COURSE DATA

DATA SUBJECT

Code: 33003
Name: Biomechanics and applied physics
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1202 - Degree in Physiotherapy	Facultat de Fisioteràpia	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1202 - Degree in Physiotherapy	Physics	BASIC

COORDINATION

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SUMMARY

Physics and biomechanics are two branches of knowledge closely related, not only to each other, but also to physiotherapy.

On the one hand, biomechanics is a discipline that studies human movement and its causes: forces. It bases the principles on mechanics, the branch of physics that studies movement. The mechanical principles help to deepen the understanding of the behavior of the different tissues of the musculoskeletal system such as bones, muscles, tendons and ligaments. The forces are decisive in the human movement, but also in the injury mechanisms of these systems, as well as in the recovery processes.

On the other hand, although biomechanics is a relatively young discipline, the close relationship between physics and physiotherapy goes back to distant times. Effectively, physical agents have been used over time to treat diseases, from their empirical application to a more scientific approach at present. Its importance in physiotherapy is still latent, being the basis of rehabilitation techniques used both for the prevention of injuries and for their correct treatment and recovery.

In these contexts, the subject Biomechanics and Applied Physics offers a knowledge base in terms of mechanics, biomechanics and physics which is associated to physical agents traditionally used in the

application of physiotherapeutic treatment and techniques. Examples are the heat used in thermotherapy, water in hydrotherapy, electromagnetic waves in phototherapy, magnetic therapy and radiotherapy, elastic waves such as ultrasound, electricity in electrotherapy, or the laws of movement and force as a knowledge base in treatments of manual therapy.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

Previous knowledge is not required

COMPETENCES / LEARNING OUTCOMES

1202 - Degree in Physiotherapy

Know and understand the sciences, models, techniques and instruments on which Physiotherapy is based, structured and developed

Know how to solve easy problems of physics related to Physiotherapy.

Know how to use the basic functions of a calculator to solve numerical cases.

Know the physic basis of the different physic agents and their applications in Physiotherapy.

Know the principles and theories of physics, biomechanics, kinesiology and ergonomics related to physiotherapy.

Know the principles of electrophysiology.

Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.

Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.

Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

DESCRIPTION OF CONTENTS

1. FUNDAMENTALS OF BIOMECHANICS

UNIT 1.1 Physics, biomechanics and physiotherapy (0.75 h)
UNIT 1.2 Scalar and vector magnitudes (1 h)
UNIT 1.3 Mechanics: kinematics and kinetics (dynamics) (2 h)
UNIT 1.4 Movement: Force, Moment of a Force and Inertia (3 h)
UNIT 1.5 Equilibrium and balance in the human body (5.5 h)
UNIT 1.6 Work and energy (2 h)
UNIT 1.7 Bio-elasticity (2 h)

2. CLINICAL BIOMECHANICS: MUSCLE-SKELETAL SYSTEM

UNIT 2.1 Biomechanics (0.75 h)
UNIT 2.2 Biomechanics of bone (5 h)
UNIT 2.3 Biomechanics of skeletal muscle (3.5 h)
UNIT 2.4 Biomechanics of tendons and ligaments (2.5 h)
UNIT 2.5 Biomechanics of joint cartilage (3 h)

3. FUNDAMENTALS of PHYSICS in PHYSIOTHERAPY

UNIT 3.1 Physical bases of electrotherapy and magnetic therapy (6 h)
3.1.1 Electricity and electrical circuits
3.1.2 Currents in physiotherapy: direct current, alternating current and variable current.
3.1.3 Magneto therapy and electromagnetism

UNIT 3.2 The waves in physiotherapy (4 h)
3.2.1 Properties of waves. Propagation and absorption by the human body
3.2.2 Waves in physiotherapy: elastic waves, electromagnetic waves and radiation

UNIT 3.3 Physical basis of the thermotherapy (2 h)
3.3.1 Heat
3.3.1 Heat transfer in the human body

UNIT 3.4 Physical bases of hydrotherapy (2 h)

PRACTICE 1. Biomechanical analysis of posture and gait (3h)
PRACTICE 2. Biomechanical analysis of balance (3h)
PRACTICE 3. Biomechanical analysis of strength (3h)

4. PRACTICAL PROGRAM

PRACTICE 1. Biomechanical analysis of posture and gait (3h)
PRACTICE 2. Biomechanical analysis of balance (3h)PRACTICE 4. Biomechanical analysis of running (3h)
PRACTICE 5. Kine-anthropometric study of the human body (3h)

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	45,00
Laboratory	15,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	30,00
Independent study and work	20,00
Preparation of lessons	20,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The contents of the theoretical classes will be explained by the teacher, besides developing group activities and encouraging a participative and cooperative learning process. Also problems will be solved in groups of work.

Practical classes are held in working groups of 2-3 students.
The teaching program may be modified during the development of the course if the teacher under teacher quality criteria and assimilation of knowledge by the student it deems appropriate

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EVALUATION

Theoretical Program

- (65%) Theoretical-practical test. 70% of the evaluation corresponds to the evaluation by means of an objective test that consists of 30 to 50 multiple-choice questions. To calculate the result, the following formula will be applied: [right guess- (errors / no. options - 1)]*(highest score/no. questions). The remaining 30% is evaluated by solving 4 to 6 theoretical-practical questions. It is a requirement to obtain a minimum of 4 out of 10 (i.e. 26% of 65%) in this test to average the grade with the rest of the sections of the program.
- (15%) Activities for continuous evaluation. Individual and group tasks that are scheduled and carried out during the semester.

Practical Program

- (10%) Attendance at practical sessions and on-site evaluation.
- (10%) Test consisting of 5 to 10 objective multiple-choice questions, which will be carried out together with the theoretical-practical test.

Note: The evaluation of the practical program is carried out on site. The practical sessions are only carried out in the first quarter and cannot be recovered outside of the hours established in the schedule. Non-attendance implies the impossibility of recovering the qualification corresponding only to this part of the evaluation.

REFERENCES

- A. Cromer. Física para ciencias de la vida. Ed Reverté, 1996.
- J. W. Kane & M. M. Sternheim. Física. Ed. Reverté, SA, 1989.
- F. Bell. Principles of mechanics and biomechanics. Ed. Stanley Thomes Ltd. Cheltenham: U.K., 1998.
- J. R. Zaragoza. Física e instrumentación médicas. Ed. Masson-Salvat Medicina, 1992.
  M. Nordin & Victor H. Frankel. Bases biomecánicas del sistema musculoesquelético. Ed. Ovid Technologies: Madrid, Spain, 2001.
- R. C. Miralles Marrero. Biomecánica clínica del aparato locomotor. Ed. Elsevier - Masson: Spain, 1998.
- S. Mccaw. Biomechanics for Dummies. Ed. John Wiley & Sons Inc.: New York, U.S., 2014.
- Donald A. Neumann,Pilar Serra Año. Cinesiología del Sistema Musculoesquelético. Fundamentos para la rehabilitación. ISBN 9788829932788. Año©2022

Likewise, each topic will specify the books, scientific articles, and readings of interest recommended for preparing the content covered.