New York.
CHAPLIN M.F., BUCKE C. Enzyme Technology. Cambridge University Press, Cambridge, 1990.
MARANGONI A.G. Enzyme Kinetics: A Modern Approach. Wiley-Interscience, Hoboken, NJ, 2003.

2. Further reading:

It will be provided along the course.

COURSE DESCRIPTION

COORDINATION CRITERIA

- Joint activities: lectures, seminars, visits ...
- Tasks performance

SCHEDULE

Period	Activity				
	Assessment activities	Case study	Lab practice	Lectures	Seminar
1# Fortnight	1	2	0	4	0
2# Fortnight	1	2	0	4	0
3# Fortnight	1	0	5	4	0
4# Fortnight	1	0	5	4	0
5# Fortnight	1	0	3	4	0
6# Fortnight	0	2	0	0	5
7# Fortnight	0	2	0	0	5
8# Fortnight	0	0	0	0	4
Total hours:	***5***	***8***	***13***	***20***	***14***

The methodological strategies and the evaluation system contemplated in this Course Description will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.