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: 6.0 Classroom hours: 60
Face-to-face classroom percentage: 40.0% Study hours: 90
Online platform: https://moodle.uco.es/m2021/

LECTURER INFORMATION

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PREREQUISITES AND RECOMMENDATIONS

Prerequisites established in the study plan

English level B1.

Recommendations

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

COURSE DESCRIPTION

INTENDED LEARNING OUTCOMES

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. Emphasis 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 it does 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 knowledge results from an integration of mathematics, physics, chemistry, and biology, hence giving an 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 familiarized 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 also 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. 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.

COURSE DESCRIPTION

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.
RIBOZYMES 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 temperature. 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.
ENZYME BIOTECHNOLOGY. Enzymes in biomedicine, agrifood, and forestry sectors. Industrial enzymes. Enzymes in analysis.

2. Practical contents

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.

SUSTAINABLE DEVELOPMENT GOALS RELATED TO THE CONTENT

No poverty
Zero hunger
Good health and well-being
Quality education
Gender equality
Clean water and sanitation
Affordable and clean energy
Industry, innovation and infrastructure
Reduced inequalities
Sustainable cities and communities
Responsible consumption and production
Climate action
Life below water
Life on land

COURSE DESCRIPTION

METHODOLOGY

General clarifications on the methodology (optional)

Assessment activities includes class questions and weekly exercises (problems)
Case studies includes the weekly reading of nature and Science journals
Bibliographic consultations includes 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	2	2	4
Case study	-	8	8
Lab practice	-	14	14
Lectures	20	-	20
Seminar	11	3	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

Coursebook
Exercises and activities
Oral presentations
References

COURSE DESCRIPTION

Clarifications

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

EVALUATION

Intended learning	Case Studies	Document Analysis	Exams	Laboratory Practice	Oral Presentation
CB1	X	X	X	X	X
CB4	X	X	X	X	X
CB7	X	X	X	X	
CB8	X	X			X
CE17	X	X		X	X
CE21	X			X	X
CE23	X			X	
CE24			X		
CE3			X		
CE5	X		X		X
Total (100%)	***25%***	***10%***	***30%***	***20%***	***15%***
Minimum grade	***5***	***5***	***5***	***5***	***5***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

COURSE DESCRIPTION

Attendance will be assessed?:

No

General clarifications on instruments for evaluation:

Exams: it includes class questions and weekly exercises.
Document analysis includes written works on relevant articles published in Nature and Science
Oral presentation corresponds to the seminars prepared and presented by the students
Case studies includes the written work on an enzyme and on the contents of the lectures.
All scores obtained in each evaluation activity will keep throughout the course.

Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

These students may be evaluated with the same assessment tools as full-time students. Alternatively, they can be evaluated through a final exam. In this case, the final grade will be: Exam: 60%, Internship report: 20% and Seminar: 20%.

Clarifications on the evaluation of the first extraordinary call and extra-ordinary call for completion studies:

The final grade will be: Exam: 60%, Internship report: 20% and Seminar: 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.
PRICE N, STEVENS l. 2001. Fundamentals of Enzimology. Cell and Molecular Biology of Catalytic Proteins. 3rd Ed. Oxford university press.

2. Further reading

It will be provided to the students along the semester

COORDINATION CRITERIA

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

COURSE DESCRIPTION

SCHEDULE

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

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.

CONTINGENCY PLAN: CASE SCENARIO A

Case scenario A will correspond to a diminished on-site academic activity due to social distancing measures affecting the permitted capacity of classrooms.

METHODOLOGY

General clarifications on the methodology on case scenario A

A multimodal (hybrid) teaching system will be adopted, combining both on-site and remote classes via videoconference (synchronous) that will be held in the timetable approved by the corresponding Faculty or School. The time distribution of teaching activities (both on-site and remote) will be decided by the aforementioned Faculties and Schools bearing in mind the permitted capacity of classrooms and social distancing measures as established at that time.

Assessment activities includes class questions and weekly exercises (problems)
Case studies includes the weekly reading of nature and Science journals
Bibliographic consultations includes the preparation of oral (seminar) and
written work.
Seminars will be presented by the students themselves.

COURSE DESCRIPTION

EVALUATION

Intended learnig	Case Studies	Document Analysis	Exams	Laboratory Practice	Oral Presentation
CB1	X	X	X	X	X
CB4	X	X	X	X	X
CB7	X	X	X	X	
CB8	X	X			X
CE17	X	X		X	X
CE21	X			X	X
CE23	X			X	
CE24			X		
CE3			X		
CE5	X		X		X
Total (100%)	***25%***	***10%***	***30%***	***20%***	***15%***
Minimum grade	***4***	***4***	***4***	***4***	***4***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

Attendance will be assessed (Scenario A)?:

No

General clarifications on instruments for evaluation (Scenario A):

Exams: it includes class questions and weekly exercises.
Document analysis includes written works on relevant articles published in Nature and Science
Oral presentation corresponds to the seminars prepared and presented by the students
Case studies 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 (Scenario A):

These students may be evaluated with the same assessment tools as full-time students. Alternatively, they can be evaluated through a final exam. In this case, the final grade will be: Exam: 60%, Internship report: 20% and Seminar: 20%.

CONTINGENCY PLAN: CASE SCENARIO B

Case scenario B will bring about a suspension of all on-site academic activities as a consequence of health measures.

COURSE DESCRIPTION

METHODOLOGY

General clarifications on the methodology on case scenario B

On-site teaching activities will be held via videoconference (synchronous) in the timetable approved by the corresponding Faculty or School. Alternative activities will be proposed for reduced groups in order to guarantee the acquisition of course competences.

Assessment activities includes class questions and weekly exercises (problems)
Case studies includes the weekly reading of nature and Science journals
Bibliographic consultations includes the preparation of oral (seminar) and written work.
Seminars will be presented by the students themselves.

EVALUATION

Intended learnig	Case Studies	Document Analysis	Exams	Laboratory Practice	Oral Presentation
CB1	X	X	X	X	X
CB4	X	X	X	X	X
CB7	X	X	X	X	
CB8	X	X			X
CE17	X	X		X	X
CE21	X			X	X
CE23	X			X	
CE24			X		
CE3			X		
CE5	X		X		X
Total (100%)	***25%***	***10%***	***30%***	***20%***	***15%***
Minimum grade	***4***	***4***	***4***	***4***	***4***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

Moodle Tools	Análisis de documentos	Estudio de casos	Exposición oral	Exámenes	Prácticas de laboratorio
Asistencia	X	X	X	X	X
Chat	X	X			

COURSE DESCRIPTION

Moodle Tools	Análisis de documentos	Estudio de casos	Exposición oral	Exámenes	Prácticas de laboratorio
Participación	X	X	X	X	X
Tarea	X	X			
Videoconferencia	X	X	X	X	X

Attendance will be assessed (Scenario B)?:

No

General clarifications on instruments for evaluation (Scenario B):

Exams: it includes class questions and weekly exercises.
Document analysis includes written works on relevant articles published in Nature and Science
Oral presentation corresponds to the seminars prepared and presented by the students
Case studies 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 (Scenario B):

These students may be evaluated with the same assessment tools as full-time students. Alternatively, they can be evaluated through a final exam. In this case, the final grade will be: Exam: 60%, Internship report: 20% and Seminar: 20%.