



Information about the subject

Degree: Bachelor of Science Degree in Medicine

Faculty: Faculty of Medicine and Health Sciences

Code: 341103 **Name:** Biophysics

Credits: 6,00 **ECTS Year:** 1 **Semester:** 2

Module: Morphology, structure and function of the human body

Subject Matter: Physics **Type:** Basic Formation

Field of knowledge: Health Science

Department: -

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

341A Antonio Peiró Cloquell (**Responsible Lecturer**)

antonio.peiro@ucv.es

341B Antonio Peiró Cloquell (**Responsible Lecturer**)

antonio.peiro@ucv.es



Module organization

Morphology, structure and function of the human body

Subject Matter	ECTS	Subject	ECTS	Year/semester
Morphology and microscopic structure of the human body	6,00	Histology	6,00	2/1
Biology	6,00	Cell Biology	6,00	1/1
Anatomy	27,00	Anatomy II	9,00	2/1
		Anatomy III	6,00	2/2
		Embryology and Anatomy I	12,00	1/2
Biochemistry	9,00	Biochemistry and Molecular Biology	9,00	1/2
Physics	6,00	Biophysics	6,00	1/2
Physiology	12,00	Human Physiology I	6,00	2/1
		Human Physiology II	6,00	2/2

Recommended knowledge

There are no mandatory prerequisites to take this course. Basic prior knowledge of General Physics and Mathematics (analysis and numerical calculation) is recommended.



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 Cellular communication. Excitable membranes. Cell cycle. Cell differentiation and proliferation.
- R2 Principles of thermodynamics.
- R3 Waves, optics and acoustics.
- R4 Material radiation interaction.



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 have demonstrated to possess and understand knowledge in a study area that starts from the base of the general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study				X
CB2	Students know how to apply their knowledge to their job or vocation in a professional way and possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study				X
CB3	Students have the ability to collect and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical topics				X
CB4	Students can pass on information, ideas, problems and solutions to both a specialized and non-specialized audience				X
CB5	Students have developed the learning skills needed to undertake further studies with a high degree of autonomy				X
GENERAL		Weighting			
		1	2	3	4
CG6	Developing professional practice with respect for other health professionals, acquiring teamwork skills			X	
CG7	Understanding and recognizing the normal structure and function of the human body, at the molecular, cellular, tissue, organic and systems levels, at the different stages of life and in both sexes			X	
CG11	Understanding and recognizing the effects of growth, development and aging on the individual and their social environment	X			



CG30 Basic knowledge of the National Health System and health legislation

x

TRANSVERSAL

Weighting

1 2 3 4

CT1 Analytical and synthesis capacity

x

CT2 Planification and organization capacity

x

CT6 Manage information capacity

x

CT7 Solving problems

x

CT14 Critical reasoning

x

CT16 Individual learning

x

CT18 Creativity

x

CT25 Autocriticism capacity

x

Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes

Granted
percentage

Assessment method

R1, R2, R3, R4

100,00%

Tests

0,00%

Participation in class

Observations

Review open questions

Written test that assesses knowledge and primarily the student's ability to relate, integrate, and express coherently in written language. case Studies.(30,00%)



MENTION OF DISTINCTION:

According to Article 22 of the Regulations governing the Evaluation and Qualification of UCV Courses, the mention of "Distinction of Honor" may be awarded by the professor responsible for the course to students who have obtained, at least, the qualification of 9 over 10 ("Sobresaliente"). The number of "Distinction of Honor" mentions that may be awarded may not exceed five percent of the number of students included in the same official record, unless this number is lower than 20, in which case only one "Distinction of Honor" may be awarded.

Learning activities

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

- | | |
|-----|---|
| M1 | Masterclass |
| M2 | Problems resolution and practical cases |
| M4 | Content presentations by teacher |
| M5 | Knowledges and skills explanation |
| M6 | Laboratory practices |
| M8 | Group activities supervised by professor |
| M9 | Knowledge acquirance through student interaction and activity |
| M11 | Personalised attention by professor |
| M14 | Online activity on e-learning |
| M15 | Personal study |
| M19 | Group work for searching, discussion and information research |



IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
Theory class M1, M2, M4	R1, R2, R3, R4	36,00	1,44
Seminar and group practices M1, M2, M4, M8	R1, R2, R3, R4	9,00	0,36
Practices in small groups M2, M8, M9, M11, M19	R1, R2, R3, R4	4,50	0,18
Tutoring M1, M2, M4, M5	R1, R2, R3, R4	1,50	0,06
Evaluation M2, M9, M11	R1, R2, R3, R4	1,50	0,06
TOTAL		52,50	2,10

LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
No attendance M9, M14, M15	R1, R2, R3, R4	97,50	3,90
TOTAL		97,50	3,90



Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

Content block

Contents

SECTION I: Biomechanics.

1.- Fundamentals of Biomechanics.

- Newton's Laws and their applications. Conservation of Momentum. Energy Conservation.
- Torque and balance. Forces in muscles and bones.
- Exercises

2.- Elasticity.

- Effort and deformation. Rigidity, elasticity, rupture. Structures and resistance.
- Exercises.
- Elastic materials in biology. Bones and muscles.

3.- Surface phenomena.

- Forces of cohesion in liquids.
- Surface effects. Respiratory system.
- Exercises.

4.- Fluid Mechanics and Biorreologia.

- Mechanics of fluids.
- Fluid dynamics or hydrodynamics.
- Fluids at rest.
- Fluid in movement. Viscosity. Laminar and turbulent movement.
- Physical principles of hemodynamics.

5.- Sedimentation in Biomedicine.

- Dynamics of sedimentation. Speed and Sedimentation constant. Concept of erythrocyte sedimentation rate (ESR).
- Ultracentrifugation.

SECTION II: Thermodynamics.

6.- Fundamentals of Thermodynamics.

- Thermal expansion of solids, liquids and gases. Calorimetry. Heat transfer. Metabolism and weight loss.
- Exercises.



SECTION III: Physical principles of medical imaging.

7.- Medical imaging.

- Positron Emission Tomography (PET).
- Computed Tomography (CT).
- Nuclear Magnetic Resonance (NMR).
- Ultrasonic Tomography

SECTION IV: Fundamentals of Audiology.

8.-Vibrations and Waves materials.

- Vibration movement. Waves, sound.
- Oscillations and waves.
- Exercises.

9.- Fundamentals of physiological acoustics.

- Physics of sound production and perception (hearing).
- Wave phenomena.
- Bioacoustics. Sound applications in diagnostics and therapeutics. Doppler. Ultrasound. Resonance.Exercises.

SECTION V: Electricity and Magnetism.

10.- Fundamentals of Electricity and Magnetism.

- Electric Force and Electric Field.
- Capacitance
- Resistive and capacitive electrical circuits. Electrical equivalent circuit of the membranes.
- Electrical circuits. Biomedical applications.
- A comparison with nerve conduction current.
- Electrical risk.
- Exercises.
- Magnetic field and its sources.
- Magnetic induction. Faraday's Law.
- Exercises.

SECTION VI: Optics.

11.- Fundamentals of Optics.

- Geometrical Optics: Index of refraction, reflection and refraction, thin lenses.
- Visual defects
- Exercises.

SECTION VII: Radioactivity.

12.- Fundamentals of Radioactivity.

- Ionizing radiation.
- Photoelectric effect, Compton effect.
- Half-life decay.
- Dosimetry.
- Effects and uses of ionizing radiation.
- Exercises.



SECTION VIII: Fundamentals of Lasers and their applications in medicine.

13.- LASER.

- Laser and its applications in medicine.
- Exercises

Temporary organization of learning:

Block of content	Number of sessions	Hours
SECTION I: Biomechanics.	8,00	16,00
SECTION II: Thermodynamics.	3,50	7,00
SECTION III: Physical principles of medical imaging.	2,00	4,00
SECTION IV: Fundamentals of Audiology.	3,00	6,00
SECTION V: Electricity and Magnetism.	2,00	4,00
SECTION VI: Optics.	3,50	7,00
SECTION VII: Radioactivity.	3,50	7,00
SECTION VIII: Fundamentals of Lasers and their applications in medicine.	0,75	1,50



References

MAIN BIBLIOGRAPHY

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FRUMENTO A.: Biofísica. Ed. Mosby/Doyma Libros, Madrid.

PARISI M.: Temas de Biofísica. McGraw-Hill Interamericana, Madrid.

BUCETA, J., KOROUTCHEVA, E. y PASTOR, J. M.: Temas de Biofísica. Editorial UNED. Colección Cuadernos de la UNED. Madrid, 2006.

ADDITIONAL BIBLIOGRAPHY

DÍEZ DE LOS RÍOS, A: Introducción a la Biofísica y a la Física Médica. Editorial: Universidad de Málaga.

MC DONALD & BURNS: Física para las ciencias de la vida. Editorial: Fondo educativo interamericano.

MARTINEZ SANCHO V.: Fonaments de Física (2 vol.). Biblioteca Universitària, Barcelona.

GONZÁLEZ IBEAS: Introducción a la Física y Biofísica. Editorial: Alambra.

CROMER A.H.: Física para las ciencias de la vida. Ed. Reverté S.A., Barcelona.

CAMERON J.L. & SKOFRONIC, J.G.: Medical Physics. Editorial: Wiley Interscience.

GREMY F.: (ed.) Biophysique. Flammarion Médecine Sciences, Paris

McDONALD SG, BURNS DM.: Física para las ciencias de la vida. Fondo Educ. Interamericano, Bogotá.

STROTHER GK.: Física aplicada a las ciencias de la salud. McGraw-Hill, Bogotá.

KANE JW, STERNHEIM MM.: Física (para estudiantes de biología y medicina). Reverté, Barcelona.

CATALA J.: Física. Ed. Saber, Valencia.



Addendum to the Course Guide of the Subject

Due to the exceptional situation caused by the health crisis of the COVID-19 and taking into account the security measures related to the development of the educational activity in the Higher Education Institution teaching area, the following changes have been made in the guide of the subject to ensure that Students achieve their learning outcomes of the Subject.

Situation 1: Teaching without limited capacity (when the number of enrolled students is lower than the allowed capacity in classroom, according to the security measures taken).

In this case, no changes are made in the guide of the subject.

Situation 2: Teaching with limited capacity (when the number of enrolled students is higher than the allowed capacity in classroom, according to the security measures taken).

In this case, the following changes are made:

1. Educational Activities of Onsite Work:

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject will be made through a simultaneous teaching method combining onsite teaching in the classroom and synchronous online teaching. Students will be able to attend classes onsite or to attend them online through the telematic tools provided by the university (videoconferences). In any case, students who attend classes onsite and who attend them by videoconference will rotate periodically.

In the particular case of this subject, these videoconferences will be made through:

☒ Microsoft Teams

☐ Kaltura



Situation 3: Confinement due to a new State of Alarm.

In this case, the following changes are made:

1. Educational Activities of Onsite Work:

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject, as well as the group and personalized tutoring, will be done with the telematic tools provided by the University, through:

☒ Microsoft Teams

☒ Kaltura

Explanation about the practical sessions:



2. System for Assessing the Acquisition of the competences and Assessment System

ONSITE WORK

Regarding the Assessment Tools:

☒ The Assessment Tools will not be modified. If onsite assessment is not possible, it will be done online through the UCVnet Campus.

☐ The following changes will be made to adapt the subject's assessment to the online teaching.

Course guide		Adaptation	
Assessment tool	Allocated percentage	Description of the suggested changes	Platform to be used

The other Assessment Tools will not be modified with regards to what is indicated in the Course Guide.

Comments to the Assessment System: