COURSE DESCRIPTION

COURSE DETAILS

Title (of the course): **FÍSICA ATÓMICA Y MOLECULAR**
Code: 100515
Degree/Master: **GRADO DE FÍSICA** Year: 4
Name of the module to which it belongs: MÓDULO ESPECÍFICO
Field: AMPLIACIÓN DE FÍSICA
Character: OBLIGATORIA Duration: FIRST TERM
ECTS Credits: 6.0 Classroom hours: 60
Face-to-face classroom percentage: 40.0% Study hours: 90
Online platform: http://www3.uco.es/moodlemap/

LECTURER INFORMATION

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Name: SARSA RUBIO, ANTONIO JESÚS
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PREREQUISITES AND RECOMMENDATIONS

Prerequisites established in the study plan

To have, at least, B1 Level in English to take this course in the bilingual group.

Recommendations

It is recommended:
- Math and numerical methods skills up to second course level.
- Quantum Physics knowledge.
- General and specific competences up to this level.

This is a subject of the last undergraduate course. It shares many of the competences with previous courses. This means that a certain level of math and physics knowledge and skill have been attained by the students. Our goal is to fix and improve this level.

COURSE DESCRIPTION

INTENDED LEARNING OUTCOMES

CB1	Capacity to analyse and synthesise.
CB2	Capacity to organise and plan.
CB3	Oral and/or written communication.
CB4	Capable of information management.
CB5	Resolution of problems.
CB6	Team work.
CB8	Independent learning.
CB9	Creativity.
CE1	Knowledge and comprehension of phenomena and the most important physical theories.
CE2	Capacity to estimate orders of magnitude to interpret different phenomena.
CE5	Capacity to model complex phenomena, translating a physical problem into mathematical lanaguage.
CE7	Capacity to transmit knowledge in a clear manner both in educational and in non-educational environments.
CE8	Capacity to use computing tools to resolve and model problems and to present the results.

OBJECTIVES

Study the electronic strurcture of many electron atoms (mean field model and variational approimation) and understand its role in the periodic properties of the elements. Multiplets. Selectrion rules and phenomenology of atomic spectra.
Study the phenomenology of the molecular spectra and identify the excitation modes giving rise to the molecular band structure. Born-Oppenheimer approximation. Quantum grounds of the chemical bond.

CONTENT

1. Theory contents

Two electron atoms. Many electron atoms I: Mean field model. Many electron atoms II: Electrostatic multiplets. Atomic fine structure. Atoms in static external fields. Introduction to Molecular Physics. Electronic structure of linear molecules. Electronic structure of many electron molecules.

2. Practical contents

In each subject, both theory and exercises will be worked out. Some proposed problems will be solved in the sesions. It is expected that the students solve other exercises provided. More complicated problems will be boarded under the guidance of the teachers and the use of some computer codes provided to the students. A paper describing the problem, the work done to solve it and the results obtained, including a discussion will be asked for.

COURSE DESCRIPTION

METHODOLOGY

General clarifications on the methodology (optional)

In this course the methodology will pursue the achievement of the Sustainable Development Goals (SDGs). Particular attention will be paid to Goal 4: "Quality Education", Goal 5: "Gender Equality", and Goal 10: "Reducing Inequality".

Methodological adaptations for part-time students and students with disabilities and special educational needs

Specific methodology for these students will be developed and it will be designed in work sesions with the students in order to apply the specific metodology more appropiate to the particular circumstances.

Face-to-face activities

Activity	Large group	Medium group	Total
Assessment activities	3	-	3
Group work (cooperative)	-	8	8
Lectures	33	-	33
Seminar	-	16	16
Total hours:	***36***	***24***	***60***

Off-site activities

Activity	Total
Exercises	30
Group work	12
Information search	4
Reference search	4
Self-study	40
Total hours	***90***

WORK MATERIALS FOR STUDENTS

Coursebook
Exercises and activities
References

COURSE DESCRIPTION

EVALUATION

Intended learnig	Case study/clinical case discussion/scientific work discussion	Exams	Problem solving
CB1	X	X	X
CB2			X
CB3	X	X	
CB4	X		
CB5		X	X
CB6	X		
CB8	X		X
CB9	X	X	X
CE1		X	X
CE2	X		X
CE5		X	X
CE7	X	X	
CE8	X		X
Total (100%)	***10%***	***80%***	***10%***
Minimum grade	***6***	***4***	***7***

(*)Minimum grade necessary to pass the course

COURSE DESCRIPTION

¿Valora la asistencia?:

No

General clarifications on instruments for evaluation:

The "Exams" consist on theory questions and practical excercises to be solved by the students. The other evaluation tools will be used for continuous evaluation.
"Problem solving" sessions are compulsory.
"Case study" is the resolution of an advanced problem by the students by themselves (autonomous work) by using the knowledge and skills of this Subject. "Scientific work discussion" is the study and presentation by the students of a published research work. The qualification will be consistent with the level, contents and skills of the subject.
The evaluation of the "Problem solving" is based on the attendance and participation of the students to the sessions and the qualification of the homework.
If the threshold is not reached in any of the instruments and the weighted qualification is above 5, the final qualification will be 4.

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

For part time students, special evaluation tools will be taylored according to the specific teaching methodology selected for them.

Qualifying criteria for obtaining honors:

An overall qualification of 9.0 is required (Artículo 80.3 del Reglamento de Régimen Académico de la Universidad de Córdoba)

BIBLIOGRAPHY

1. Basic Bibliography

B.H. Bransden and C.J. Joachain, Physics of atoms and molecules, Prentice Hall 2003.
M. Weissbluth, Atoms and molecules, Academic 1978.
C. Sánchez del Río, Introducción a la teoría del átomo, Alhambra 1977.
A. Requena Rodríguez, Espectroscopía, Pearson 2004.
F.L. Pilar, Elementrary quantum chemistry, McGraw-Hill 1990.
P.F. Bernath, Spectra of atoms and molecules, Oxford 1995.

2. Further reading

J.C. Slater, Quantum theory of atomic structure, Vols. I and II. McGraw-Hill 1960.
J.C. Slater, Quantum theory of molecules and solids, Vols I. McGraw-Hill 1964.
L. D. Landau and E. M. Lifshitz, Quantum Mechanics (Vol. 3 of a Course of Theoretical Physics). Pergamon Press 1965.
H.A. Bethe and R. Jackiw, Intermediate Quantum Mechanics. Addison-Wesley 1997.
M. Alonso y E.J. Finn, Física Vol. III: Fundamentos cuánticos y estadísticos. Fondo educativo interamericano 1971.

COORDINATION CRITERIA

Common evaluation criteria
Tasks deadlines

COURSE DESCRIPTION

SCHEDULE

Period	Assessment activities	Group work (cooperative)	Lectures	Seminar
1# Week	0,0	0,0	4,0	0,0
2# Week	0,0	0,0	4,0	0,0
3# Week	0,0	2,0	0,0	2,0
4# Week	0,0	0,0	2,0	2,0
5# Week	0,0	0,0	4,0	0,0
6# Week	0,0	0,0	4,0	0,0
7# Week	0,0	2,0	0,0	2,0
8# Week	0,0	0,0	2,0	2,0
9# Week	0,0	0,0	4,0	0,0
10# Week	0,0	2,0	2,0	0,0
11# Week	0,0	0,0	1,0	3,0
12# Week	0,0	0,0	2,0	2,0
13# Week	0,0	0,0	4,0	0,0
14# Week	0,0	2,0	0,0	3,0
15# Week	3,0	0,0	0,0	0,0
Total hours:	***3,0***	***8,0***	***33,0***	***16,0***

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.

COURSE DESCRIPTION

In this course the methodology will pursue the achievement of the Sustainable Development Goals (SDGs). Particular attention will be paid to Goal 4: "Quality Education", Goal 5: "Gender Equality", and Goal 10: "Reducing Inequality".

EVALUATION

Intended learnig	Case study/clinical case discussion/scientific work discussion	Exams	Problem solving
CB1	X	X	X
CB2			X
CB3	X	X	
CB4	X		
CB5		X	X
CB6	X		
CB8	X		X
CB9	X	X	X
CE1		X	X
CE2	X		X
CE5		X	X
CE7	X	X	
CE8	X		X
Total (100%)	***20%***	***60%***	***20%***
Minimum grade	***4***	***4***	***4***

(*)Minimum grade necessary to pass the course

Attendance will be assessed (Scenario A)?:

No

General clarifications on instruments for evaluation (Scenario A):

The "Exams" consist on theory questions and practical excercises to be solved by the students. The other evaluation tools will be used for continuous evaluation.

"Case study" is the resolution of an advanced problem by the students by themselves (autonomous work) by using the knowledge and skills of this Subject. "Scientific work discussion" is the study and presentation by the students of a published research work. The qualification will be consistent with the level, contents and skills of the subject.

COURSE DESCRIPTION

"Problem solving" homework tasks are compulsory. A proper and original justification of the solution is needed to get the maximum grade.

If the threshold is not reached in any of the instruments and the weighted qualification is above 5, the final qualification will be 4.
In the final exam, the student will have a second attempt on those continuous assessment instruments not passed, as long as the corresponding assignments have been turned in on time during the lecture period.

The assessment instruments and their weights in the extraordinary call (September-October) of the 2020/21 academic year will remain identical to those of the 2019/20 academic year. We remind the students that the assessment instruments approved in the Syllabus (Teaching Guide) of this subject in the 2019/20 academic year are the following: Exams (weight: 80%), Case study / clinical case discussion / scientific work discussion (weight: 10%), Problem solving (weight: 10%). These assessment instruments require a minimum grade of 5 in each of them in order to pass the course, except for the exam, which has a minimum grade of 4.

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

For part time students, special evaluation tools will be taylored according to the specific teaching methodology selected for them.

Qualifying criteria for obtaining honors (Scenario A):

An overall qualification of 9.0 is required (Artículo 80.3 del Reglamento de Régimen Académico de la Universidad de Córdoba)

CONTINGENCY PLAN: CASE SCENARIO B

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

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.
In this course the methodology will pursue the achievement of the Sustainable Development Goals (SDGs). Particular attention will be paid to Goal 4: "Quality Education", Goal 5: "Gender Equality", and Goal 10: "Reducing Inequality".

COURSE DESCRIPTION

EVALUATION

Intended learnig	Case study/clinical case discussion/scientific work discussion	Exams	Log	Problem solving
CB1	X	X	X	X
CB2			X	X
CB3	X	X	X	
CB4	X		X	
CB5		X		X
CB6	X			
CB8	X			X
CB9	X	X		X
CE1		X		X
CE2	X			X
CE5		X		X
CE7	X	X	X	
CE8	X			X
Total (100%)	***20%***	***40%***	***20%***	***20%***
Minimum grade	***4***	***4***	***4***	***4***

(*)Minimum grade necessary to pass the course

Moodle Tools	Diarios	Exámenes	Resolución de problemas	Supuesto práctico/discusión caso clínico/discusión trabajo científico
Cuestionario		X		
Foro	X			
Pruebas simultáneas por videoconferencia		X		
Tarea	X		X	X

Attendance will be assessed (Scenario B)?:

No

COURSE DESCRIPTION

General clarifications on instruments for evaluation (Scenario B):

The "Exams" consist on the solution of a final questionnaire (in Moodle) with practical excercises to be solved by the students. The other evaluation tools will be used for continuous evaluation.

The "Log" is to be filled weekly with a summary the contents discussed during that week, using the student's own words. Originality, linking between concepts, brief discussion of all topics, and the use of the Forum will have equal weight.

"Case study" is the resolution of an advanced problem by the students by themselves (autonomous work) by using the knowledge and skills of this Subject. "Scientific work discussion" is the study and presentation by the students of a published research work. The qualification will be consistent with the level, contents and skills of the subject.

"Problem solving" homework tasks are compulsory. A proper and original justification of the solution is needed to get the maximum grade.

If the threshold is not reached in any of the instruments and the weighted qualification is above 5, the final qualification will be 4.

In the final exam, the student will have a second attempt on those continuous assessment instruments not passed, as long as the corresponding assignments have been turned in on time during the lecture period.

The assessment instruments and their weights in the extraordinary call (September-October) of the 2020/21 academic year will remain identical to those of the 2019/20 academic year, although adapted to this scenario. The assessment instruments approved in the Teaching Guide of this subject in the 2019/20 course adapted to this scenario are the following: Exams (Moodle tool: Quiz, weight: 80%), Case study / clinical case discussion / scientific work discussion (Moodle tool: Task, weight: 10%), Problem solving (Moodle tool: Task, weight: 10%). These assessment instruments require a minimum grade of 5 in each of them in order to pass the course, except for the exam, which has a minimum grade of 4.

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

For part time students, special evaluation tools will be taylored according to the specific teaching methodology selected for them.

Qualifying criteria for obtaining honors (Scenario B):

An overall qualification of 9.0 is required (Artículo 80.3 del Reglamento de Régimen Académico de la Universidad de Córdoba)