VNIVERSITAT DE VALÈNCIA

Course Guide
44297 Laboratory techniques and analytical methods in palaeontology

COURSE DATA

Data Subject	
Code	44297
Name	Laboratory techniques and analytical methods in palaeontology
Cycle	Master's degree
ECTS Credits	4.5
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
2200 - Master?s Degree in Applied Palaeontology	Faculty of Biological Sciences	1	Annual

Subject-matter

Degree	Subject-matter	Character
2200 - Master?s Degree in Applied Palaeontology	2 - Study techniques in palaeontology	Obligatory

Coordination

Name	Department
MARTINEZ PEREZ, CARLOS	356 - Botany and Geology

SUMMARY

The subject Laboratory Techniques and Analytical Methods is essentially a subject practice made up of laboratory activities, which will be supported by introductory / explanatory theoretical classes. The subject presents the sequence of practical work in paleontology as well as the quantity and quality of the methods and techniques used. The course will focus on the main techniques and laboratory methods most common in paleontology, including preparation (until the materials are ready for study or exhibition), the different methods of analysis and the interpretation and integration of data. The subject includes specific contents on different techniques for the extraction of macro and microfossils: mechanical and chemical methods, washing and picking of micropaleontological samples, concentration reduction techniques, making thin sheets and replicas, complemented with microscopic techniques (optical microscope and microscope), scanning electron, X-ray diffraction, isotopic analysis methods. Tomographic analysis methods in paleontology (CT and micro-CT scan, syncroton), analysis and treatment of derived data. Finally, various analytical methods will be introduced in paleontology: geometric morphometry, Finite Element Analysis. Statistical analysis of data in Paleontology.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no enrolment restrictions with other subjects.

2200 - Master?s Degree in Applied Palaeontology

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Be able to access to information tools in other areas of knowledge and use them properly.
- To be able to assess the need to complete the scientific, historical, language, informatics, literature, ethics, social and human background in general, attending conferences, courses or doing complementary activities, self-assessing the contribution of these activities towards a comprehensive development.
- Be able to apply the research experience acquired to professional practice both in private companies and in public organisations.
- Be able to communicate and disseminate scientific ideas.
- Be able to plan and manage the resources available taking into account the basic principles of quality, risk prevention, safety and sustainability.
- Be able to apply the research experience acquired to begin the research phase of a doctoral programme in the field of biodiversity.
- Ser capaces de trabajar en equipo con eficiencia en su labor profesional o investigadora, adquiriendo la capacidad de participar en proyectos de investigación y colaboraciones científicas o tecnológicas
- Ser capaces de realizar una toma rápida y eficaz de decisiones en situaciones complejas de su labor profesional o investigadora, mediante el desarrollo de nuevas e innovadoras metodologías de trabajo adaptadas al ámbito científico/investigador, tecnológico o profesional en el que se desarrolle su actividad.

- Aplicar el razonamiento crítico y la argumentación desde criterios racionales.
- Capacidad para preparar, redactar y exponer en público informes y proyectos de forma clara y coherente, defenderlos con rigor y tolerancia y responder satisfactoriamente a las críticas que pudieren derivarse de su exposición.
- Proyectar la inquietud intelectual y fomentar la responsabilidad del propio aprendizaje.
- Asumir el compromiso ético y la sensibilidad hacia los problemas medioambientales, hacia el patrimonio natural y cultural.
- Conocer y comprender en profundidad la naturaleza de la biodiversidad y sus relaciones ecosistémicas tanto en la actualidad como en el pasado.
- Conocer la naturaleza del registro fósil en relación con el proceso sedimentario, las fases bioestratinómicas y fosildiagenéticas del proceso y los mecanismos de fosilización.
- Conocer, entender y extraer conclusiones, aplicables al momento actual, sobre las crisis de diversidad biológica, sus causas y consecuencias en el marco del actualismo.
- Conocer y comprender los eventos biológicos del pasado, así como las zonaciones, en el tiempo y en el espacio, de las biotas en orden a establecer la posición estratigráfica relativa de las rocas sedimentarias de zonas geográficas divesas.
- Conocer y manejar con fluidez, las divisiones de la escala de tiempo geológico, y las escalas bioestratigráficas construidas a partir de diferentes grupos de biotas del registro fósil.
- Ser capaces de interpretar varibles ambientales y ecológicas del pasado a partir del estudio de las trazas de organismos del reisro fósil.
- Conoce la naturaleza del registro estratigráfico, sus discontinuidades, los ciclos y eventos, los diferentes tipos de cuencas sedimentarias, los factores que controlan su relleno, las geometrías tridimensionales resultantes y las correlaciones estratigráficas.
- Conocer los principios fundametales del análisis de fácies en sistemas deposicionales continentales, transicionales y marinos, y el uso de los fósiles para la interpretación paleoambiental del registro estratigráfico.
- Recoger, representar y analizar datos para la interpretación y realización de cartografías geológicas y/o otros modos de representación (columnas estratigráficas, cortes geológicos, etc.) con vistas a su implementación en informes, publicaciones científicas u otros resultados.
- Conocer y entender en profundidad la Geología regional de España y de zonas periféricas, y en particular de la Comunitat Valenciana, conociendo en detalle los principales hitos paleontológicos representados en los yacimientos de la Península Ibérica y el norte de África.
- Conocer y manejar con dstreza las técnicas de campo, laboratorio y gabinete para la extracción, preparación, catalogación, reconstrucciones digitales, estudio y divulgación de microfósiles y macrofósiles.
- Conocer, elaborar y manejar bases de datos georeferenciadas de elementos del registro geológico y paleontológico, y los programas de representación y análisis espacial de estos elementos.

- Elaborar de una forma clara y concisa, todo tipo de memorias relacionadas con la temática paleontológica a nivel oficial o profesional (informes, subvenciones, memorias de impactos patrimonial, proyectos de investigación, etc.)
- Realizar estudios, aplicando los métodos y técnicas necesarios para conservar y gestionar el patrimonio paleontológico.
- Desarrollar las habilidades experimentales en el manejo de material y equipos de laboratorio en paleontología.

The subject will provide the student with the bases of laboratory and analytical work in paleontology, through programming mainly of a practical nature. The learning outcomes are:

- Know the various techniques of fossil extraction through mechanical and chemical methods.

- Know the various microscopic techniques, X-ray diffraction and isotopic analysis methods used in paleontological studies.

- Know the tomographic methods applied to paleontological elements.

- Employ analytical methods such as geometric morphometry and finite element analysis.

- Know and use in practical cases statistical treatments of interest in paleontology.

DESCRIPTION OF CONTENTS

1. Laboratory Techniques

Unit 1. Macro and microfossil extraction techniques:
-Mechanical methods and chemical methods
-Washing and triage of micropaleontological samples
-Concentrate reduction techniques

Unit 2. Preparation of paleontological samples
- Thin sections
- Levigates
- Smear
- Oriented serial sections
- Obtaining acetate peels in specimens and in mesoscopic samples
- Polished sections and basic mechanical extraction with hammer and ultrasound.

Unit 3. Introduction to casts and molds

2. Microscopic and analytical techniques

Unit 4. Microscopic and analytical techniques
- Optical microscope and scanning electron microscope
- Use of lucid camera and scans
- Specific photographic techniques (Mg oxide bleaching; image processing

Unit 5. Analytical Techniques
- X-ray diffraction
- Isotopic analysis methods.

3. Block 3. Computerized Techniques and Analytical Methods

Unit 6. Computerized tomography
-Tomographic analysis methods in paleontology (CT and micro-CT scan, synchroton) T

Unit 7. Analysis and treatment of derived data:
-Segmentation
-Obtaining virtual thin sheets
-3D models and 3D printing.

Unit 8. Analytical methods in paleontology
-Geometric morphometry
-Finite Element Analysis / Computational Fluid Dynamics.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	30,00	100
Theory classes	15,00	100
TOTAL	**45,00**	

TEACHING METHODOLOGY

Theoretical-practical classes:

- Lectures with computer presentations

- Face-to-face personal work on practical cases

- Writing reports with the teacher's guidance on practical cases

- Exhibition and public defense of the work done individually and in groups

Practical laboratory and computer classes:

- Introduction and planning of each practice
- Making observations, taking data, gathering information
- Use of specific software for data analysis
- Analysis of paleontological data

Evaluable individualized work:

- Laboratory work.
- Processing and treatment of the data obtained through the preparation of short reports.
- Elaboration of various materials and documents in theoretical-practical activities.
- Elaboration of reports on exposed contents.
- Participation in discussion groups on content related to the subject.

EVALUATION

• Practical and / or written exercises to be carried out, individually or in groups, throughout the semester for the continuous evaluation of the technical competences of the subject

• Attendance and use of classes

• Report of laboratory-cabinet practices

• Development of a final practical work that includes the entire subject and whose contribution to the final grade may not exceed 50% of the total Evaluation activities

Evaluation Activities

• Practical work 50%

• Laboratory-cabinet practices 15%

• Memories-Reports seminars 10%

• Continuous evaluation 25%

REFERENCES

Basic

- Leiggi,P. & May , P. (Editors), 1995. Vertebrate Paleontological Techniques (Vol 1) 366 pp. Cambridge University Press
- Bernhard, K. 1965 Handbook of paleontological techniques. 852pp. Freeman
- Green O.R. 2001 A Manual of Practical Laboratory and Field Techniques in Palaeobiology. 538 pp. Springer Netherlands
- Hammer, A. & Harper, D. A.T. 2005. Paleontological Data Analysis. 368 pp. Wiley-Blackwell
- Sutton, M.; Rahman, I. & Garwood, R. 2014. Techniques for Virtual Palaeontology. 208 pp. Wiley-Blackwell