Information about the subject

Degree: Bachelor of Science Degree in Biotechnology

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 1100304 **Name:** Enzymology

Credits: 6,00 **ECTS Year:** 3 **Semester:** 1

Module: Biochemistry and Molecular Biology

Subject Matter: Enzimology **Type:** Compulsory

Department: Biotechnology

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

1103	David Talens Perales **(Responsible Lecturer)**	david.talens@ucv.es
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Module organization

Biochemistry and Molecular Biology

Subject Matter	ECTS	Subject	ECTS	Year/semester
Biochemistry	12,00	Biochemistry I	6,00	1/2
		Biochemistry II	6,00	2/1
Molecular Genetics	6,00	Molecular Genetics	6,00	2/1
Molecular Biology of Microorganisms	6,00	Molecular Biology of Microorganisms	6,00	2/2
Enzimology	6,00	Enzymology	6,00	3/1

Recommended knowledge

Having completed or being receiving courses on the following subjects: General and organic chemistry, Biochemistry I and II, Thermodynamics and kinetics

Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

R1 The student has understood and assimilated the contents of the subject.

R2 The student is able to solve problems or case studies related to the subject contents, by using different resources (bibliographic, IT, etc.)

R3 The student is able to work in a laboratory, carrying out basic operations correctly and taking into account the corresponding safety standards. He/she understands the planning, development and purpose of the experience, and is able to contrast and validate the obtained results.

R4 The student is able to write an intelligible and organized text on different aspects of the subject.

R5 The student is able to present and defend his/her work adequately.

R6 The student seeks bibliographic information from different sources and can analyze it with a critical and constructive spirit.

R7 The student collaborates with the teacher and his/her peers throughout the learning process; he/she works in a team; treats everyone with respects, is proactive and fulfills the organization rules of the course.

Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

BASIC		Weighting			
		1	2	3	4
CB1	Students acquire and understand knowledge in their field of study based on general secondary education but usually reaching a level that, although supported on advanced text books, also includes aspects involving state-of-the-art knowledge specific to their area.		x		
CB2	Students are able to apply knowledge to their work in a professional way and have the competences enabling them to state and defend views and opinions as well as perform problem-solving tasks in their field of study.		x		
CB3	Students are able to collect and interpret relevant data (generally in their field of study) and give opinions that involve reflection on relevant social, scientific or ethical issues.			x	
CB4	Students can communicate information, ideas, problems and solutions to a specialized or non-specialized audience.		x		
CB5	Students develop the necessary learning skills to undertake further studies with a high level of autonomy.		x		

GENERAL		Weighting			
		1	2	3	4
CG01	Capacity to analyze and synthesize.			x	

SPECIFIC		Weighting			
		1	2	3	4
CE23	Knowing how to use laboratory equipment and to carry out basic operations for each discipline including: safety measures, handling, waste disposal and activity register.			x	

CE24	Knowing basic and instrument laboratory techniques in the different areas of biotechnology.		x		
CE25	Knowing how to analyze and understand scientific data related to biotechnology.				x
CE29	Contrasting and checking results of biotechnological experimentation.		x		
CE32	Knowing how to use different specific operating systems and software packages designed for Biotechnology.			x	

TRANSVERSAL		Weighting			
		1	2	3	4
CT02	Capacity to organize and plan.			x	
CT03	Mastering Spanish oral and written communication.			x	
CT05	Knowing and applying Basic ITC skills related to Biotechnology.	x			
CT06	Capacity to manage information (capacity to look for and analyze information coming from different types of sources).			x	
CT07	Problem solving.			x	
CT08	Decision making			x	
CT09	Capacity to work in interdisciplinary and multidisciplinary team.			x	
CT10	Interpersonal skills.			x	
CT11	Understanding multicultural and diverse environment			x	
CT12	Critical and self-critical capacity.			x	
CT13	Ethics.	x			
CT14	Capacity to learn			x	
CT15	Capacity to adapt to new situations			x	

CT16	Capacity to produce new ideas (creativity)			x
CT17	Leadership abilities			x
CT18	Taking initiatives and enterprising spirit			x
CT19	Capacity to apply theoretical knowledge			x
CT20	Research skills			x
CT21	Sensitivity to environmental issues			x

Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes	Granted percentage	Assessment method
R1	50,00%	Written test
R2, R3, R5, R6, R7	25,00%	Submission of papers
R2, R4	12,50%	Laboratory test
R2, R4, R5, R7	12,50%	Solving problems with the computer

Observations

According to the general evaluation and qualification regulations, the preferred evaluation system will be by means of continuous evaluation:
Continuous assessment will be conducted during in-person classes through questions and problems that will complement the theoretical information of each session, allowing both the student and the instructor to monitor the progress of learning in the course.
For the calculation of the final grade, a minimum of 5/10 is required in all evaluation instruments.
When it says Resolution of Problems with the Computer, it refers to the laboratory practices, and specifically to the reports, while the laboratory test is the practical exam (due to platform automatisms)
The mark of each part (only if it is greater than or equal to 5) is given the corresponding correction based on the percentage awarded.
Attendance at practices is compulsory to be able to evaluate the practical part of the subject.
According to the general regulations, only one honor degree can be given for every 20 students, not for a fraction of 20, with the exception of the case of groups of less than 20 students in total.
Also, according to the agreement of the teaching staff of January 26, 2010:
-It can only be granted honors in the first or second call of the first year of enrollment of the student in the subject.
-The teacher may grant honors to any of the students who have obtained between 9 or 10 points in the subject.

MENTION OF DISTINCTION:
In accordance with the regulations governing the assessment and grading of subjects in force at UCV, the distinction of "Matrícula de Honor" (Honours with Distinction) may be awarded to students who have achieved a grade of 9.0 or higher. The number of "Matrículas de Honor" (Honours with Distinction) may not exceed five percent of the students enrolled in the group for the corresponding academic year, unless the number of enrolled students is fewer than 20, in which case a single "Matrícula de Honor" (Honours with 9 Distinction) may be awarded. Exceptionally, these distinctions may be assigned globally across different groups of the same subject. Nevertheless, the total number of distinctions awarded will be the same as if they were assigned by group, but they may be distributed among all students based on a common criterion, regardless of the group to which they belong. The criteria for awarding "Matrícula de Honor" (Honours with Distinction) will be determined according to the guidelines stipulated by the professor responsible for the course, as detailed in the "Observations" section of the evaluation system in the course guide.

Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

M1	Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.
M2	Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity.
M3	Activities carried out in spaces with specialized equipment.
M4	Supervised monographic sessions with shared participation..
M5	Application of multidisciplinary knowledge.
M6	Personalized and small group attention. Period of instruction and/or guidance carried out by a tutor to review and discuss materials and topics presented in classes, seminars, readings, papers, etc.
M7	Set of oral and/or written tests used in initial, formative or additive assessment of the student
M8	Group preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical , practical and/or small-group tutoring sessions. Work done on the university e-learning.

M9 Student's study: Individual preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning platform.

IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
ON-CAMPUS CLASS M1	R1, R2, R5, R6, R7	37,00	1,48
PRACTICAL CLASSES M2	R1, R2, R3, R5, R6, R7	5,00	0,20
LABORATORY M3	R4	8,00	0,32
SEMINAR M4	R1, R2, R6	3,00	0,12
GROUP PRESENTATION OF ASSIGNMENTS M5	R1, R2, R6	3,00	0,12
TUTORIAL M6	R2, R3, R5, R6	2,00	0,08
ASSESSMENT M7	R1, R2, R3, R4, R5, R6, R7	2,00	0,08
TOTAL		**60,00**	**2,40**

LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
AUTONOMOUS GROUP WORK M8	R1, R2, R3, R4, R5, R6	18,00	0,72
AUTONOMOUS INDIVIDUAL WORK M9	R1, R2, R3, R4, R5, R6	72,00	2,88
TOTAL		**90,00**	**3,60**

Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

Content block	Contents
1. INTRODUCTION	Introduction to Enzymology - Properties and classification of enzymes - Chemical bonding and reactions in biochemistry - Structural components of enzymes
2. ENZYMATIC KINETICS	- Protein-ligand binding balance - Monosustrate enzymatic reaction kinetics - Kinetics of reactions with multiple substrates - Factors that affect the speed of the enzymatic reaction - Enzymatic inhibition, reversible inhibitors and high binding inhibitors
3. MECHANISMS AND ENZYMATIC REGULATION	-Complementarity between the active site and the substrate. Stabilization of the transition state - Serine proteases: An illustrative example. Nomenclature of the enzymatic reaction - Cooperativity in enzymatic catalysis - Allosteric behavior models. Effects of cooperativity on speed curves

4. PURIFICATION, CHARACTERIZATION AND APPLICATIONS (EXAMPLES OF ENZYMES)	- Enzymatic immobilization - Protein expression, isolation and purification - Affinity chromatography, molecular exclusion, ionic and hydrophobic exchange - Biophysical enzyme characterization - Biotechnological and clinical applications of enzymes. Examples (These contents are studied through the seminars developed by the students under teachers indications, are evaluated as exam content and can be complemented during the sessions by the teacher)
5. PRACTICES	Practice 1 ENZYMES AND CHEESE PRODUCTION Practice 2 STUDY OF ENZYMATIC ACTIVITY. EFFECT OF THE REACTION TIME IN THE PRESENCE AND ABSENCE OF ENZYME. Practice 3 STUDY OF ENZYMATIC ACTIVITY. EFFECT OF ENZYME CONCENTRATION ON REACTION RATE. Practice 4 STUDY OF ENZYMATIC ACTIVITY. EFFECT OF SUBSTRATE CONCENTRATION ON REACTION RATE. CALCULATION Km and Vm Practice 5 STUDY OF ENZYMATIC ACTIVITY. EFFECT OF AN INHIBITOR (SODIUM MOLYBDATE) ON ALKALINE PHOSPHATASE ACTIVITY Practice 6 SOLVING ENZYMATIC PROBLEMS Practice 7 PROTEIN BIOINFORMATIC WORKSHOP

Organization of the practical activities:

	Content	Place	Hours
PR1.	ENZYMES AND CHEESE PRODUCTION	Laboratory	2,00
PR2.	ENZYMATIC KINETICS	Laboratory	2,00
PR3.	MECHANISMS AND ENZYME REGULATION	Laboratory	2,00
PR4.	STUDY OF ENZYMATIC ACTIVITY. EFFECT OF SUBSTRATE CONCENTRATION ON REACTION RATE. CALCULATION Km and Vm	Laboratory	2,00
PR5.	STUDY OF ENZYMATIC ACTIVITY: EFFECT OF AN INHIBITOR (SODIUM MOLYBDATE) ON ALKALINE PHOSPHATASE ACTIVITY	Laboratory	2,00
PR6.	SOLVING ENZYMATIC PROBLEMS	Lecture room	1,00
PR7.	PROTEIN BIOINFORMATIC WORKSHOP	Computer	2,00

Temporary organization of learning:

Block of content	Number of sessions	Hours
1. INTRODUCTION	4,00	8,00
2. ENZYMATIC KINETICS	6,00	12,00
3. MECHANISMS AND ENZYMATIC REGULATION	6,50	13,00
4. PURIFICATION, CHARACTERIZATION AND APPLICATIONS (EXAMPLES OF ENZYMES)	7,00	14,00
5. PRACTICES	6,50	13,00

References

Basic bibliography:

·**Copeland, "Enzymes - A Practical Introduction to Structure, Mechanism And Data Analysis", Wiley-VCH, 2000**

·Bisswanger, "Enzyme Kinetics", Wiley-VCH, 2002

Complementary bibliography:

·Chaplin & Bucke, "Enzyme Technology", University of Cambridge, 1990

·Bommarius & Riebel, "Biocatalysis", Wiley-VCH, 2004

·Tanaka, Tosa & Kobayashi, "Industrial applications of immobilized biocatalysts", Marcel Dekker, New York, 1993.

·Mathews & Van Holde, "Bioquímica", MacGraw-Hill, 1996

·Godfrey & West, "Industrial Enzymology", Stockton Press NY, 1996

·Frey, "Enzymatic Reaction Mechanisms", Oxford, 2007

·Bugg, "Introduction to Enzyme and Coenzyme Chemistry", 2nd Ed. Blackwell, 2004