1. OVERVIEW

Subject Area	Thermodynamics and Chemical Kinetics
Degree	Bachelor's Degree in Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	Second
ECTS	6
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	S1
Academic Year	24-25
Coordinating professor	María Piedad Ros Viñegla
Teacher	

2. INTRODUCTION

Thermodynamic and Chemical Kinetics is one of the core subjects worth 6 ECTS credits and is delivered each semester in the second year of the Bachelor's Degree in Biotechnology. The main aim of this object is to teach students theory which allows them to develop the professional profile required: "Teaching and Research Activity", "Healthcare in Biochemistry and Molecular Biomedicine" and "Activity in the Industrial Sector". They will also learn knowledge and skills for the foundations required to carry out subsequent studies with a high level of autonomy.

The subject mainly deals with the study of material and phenomena associated with physicochemical and biological processes. We begin with fundamentals of kinetics of physical processes and catalysis. Then we move on to the conservation of energy, spontaneity criteria and the equilibrium of chemical processes and the equilibrium between phases in systems of one or more components. Finally, we look at the most important aspects of real solutions and surface phenomena.

The contents of this subject area form the basis for subject areas studied later in the degree such as Bioreactors, and Protein Chemistry and Engineering, and are very useful for the proper development and understanding of topics covered in other modules of the degree.

3. LEARNING OUTCOMES (RA, by the acronym in Spanish)

Knowledge (CON, by the acronym in Spanish)

CON03. Identify the physical, biophysical and thermodynamic processes which affect biological structures and the different phenomena which occur in them.

• Acquire a solid base of knowledge and skills which permits students to continue studying more specific subjects in the degree course and in their professional development.

Abilities (HAB, by the acronym in Spanish)

HAB03. Apply the right equations or procedures to interpret the mathematical, statistical, biophysical and thermodynamic data to study systems of interest in biotechnology.

• Apply the main concepts and principles of thermodynamics and apply them to the study of systems of interest in biotechnology.

• Express, use and apply chemical reaction rate equations correctly

and know how to predict factors which affect the reaction rate.

• Apply knowledge acquired to solving questions and problems, correctly analysing and interpreting results obtained.

Skills

COMP03. Apply the laws and principles of physicochemical processes which govern biological systems.

COMP06. Develop the skills needed to use the most common equipment, instruments and basic techniques in biotechnology, following quality standards and current biosecurity regulations.

4. CONTENTS

- Fundamentals of thermodynamics. Principles. Applications.
- Study of multicomponent systems.
- Chemical equilibrium.
- Chemical kinetics. General concepts.
- Simple reactions. Mechanism.
- Catalysis.
- Colloid systems.
- Surface phenomena.

This subject area is divided into five learning units, which are then divided into various topics:

LEARNING UNIT 1. Kinetics and catalysis

- Topic 1. Chemical kinetics
- Topic 2. Complex reactions and reaction mechanisms
- Topic 3. Catalysis

LEARNING UNIT 2. Thermodynamics

- Topic 4. Fundamentals of thermodynamics
- Topic 5. Principles of thermodynamics
- Topic 6. Gibbs free energy and chemical equilibrium.

LEARNING UNIT 3. Solutions

- Topic 7. Real and ideal solutions

LEARNING UNIT 4. Surface phenomena

- Topic 8. Adsorption phenomena

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:
The types of teaching/learning methods are as follows:

- Lecture
- Problem-based learning
- Learning based on workshop teaching

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	30
Asynchronous master lectures	10
Problem-solving	27
Written reports and essays	3
Tutorials	15
Independent working	50
Workshops and/or lab work	9
On-campus knowledge tests	6
TOTAL	**150**

7. ASSESSMENT

The assessment methods, together with how much they each count towards the final grade for the subject area, are as follows:

On campus:

Assessment system	Weight
Reports and written work	5%
Case study/problem scenario	20%

Laboratory practice	15%
On-campus knowledge tests	60%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period you must obtain a mark of 5.0 or more out of 10.0 in all assessed parts of the subject. Any part you do not pass in the ordinary exam period will need to be recovered in the extraordinary exam period (resits).

Your final grade will be the average of the partial marks in each of the learning activities you have passed. The continuous assessment system for the learning activities requires attendance to at least 50% of the classes.

It is compulsory for students studying degrees on-campus to accredit attendance to at least 50% of classes. This requirement qualifies students for the right to obtain academic counselling, support and monitoring from the professor. Failure to accredit attendance to at least 50% of the classes by any of the means proposed by the University will mean that the professor awarding a fail to the student for that subject area in the ordinary exam period in accordance with the grading system outlined in these regulations. All of the above, without prejudice to the other requirements or higher attendance percentages that other faculties may stipulate in their learning guides or internal regulations. Regulations for the assessment of official degree programmes, Art. 1 point 4.

(*https://universidadeuropea.com/documents/1798/6.__Reglamento_evaluacion_titulaciones_oficiales_grado_UEM_v2.pdf*)

7.2. Extraordinary exam period (resits)

To pass the subject area in the extraordinary exam period (resits), the students must obtain a mark equal to or above 5.0 out of 10.0 in all parts of the subject assessment they did not pass during the ordinary exam period.

The student must submit the activities not passed in the ordinary exam period taking into account the corrections or comments made by the teacher. The student must also submit any activities which were not submitted.

The final grade will be the average of the partial marks in each of the activities passed (with a mark equal to or higher than 5 out of 10). The marks for the assessable activities the student passed in the ordinary exam period will be maintained for calculating this grade.

8. TIMELINE

The timeline with delivery dates of assessable activities in the subject area is indicated in this section:

Assessable activities	Date
Activity 1. Solving applied activities individually or as a group – written texts	Week 2-15
Activity 3. Laboratory practice	Week 2-14
Activity 4. Knowledge tests	Week 8 and 17
Activity 5. Molecular dynamics workshop	Week 12

There are also activities which are not assessed in the subject area, the dates for which are established below:

Non-assessable activities	Date
Activity 2. Tutorials and question and answer forums	Week 1-15

The timeline may be subject to modifications for logistical reasons of the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The reference work for following this subject area is:

- "Fisicoquímica para Farmacia y Biología", Sanz Pedrero, P. y otros. Masson-Salvat, 1996 (y eds. posteriores).
- "Fisicoquímica", Levine, I. N. (2 tomos), McGraw-Hill, 2010.
- "Atkins' Physical Chemistry" P.W. Atkins y J. De Paula, 4th Edition, Oxford University Press, 2010.
- "Termodinámica Química", J. Rodríguez-Renuncio, Editorial Síntesis, 2000

The recommended bibliography is indicated below:

- "Cinética química básica y mecanismos de reacción", Avery, H. E. Ed. Reverté, S. A., 2002.
- "Cómo iniciarse en la resolución de integrales". Josa, Santi. Ed. Edunsa, 1992.

- "Cálculo integral", René Jiménez, Ed. Pearson Educación, 2008. E-book, 2010.
- "Cálculo Diferencial e Integral". CONAMAT, Ed. Pearson Educación, 2009. E-book, 2010.
- "Problemas de Física- Termodinámica y Transferencia de Calor", S. Burbano de Ercilla. E. Burbano García, C. García Muñoz, Ed. Tébar, 2006.

Relevant websites:

- http://www.redcientifica.com/doc/doc200403270001.html
- http://www.fisicanet.com.ar/biologia/metabolismo/ap07_leyes_de_la_termodinamica.php
- http://biorigel.blogspot.com.es/2010/04/termodinamica-y-conceptos-relacionados.html
- http://www.juntadeandalucia.es/averroes/recursos_informaticos/concurso2005/06/quimbach/apuntes_cinetica.pdf
- http://www.fisicanet.com.ar/quimica/q1_cinetica_quimica.php

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

The Educational Guidance and Diversity Unit (ODI in Spanish) offers support throughout your time at university to help you with your academic achievement. Other cornerstones of our educational policy are the inclusion of students with special educational needs, universal access in all our university campuses and equal opportunities.

This ODI unit offers students:

1. Support and monitoring through counselling and personalised student plans for those who need to improve their academic performance.
2. Curricular adaptations to uphold diversity, with assistance for those students who require specific educational support, leading to equal opportunities without significant changes to methodology or evaluation.
3. We offer students a range of extracurricular educational resources to reinforce skills which will enhance their personal and professional development.
4. Career guidance by offering tools and advice to students with doubts regarding their professional careers or those who believe they have chosen the wrong line of study.

Students who need educational support can contact us at:
orientacioneducativa@universidadeuropea.es

11. SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degree courses and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the course.

Many thanks for taking part.