

<b>POLI</b> ESCOLA SUPERIOR EDUCAÇÃO COMUNICAÇÃO DESPORTO <b>TÉCNICO</b> <b>GUARDA</b>	<b>SUBJECT DESCRIPTION</b>	<b>MODELO</b> PED.012.03
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<i>Course</i>	<b>Sports</b>					
<i>Subject</i>	<b>Biomechanics</b>					
<i>Academic year</i>	2023-2024	<i>Curricular year</i>	1st	<i>Study period</i>	1st semester	
<i>Type of subject</i>	Compulsory	<i>Student workload (H)</i>	Total: 135	Contact: 60	<i>ECTS</i>	5
<i>Professor(s)</i>	Carolina Júlia Félix Vila-Chã					
<input type="checkbox"/> <i>Area/Group Coordinator</i> <input type="checkbox"/> <i>Head of Department</i>	(select)	Teresa de Jesus Trindade Moreira da Costa e Fonseca				

## PLANNED SUBJECT DESCRIPTION

### 1. LEARNING OBJECTIVES

At the end of the UC, the student should be able to:

- a) Analyse and diagnose motor behaviours on biomechanical principles;
- b) Prescribe motor behaviours based on biomechanical principles;
- c) Understand the stages underlying research in Biomechanics of Physical Exercise;
- d) Implement laboratory and fieldwork based on biomechanical principles.

### 2. PROGRAMME

#### A - Introduction to Biomechanics

- Biomechanics applied to Sports Sciences, Physical Exercise and Health;
- Basic concepts and object of study of Biomechanics;
- Qualitative assessment models;
- Quantitative assessment methodologies (kinemetry, dynamometry, electromyography and anthropometry);
- Practical applications to the study of human movement and physical exercise and sports techniques.

#### B - Assessment of the technical standard

- The forms of movement (linear movement, angular movement and general movement);
- Classification of qualitative observations vs quantitative;
- Quantitative analysis from the point of view of the physical exercise technician vs coach vs Investigator.

#### C - Linear kinematics

- Position, distance, displacement and time;
- Speed and celerity;
- Acceleration (uniform motion, uniformly accelerated motion);
- Projectile kinematics (range, projection height, projection velocity; projection angle, laws of acceleration);

#### D - Angular kinematics

- Absolute and relative angle;
- Position, angular distance, angular displacement and time;
- Period and frequency;

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- Celerity and angular velocity;
- Angular acceleration;
- Relationship between linear and angular kinematics variables
- Practical applications to the study of human movement and physical exercise and sports techniques.

#### E - Static

- The moment of a force;
- Anatomical levers (definition, constitution, classification and concept of mechanical advantage);
- Centre of mass (definition, characteristics and determination methodologies);
- Stability and balance (definitions, biomechanical characterization of body posture and factors that determine postural stability);
- Practical applications to the study of human movement and physical exercise and sports techniques.

#### F - Linear Kinetics

- Newtonian laws (the laws of inertia, acceleration, action-reaction, and gravitation);
- The friction
- The amount of movement;
- The power boost;
- -The pressure:
- Mechanical work;
- The mechanical power;
- Mechanical energy (kinetic energy, potential energy, elastic energy);
- Practical applications to the study of human movement and physical exercise and sports techniques.

#### G - Angular Kinetics

- The moment of inertia;
- Angular momentum (conservation of angular momentum, transfer of angular momentum, change of angular momentum);
- Body dimensions and proportions and inertial characteristics;
- Angular analogues to Newtonian laws;
- Centripetal and centrifugal forces;
- Practical applications to the study of human movement and physical exercise and sports techniques.

#### G - Biomechanics applied to injury prevention

- Mechanical loads on the human body;
- Mechanical stress;
- Effects of mechanical load;
- Biological tissue response to mechanical stress;
- Repetitive loads vs acute loads.

### 3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

The content “Introduction to biomechanics” refers to objective three “Understanding the stages underlying research in Biomechanics of Sport” and 4 “Ability to implement biomechanical laboratory and field work”. Content B, “Evaluation of the

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technical standard”, refers to competence 1 “, Analyzing and diagnosing motor behaviours based on biomechanical principles”. The contents C “Linear Kinematics”, D “Angular Kinematics”, E “Statics”, F “Linear Kinetics”, G “Angular Kinetics”, and “G – Biomechanics applied to injury prevention” are propaedeutics of the subsequent contents and refer to competence 1 “Capabilities to analyse and diagnose motor behaviours based on biomechanical principles” and 2 “Capacity to prescribe motor behaviours based on biomechanical principles”.

#### 4. MAIN BIBLIOGRAPHY

Balzevich, A. (2011). Biomecânica Deportiva: Manual para la mejora del rendimiento humano. Paidotribo, Barcelona.

Bartlet, R.M. (2007). Introduction to sports biomechanics: analyzing human movement patterns (2nd edition). Routledge, New York.

Hall, S. (2016). Biomecânica Básica (7ª edição). Guanabara Koogan, São Paulo.

Knudson, D. (2021) Fundamentals of Biomechanics (3rd Ed.). Springer, New York.

McGinnis, P.M. (2005). Biomechanics of Sport and Exercise (2nd Ed.). Champaign: Human Kinetics.

Payton, C.J., Bartlet, R.M. (2018). Biomechanical evaluation of movement in sport and exercise (2nd Ed.). Routledge, London.

Vilas-Boas, J.P (2016). Biomecânica do Desporto. Manual do Curso de treinadores de Desporto – Grau II. PNFT, Instituto Português do Desporto e da Juventude.

#### 5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

Theoretical-practical classes provide students with practical experiences in the scope of analysis and study of movement in the context of physical exercise within the framework of biomechanical principles. Laboratory practice classes aim to develop skills to implement laboratory and field work sessions. The final assessment will consider the student's performance in the:

- two written tests (35% each);
- laboratory work/reports (30%).

For final approval, the student must present an average equal to or greater than ten values in the sum of both components. If this minimum grade is not reached, there will be an exam whose weighting in the final grade will be 100%. Students with special statutes must attend the assessment moments without fail.

#### 6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

The methodologies will be selected to optimize and maximize the acquisition of content associated with each competence acquired:

1. Exposure of contents orally and through multimedia means. This methodology will be used to present the fundamental contents associated with all competencies;
2. Application of knowledge acquired in theoretical, theoretical-practical classes through implementing activities such as filling in worksheets and practical studies. This methodology will be used to consolidate the acquisition of content associated with all competencies;
3. Execution of laboratory work to develop and consolidate the skills “Mastering the stages underlying research in Biomechanics” and “Ability to implement laboratory and fieldwork in a biomechanical scope”.

#### 7. ATTENDANCE

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According to the regime applied at ESECD.

## 8. CONTACTS AND OFFICE HOURS

Email: [cvilacha@ipg.pt](mailto:cvilacha@ipg.pt)

Attendance: Monday from 10:30 am to 12:30 pm; Tuesday from 16:00 to 18:00 and Thursday from 10:30 to 12:30.

## 9. OTHERS

Nothing to declare.

## DATE

10 de outubro de 2023

## SIGNATURES

*Professor(s), Area/Group Coordinator or Head of Department signatures*

Professor

*Carolina Vila-Chã*

(Carolina Júlia Félix Vila-Chã)

Area Coordinator

(Teresa de Jesus Trindade Moreira da Costa e Fonseca)