# 1. BASIC INFORMATION

| | |
|---|---|
| **Course** | Exercise and Sport Biomechanics |
| **Degree program** | Bachelor's Degree in Exercise and Sport Sciences |
| **School** | Medicina, Salud y Deportes |
| **Year** | 2º |
| **ECTS** | 6 |
| **Credit type** | Compulsory |
| **Language(s)** | Spanish / English |
| **Delivery mode** | On campus |
| **Semester** | S3 and S4 |
| **Academic year** | 2025-2026 |
| **Coordinating professor** | Ignacio López Moranchel |

# 2. PRESENTATION

Biomechanics is a discipline that studies the structure of the musculoskeletal system and its movements, considering the connection between the properties and mechanical implications of movement and the biological conditions of the organism. Specifically, Sport Biomechanics focuses on studying human movement from the perspective of physical activity, analysing the structure of basic movements and sports techniques.

On 08 March 2016, Spain's General Council of Professional Colleges of Physical and Sport Education (CONSEJO COLEF) announced the following in relation to biomechanical studies and the professions that can conduct them: Spain's Ministry of Health, Social Services and Equality (MSSI) reports that it is feasible for Exercise and Sport Science graduates to perform "for purposes other than medical diagnosis, in the field of sports performance, physical education and research, sports biomechanics studies that include gait analysis in health people, providing that the purpose of such work is not to diagnose, treat or monitor patients, regardless of whether they are athletes or not". The same CONSEJO COLEF announcement also states that: "biomechanical assessment in all professional fields (sport, education, health, research, etc.) is a professional skill and an important part of the work performed regularly by professionals with a university degree in exercise and sport sciences".

The final conclusions of the announcement highlight the most important message: "the improvement of sports performance and prevention of injuries in professional athletes or amateurs should always involve a multi-disciplinary team. As such, any sport or health professional (doctors, physiotherapists, podiatrists,

coaches, trainers, etc.) may ask professionals with a university degree in exercise and sport science to perform a biomechanical assessment on one of their patients or athletes".

This subject area explores the fundamentals of biomechanics to analyse human movement in any type of sport, focusing on the specific actions of throwing and hitting and the core actions of walking, running and jumping.

The ECTS for this subject area include lectures, case studies, problem-based learning, guided projects, tutorials, independent working and collaborative learning.

# 3. COMPETENCIES AND LEARNING OUTCOMES

**Core competencies:**

- CB1: Students have demonstrated knowledge and understanding of a study area originating from general secondary school education, and are usually at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.
- CB3: Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.
- CB5: Students have developed the necessary learning skills to undertake further study with a high degree of autonomy.

**Cross-curricular competencies:**

- CT11: Planning and time management: Ability to set objectives and choose the right means to fulfil them through efficient use of time and resources.
- CT13: Problem solving: Ability to resolve an unclear or complex issue or situation which has no established solution and requires skill to reach a conclusion.
- CT18: Use of information and communication technology (ICT): Ability to effectively use information and communication technology as a tool for finding, processing and storing information, and for developing communication skills.

**Specific competencies:**

- CE03: Ability to plan, programme, apply, control and assess the process of training and competition at different levels and in different age groups.
- CE04: Ability to analyse and apply physiological, biomechanical, psychological and social principles in different areas of physical activity, sport and recreation.
- CE05: Ability to identify inappropriate practices that pose a risk to health in order to prevent and correct them in different groups of people.
- CE06: Ability to assess levels of physical fitness and motor skills, prescribing and planning health- orientated physical exercises in different age groups.
- CE09: Ability to select and know how to use the right material and sports equipment for each type of activity, identifying the technical characteristics of different sports spaces.

**Learning outcomes:**

- RA1: To understand fundamental concepts related to the application of biomechanical principles in different fields of sport and exercise.
- RA2: To act professionally when using equipment and following safety protocols for laboratory work.
- RA3: To conduct tests to study human movement, applying the relevant biomechanical principles and understanding the methods and techniques that contribute to measuring different characteristics related to efficiency.
- RA4: To conduct in-depth projects related to the analysis of movement in sport.

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

| Competencies | Learning outcomes |
|---|---|
| CB1, CB3, CT11, CT13, CE4 | RA1: To understand fundamental concepts related to the application of biomechanical principles in different fields of sport and exercise. |
| CB3, CT13, CT18, CE4, CE5, CE9 | RA2: To act professionally when using equipment and following safety protocols for laboratory work. |
| CB1, CB3, CB5, CT11, CT13, CT18, CE3, CE4, CE6, CE9 | RA3: To conduct tests to study human movement, applying the relevant biomechanical principles and understanding the methods and techniques that contribute to measuring different characteristics related to efficiency. |
| CB3, CB5, CT11, CT13, CT18, CE4, CE6, CE9 | RA4: To conduct in-depth projects related to the analysis of movement in sport. |

# 4. CONTENT

1. Principles and laws of physics to understand how to correctly perform exercises and sports techniques.

2. Description and analysis of exercises and sports techniques using biomechanical criteria.

3. Measuring human movement using instrumental techniques and methods.

The subject is organised into 3 learning units and 11 topics:

Learning unit 1: The fundamentals of biomechanics.

Topic 1. Introduction to biomechanics and its units of measurement.

Topic 2. Kinematics.

Topic 3. Kinetics. Dynamic and static (balanced systems).

Topic 4. Mechanical work and energy.

Topic 5. Forces exerted by fluids

Learning unit 2: Application of biomechanics to biological tissue

Topic 6. Fundamental biomechanics of bone structure. Elasticity, resistance and mechanical stress.

Topic 7. Fundamental biomechanics of the muscle and connective tissue system.
Lengthening/shortening cycle. Types of contraction. Analysis of how force is recorded (force-time and force-velocity curves).

Learning unit 3: Biomechanical analysis of sport movement

Topic 9. Biomechanics of jumping andcatching
Topic 10. Sports surfaces and footwear
Topic 11. Biomechanics of walking and running.

## 5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Lectures.
- Problem-based learning (ABP by its acronym in Spanish).
- Simulation environments.

## 6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

**Campus-based mode:**

| Learning activity | Number of hours |
|---|---|
| Lectures | 28 |
| Asynchronous lectures | 12 |
| Case studies | 30 |
| Problem-solving | 22 |
| Searching resources and choosing information sources | 10 |
| Formative assessment (feedback on assessment) | 30 |

| | |
|---|---|
| Case studies/workshop activities | 10 |
| Tutorials | 8 |
| **TOTAL** | **150** |

# 7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

**Campus-based mode:**

| Assessment system | Weighting |
|---|---|
| On-campus knowledge tests | 60% |
| Learning portfolio (learning activities) | 10% |
| Oral presentations | 20% |
| Participation in debates and forums | 10% |

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you must complete, as well as the delivery deadline and assessment procedure for each one.

## 7.1. First exam period

To pass the course in the first exam period, you must obtain a final course grade of at least 5 out of 10 (weighted average).

In any case, you will need to obtain a grade of at 4.0 in the final exam for it to count towards the final grade along with all the grades corresponding to the other activities.

## 7.2. Second exam period

To pass the course in the second exam period, you must obtain a final grade of at least 5 out of 10 (weighted average).

In any case, you will need to obtain a grade of at 4.0 in the final exam for it to count towards the final grade along with all the grades corresponding to the other activities.

The student must deliver the activities not successfully completed in the first exam period after having received the corresponding corrections from the professor, or those that were not delivered in the first place.

# 8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

| Assessable activities | Deadline |
|---|---|
| Activity 1. Application of kinetic and kinematic parameters in sport movements or activities | Weeks 3-5 |
| Activity 2. Finding reliable scientific sources and search processes in the field of biomechanics | Weeks 6-7 |
| Activity 3. Test 1 | Weeks 6-7 |
| Activity 4. Kinetic analysis of movement in sport using Kinovea | Weeks 8-10 |
| Activity 5. Laboratory work. Analysing and recording measurements of force | Weeks 11-12 |
| Activity 6. Test 2 | Week 12 |

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

# 9. BIBLIOGRAPHY

The main reference work for this subject is:


- AGUADO, X. (1993): Eficacia y técnica deportiva. Análisis del movimiento humano. Barcelona. INDE. ISBN 848730207. Colección Villaviciosa QP303 .A38 1993
- AGUADO, X.; IZQUIERDO, M. (1997): Biomecánica fuera y dentro del laboratorio. León. Universidad de León. ISBN 8477196265. Colección Villaviciosa QP303 .A382 1997
- ARTEAGA, R.; VICTORIA, J. (2001): Problemas de biomecánica para estudiantes de Educación Física. Las Palmas. Universidad de Las Palmas de Gran Canaria. ISBN 8495286750. Colección Villaviciosa QP303 .A78 2001
- BARTLETT, R. (2007): Introduction to sports biomechanics: analysing human movement patterns. Routledge. . ISBN 9780415339933. Colección Villaviciosa QP303 .B37 2007
- BINI, R.R.; CARPES, F.P. (2014): Biomechanics of Cycling. Spinger eBooks. ISBN 9783319055398. Colección E-book
- BLAZEVICH, A. (2013): Biomecánica deportiva: manual para la mejora del rendimiento humano. Badalona. Paidotribo. ISBN 9788499100715. Colección Villaviciosa QP303 .B54318 2013
- CARR, G. (1997): Mechanics of Sport, Champaign, Human Kinetics. ISBN 0873229746. Colección Villaviciosa QP303 .C37 1997
- FUCCI, S.; BENIGNI, M; FORNASARI, V. (2008): Biomecánica del aparato locomotor aplicada al acondicionamiento muscular, Barcelona, Mosby/Doyma. ISBN 9788481746457. Colección Villaviciosa QP303 .F8318 2008
- GIANCOLI, D.C. (1997): Física. Principios con aplicaciones, México, Prentice-Hall Hispanoamericana. ISBN 9688808989. Colección Villaviciosa QC21.2 .G5318 1997
- GLASS, S. (2014): Kinesiology for dummies. ISBN 9781118549230. Colección E-book

- GORROTXATEGI, A.; ARANZABAL, P. (1996): El movimiento humano: bases anatomo- fisiológicas, Madrid, Gymnos. ISBN 8480130490. Colección Villaviciosa QP303 .G67 1996
- GUTIÉRREZ, M (2015): Fundamentos de Biomecánica Deportiva, Madrid, Síntesis. ISBN 9788490771921. Colección Villaviciosa QP303 .G884 2015
- HALL, S.J. (2007): Basic Biomechanics, Dubuque (Iowa), McGraw-Hill. ISBN 0073044814. Colección Villaviciosa QP303 .H35 2007
- HAY, J.G. (1993): The Biomechanics of sports techniques, Philadelphia, Prentice-Hall. ISBN 0130845345. Colección Villaviciosa QP303 .H392 1993
- IZQUIERDO, M. (2008): Biomecánica y bases neuromusculares de la actividad física y el deporte, Madrid, Médica Panamericana. ISBN 9788498350234. Colección Villaviciosa QP303 .B53 2008
- KAPANDJI, I. (1994): Cuadernos de fisiología articular, Barcelona, Toray-Masson. ISBN8431101520. Colección Villaviciosa QP303 .K3718 1994
- KNUDSON, D. (2007): Fundamentals of biomechanics. Springer. ISBN 9780387493114. Colección Villaviciosa QP303 .K584 2007
- LUTTGENS, K.; WELLS, K.F. (1985): Kinesiología. Bases Científicas del Movimiento Humano, Madrid, Saunders College Publishing. ISBN 8485514521. Colección Villaviciosa QP303 .L8818 1995
- REISCHLE, K. (1993): Biomecánica de la Natación, Madrid, Gymnos. ISBN 8480130024. Colección Villaviciosa GV837.65 .R4518 1993
- TREW, M.; EVERETT, T. (2006): Fundamentos del movimiento humano. Barcelona. Masson. ISBN 8445816063. Colección Villaviciosa QP303 .T7418 2006
- VERA, P.; HOYOS, J.V.; NIETO, J. (1985): Biomecánica del aparato locomotor Tomo I Fundamentos, Valencia, Instituto de Biomecánica de Valencia. Colección Villaviciosa QP303 .V47 1985 V.1
- WATKINS, J. (2014): Fundamental biomechanics of sport and exercice. Routledge. ISBN 9780203066461. Colección E-book
- WILSON, J.D. (2007): Física, México, Pearson Educación. ISBN 9789702608516. Colección Villaviciosa QC21.3 .W5518 2007
- WIRHED, R. (1993): Habilidad atlética y anatomía del movimiento, Barcelona, Edika-Med. Colección Villaviciosa QP303 .W57 199


## 10. EDUCATIONAL GUIDANCE, DIVERSITY AND INCLUSION UNIT

From the Educational Guidance and Diversity Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students' inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

1. Accompaniment and follow-up by mean of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunity for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:
orientacioneducativa@universidadeuropea.es

# 11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.