COURSE DATA

Data Subject	
Code	33003
Name	Biomechanics and applied physics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1202 - Degree in Physiotherapy	Faculty of Physiotherapy	1	First term

Subject-matter

Degree	Subject-matter	Character
1202 - Degree in Physiotherapy	3 - Physics	Basic Training

Coordination

Name	Department
BLASCO IGUAL, JOSE MARIA	191 - Physiotherapy

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

OUTCOMES

1202 - Degree in Physiotherapy

- 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 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 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.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Know and understand the sciences, models, techniques and instruments on which Physiotherapy is based, structured and developed
- Know the principles and theories of physics, biomechanics, kinesiology and ergonomics related to physiotherapy.
- Know the physic basis of the different physic agents and their applications in Physiotherapy.

- 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 principles of electrophysiology.

LEARNING OUTCOMES

Upon passing the course the student must have acquired the competences of this subject. Likewise, the student must understand the mechanical and biomechanical principles that comprise the basis of the joint movement and human movement. These include the production of force by the body and its absorption, knowledge that is necessary and basic for the understanding of the causes and processes of the injury mechanisms and their recovery. Finally, the student must know the physical basis at a theoretical-practical level of physical means that, due to their current use and characteristics, have a significant relative weight in the prevention and recovery of mechanical injuries.

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)

4. PRACTICAL PROGRAM

PRACTICE 1. Assessment and biomechanical analysis of force and balance (3h)
PRACTICE 2. Biomechanical analysis of posture and gait (3h)
PRACTICE 3. Biomechanical running analysis (3h)
PRACTICE 4. 1) Pulley systems: work, energy and mechanical advantage; 2) Deformations in the musculoskeletal system: tensile test (3h)
PRACTICE 5. Kine-anthropometric study of the human body (3h)

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Laboratory practices	15,00	100
Development of individual work	30,00	0
Study and independent work	20,00	0
Preparation of evaluation activities	20,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

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

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.
- (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 with 5 to 10 short questions, which will be carried out together with the theoretical-practical test.

REFERENCES

Basic

- 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.