

## GRADO EN CIENCIAS AMBIENTALES

### DATOS DE LA ASIGNATURA

|              |                             |                      |                             |
|--------------|-----------------------------|----------------------|-----------------------------|
| ASIGNATURA   | METEOROLOGY AND CLIMATOLOGY | SUBJECT              | METEOROLOGY AND CLIMATOLOGY |
| CÓDIGO       | 757709221                   |                      |                             |
| MÓDULO       | MATERIAS BÁSICAS            | MATERIA              | FÍSICA                      |
| CURSO        | 2º                          | CUATRIMESTRE         | 1º                          |
| DEPARTAMENTO | CIENCIAS INTEGRADAS         | ÁREA DE CONOCIMIENTO | FÍSICA APLICADA             |
| CARÁCTER     | OBLIGATORIA                 | CAMPUS VIRTUAL       | MOODLE                      |

### DISTRIBUCIÓN DE CRÉDITOS

|      | TOTAL | TEÓRICOS GRUPO GRANDE | TEÓRICOS GRUPO REDUCIDO | PRÁCTICAS DE INFORMÁTICA | PRÁCTICAS DE LABORATORIO | PRÁCTICAS DE CAMPO |
|------|-------|-----------------------|-------------------------|--------------------------|--------------------------|--------------------|
| ECTS | 6     | 4.5                   | 0                       | 0                        | 1.5                      | 0                  |

### DATOS DEL PROFESORADO

#### COORDINADOR

|                      |   |                |           |
|----------------------|---|----------------|-----------|
| NOMBRE               | FRANCISCO PÉREZ BERNAL                          |                |           |
| DEPARTAMENTO         | CIENCIAS INTEGRADAS                             |                |           |
| ÁREA DE CONOCIMIENTO | FÍSICA APLICADA                                 |                |           |
| UBICACIÓN            | CC. EXPERIMENTALES MÓDULO 1 PLANTA 4 DESPACHO 9 |                |           |
| CORREO ELECTRÓNICO   | francisco.perez@dfaie.uhu.es                    | TELÉFONO       | 959219789 |
| URL WEB              |   | CAMPUS VIRTUAL | MOODLE    |

#### OTROS DOCENTES

|                      |   |                |           |
|----------------------|---|----------------|-----------|
| NOMBRE               | ÁNGEL MIGUEL SÁNCHEZ BENÍTEZ                    |                |           |
| DEPARTAMENTO         | CIENCIAS INTEGRADAS                             |                |           |
| ÁREA DE CONOCIMIENTO | FÍSICA APLICADA                                 |                |           |
| UBICACIÓN            | FAC. CC. EE. - PLANTA 3ª - NÚCLEO 1 - PUERTA 08 |                |           |
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| URL WEB              |   | CAMPUS VIRTUAL | MOODLE    |

### DESCRIPCIÓN GENERAL DE LA ASIGNATURA

#### DESCRIPCIÓN GENERAL

The course is organized in four main blocks. Block number 1 introduces the subject to the student (Chapter I) and present radiation heat transfer, energy budget, and temperature in the Earth. The second Block, Block number 2, explains the main concepts of atmospheric thermodynamics for non-saturated (Chapter IV), and saturated (Chapter V) air. Block number 3 presents the basics of atmospheric dynamics and meteorological analysis, with two chapters: Chapter VI presents winds, the forces that cause the wind and different local wind systems and Chapter VII contains



# Grado en CIENCIAS AMBIENTALES

Curso 2020/2021



an introduction to the main concepts of synoptic meteorology: high and low pressure areas, air masses, fronts, and mid-latitudes cyclogenesis. The last block, Block 4, is devoted to Climatology, with two chapters, Chapter VII presents global circulation patterns in the atmosphere, teleconnection indexes, and the Knöppen-Geiger climate classification; finally, Chapter VIII is a basic introduction to climate change and global warming. The course includes five lab sessions, two of them are devoted to different aspects of atmospheric thermodynamics, and three of them to the Synop code and to the Skew T-Log P diagram.

## ABSTRACT

This course introduces students to the basic physical processes that are involved in creating our weather over very different time and length scales, laying special emphasis to the use of problem solving techniques. In addition, students are provided with simple tools to understand basic principles of weather forecasting, the different Earth climates, and climate change.

## OBJETIVOS: RESULTADOS DEL APRENDIZAJE

At the end of the course students should be able to demonstrate an understanding of

- how the interplay of solar radiation, Earth characteristics, and astronomical factors determines the surface-atmosphere energy balance and Earth climate distribution.
- how dry air thermodynamics explains the concept of atmospheric stability and its consequences.
- condensation phenomena and their implications in the atmospheric energy balance.
- the forces that guide the direction and speed of winds in local and global scales.
- the physical aspects that drive climate change.

## REPERCUSIÓN EN EL PERFIL PROFESIONAL

Environmental Science students need precise a basic knowledge of the atmosphere, and the physical laws governing its behaviour at short (Meteorology) and long (Climatology) terms. These opens to them interesting professional venues as well as a possible research field that has been considered of the utmost importance in recent times.

## RECOMENDACIONES AL ALUMNADO

### Prerequisites

No formal prerequisites are required. A knowledge of basic mathematics (calculus) and thermodynamics are of great help to the understanding of the subject. Students are expected to attend classes regularly. In-class participation is highly encouraged as well as the solution of the problems given as homework. This can make a difference to the final grade.

## COMPETENCIAS

### COMPETENCIAS BÁSICAS

CB1 - Que los estudiantes hayan demostrado poseer y comprender conocimientos en un área de estudio que parte de la base de la educación secundaria general, y se suele encontrar a un nivel que, si bien se apoya en libros de texto avanzados, incluye también algunos aspectos que implican conocimientos procedentes de la vanguardia de su campo de estudio.

CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas



Universidad  
de Huelva

# Grado en CIENCIAS AMBIENTALES

Curso 2020/2021



dentro de su área de estudio.

CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética.

CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado.

CB5 - Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía.

## COMPETENCIAS GENERALES

G1 - Capacidad de análisis y síntesis.

G3 - Comunicación oral y escrita.

G6 - Capacidad de gestión de la información.

G7 - Resolución de problemas.

G9 - Trabajo en equipo.

G12 - Aprendizaje autónomo.

G14 - Razonamiento crítico.

G18 - Sensibilidad hacia temas medioambientales.

G20 - Uso de internet como medio de comunicación y como fuente de información.

## COMPETENCIAS TRANSVERSALES

CT1 - Que los estudiantes hayan desarrollado y demostrado poseer habilidades de aprendizaje y conocimientos procedentes de su campo de estudio, siendo capaces de aplicarlos en su trabajo, interpretando datos relevantes para emitir juicios de temas de diversa índole pudiendo transmitirlos a un público tanto especializado como no especializado.

## COMPETENCIAS ESPECÍFICAS

E1 - Capacidad de aplicar los principios básicos de la Física, la 4, las Matemáticas, la Biología, y la 1 al conocimiento del Medio.

E2 - Capacidad de analizar el Medio como sistema, identificando los factores, comportamientos e interacciones que lo configuran.

E10 - Capacidad de realizar evaluaciones de impacto ambiental.

E19 - Capacidad en la elaboración e interpretación de cartografías temáticas.

## TEMARIO Y DESCRIPCIÓN DE LOS CONTENIDOS

### TEORÍA

**1. Introduction.** Weather and Climate. Atmospheric variables. The climatic system: the structure of the atmosphere. (2T)

**2. Energy: Solar warming of the Earth.** Electromagnetic radiation. Temperature and radiation heat transfer. The black body. The solar and earth spectra. The greenhouse effect. Geometric effects. (4.5TP)

**3. Seasonal and Daily Temperatures in the Earth.** Terrestrial distribution of temperature. Natural temperature controls. Daily and seasonal oscillations. Atmospheric thermometry. (2T)

**4. Dry and non saturated air.** Air as an ideal gas. Water vapor, humidity indexes. Thermodynamics of dry and non-saturated air. Adiabatic processes in the atmosphere. Atmospheric stability and vertical movement of air parcels. (4TP)

**5. Condensation and precipitation.** Saturation vapor pressure dependence with temperature. Adiabatic lifting of air parcels. Condensation mechanisms in the atmosphere. Precipitation types. Fogs and cloud classification. (4.5TP)

**6. Local winds.** Atmospheric pressure variation. Pressure maps. Wind measure. Forces that determine wind direction and speed. Geostrophic and gradient winds. (3T)

**7. Air masses and fronts.** High and low pressure areas. Classification of air masses. Synoptic meteorology. Cyclogenesis and weather forecasting. (3T)

**8. Global climate.** Global wind and current systems. Global Circulation Patterns and Teleconnection Indexes. The Monsoons. World climate classification. (3T)

**9. Climate change.** History and evolution of the climate. Feedback mechanisms. Climatic models. Natural and anthropogenic causes of global warming. (4T)

Note.- Numbers in parentheses indicate the number of hours allocated to each topic and whether these consist only of (T)heory or also include (P)roblems.

### PRÁCTICAS DE LABORATORIO

#### Laboratory sessions:

Session 1. Measuring air adiabatic index.

Session 2. Air density and humidity.

Session 3. Scalar fields and the synop code.

Session 4. The skew T/log p diagram.

### METODOLOGÍA DOCENTE

Grupo grande

- Método expositivo (lección magistral).
- Exposiciones audiovisuales.
- Conferencias invitadas.
- Realización de seminarios, talleres o debates.
- Resolución de ejercicios y problemas.
- Ejercicios de autoevaluación, resolución de dudas.
- Aprendizaje autónomo.
- Aprendizaje cooperativo.
- Atención personalizada a los estudiantes.



Universidad  
de Huelva

# Grado en CIENCIAS AMBIENTALES

Curso 2020/2021



Prácticas de laboratorio

- Método expositivo (lección magistral).
- Ejercitar, ensayar y poner en práctica conocimientos previos y aplicar métodos propios de la disciplina.
- Aprendizaje autónomo.
- Aprendizaje cooperativo.
- Atención personalizada a los estudiantes.

## CRONOGRAMA ORIENTATIVO I

| SEMANAS (S):             | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | S13 | S14 | S15 |
|--------------------------|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| GRUPO GRANDE             | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3   | 3   | 3   | 3   | 3   | 3   |
| GRUPO REDUCIDO           |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |
| PRÁCTICAS DE LABORATORIO |    |    |    |    |    |    |    | 3  | 3  | 3   | 3   | 3   |     |     |     |
| PRÁCTICAS DE INFORMÁTICA |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |
| PRÁCTICAS DE CAMPO       |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |

## EVALUACIÓN DE LA ASIGNATURA

### PRIMERA EVALUACIÓN ORDINARIA (FEBRERO/JUNIO)

#### EVALUACIÓN CONTINUA

30% Theory exam: The exam will contain multiple choice and/or short essay questions. In a total of 10 points, up to an extra 0.5 points can be obtained from an active class participation and a minimum grade of 3.75/10 should be obtained in this item in order that the final average grade can be computed.

30% Problem exam: The exam will consist of two or more problems. In a total of 10 points, up to an extra 0.5 points can be obtained from the problems sent as a homework and handed over or solved in the classroom by the students. A minimum grade of 3.75/10 should be obtained in this item in order that the final average grade can be computed.

20% Lab sessions: In the lab sessions, students will work in groups in the lab and each group should hand over or upload to Moodle a resume of the session with the data, results, and details on the performed calculations to the professor some time after each sessions. Failing to accomplish the deadline will convey a penalty in the grade. The professor will also take into account how the group has performed in the Laboratory. If the student's grade in this item is less than 5/10, he will be offered the chance of sitting -the same day of the final exam- a short exam about the lab sessions.

20% Student seminar: This grade will stem from a 15 minutes seminar on a scientific paper or a subject of interest for the course. The students will preferably work on small (2-3 students) groups and the professor will evaluate the quality of the slides and the student's skills presenting the problem to his classmates and to the professor.

#### EVALUACIÓN FINAL

The single assessment will consist of a single exam with contain multiple choice and/or short essay questions (40% of the exam grade), problems (40% of the exam grade) plus an exam on the laboratory sessions (20% of the exam grade). In the lab exam the student will be provided with a set of experimental data and should work with them to extract the relevant information.

In order to compute the total exam average the student should get 50% of the possible grade in the three exam items considered.

¿Contempla una evaluación parcial?

NO



Universidad  
de Huelva

# Grado en CIENCIAS AMBIENTALES

Curso 2020/2021



## SEGUNDA EVALUACIÓN ORDINARIA

There are two possible ways of assessing the student work:

(a) A single assessment procedure consisting of a written exam that will contain multiple choice and/or short essay questions (40% of the grade), problems (40% of the grade), and questions on the laboratory sessions (20% of the grade). In the lab exam the student will be provided with a set of experimental data and should work with them to extract the relevant information. In order to compute the total exam average the student should get 50% of the possible grade in the three exam items considered.

(b) In case that the students has previous grades on laboratory sessions and seminar presentation in the present term; his final mark will be computed as 60% final exam + 20% lab sessions + 20% student's seminar; unless the student chooses the aforementioned evaluation mode. In this second case the student should get a minimum 37.5/100 mark in the exam to compute the final grade as a three-component average. Students can renounce their previous marks on lab sessions or/and problem assignments and seminar presentation to take this part of the subject in the written exam.

## TERCERA EVALUACIÓN ORDINARIA Y OTRAS EVALUACIONES

As in the previous case, there are two possible ways of assessing the student work:

(a) A single assessment procedure consisting of an exam that will contain multiple choice, and short essay questions (40% of the grade) and problems (40% of the grade) plus some questions on the laboratory sessions (20% of the exam grade).

(b) In case that the student has marks on the laboratory sessions and the problem assignments and seminar presentation in a previous academic year, his final mark will be computed as 60% final exam + 20% lab sessions + 20% student's seminar; unless the student chooses the aforementioned evaluation mode. In this case the student should get a minimum 37.5/100 mark in the exam to compute the final grade as a three-component average..

## OTROS CRITERIOS DE EVALUACIÓN

¿Contempla la posibilidad de subir nota una vez realizadas las pruebas?

NO

Requisitos para la concesión de matrícula de honor

Those established in the University of Huelva academic regulations.

## REFERENCIAS

### BÁSICAS

*Meteorology Today. An introduction to weather, climate, and the environment*, by C. Donald Ahrens. Ed. Brooks Cole. 2008.

### ESPECÍFICAS

*Practical Meteorology: An Algebra-based Survey of Atmospheric Science*, by R. Stull 2018 Ed. Univ. of British Columbia. 940 pages. isbn 978-0-88865-283-6 .

*The atmosphere, an introduction to meteorology*, by F.K. Lutgens and E.J. Tarbuck, Ed. Prentice Hall (New Jersey). 1998.

*Global Physical Climatology*, by D.L. Hartmann, Ed. Academic Press (New York). 1994.

*Principles of meteorological analysis*, by W.J. Saucier, Ed. Dover (New York). 1989.

*Fundamentals of Atmospheric Physics*, by Murry L. Salby. Ed. Academic Press (San Diego, CA) 1996.



# Grado en CIENCIAS AMBIENTALES

Curso 2020/2021



## OTROS RECURSOS

Students can find in the Moodle site for this course many links to documents and other material of interest for the different topics treated.