



## Information about the course

**Degree:** Bachelor of Sciences of Physical Activity and Sport

**Faculty:** Faculty of Physical Activity and Sport Sciences

**Code:** 281201 **Name:** Biomechanics of Physical Activity

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

**Module:** 1) Basic Training Module

**Subject Matter:** Biological and Mechanical Foundations of Human Motor Skills **Type:** Formación

Básica

**Branch of knowledge:** Health Sciences

**Department:** Physical Preparation and Conditioning

**Type of learning:** Classroom-based learning

**Language/-s in which it is given:** Spanish

### Teachers:

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## Module organization

### 1) Basic Training Module

Subject Matter	ECTS	Subject	ECTS	Year/semester
Biological and Mechanical Foundations of Human Motor Skills	36	Biochemistry and Human Physiology	9	1/2
		Biomechanics of Physical Activity	6	2/1
		Human Anatomy	9	1/2
		Kinesiology	6	2/1
		Physiology of Exercise	6	2/1
Behavioral and social foundations of human motor skills.	24	History and Sociology of Physical Activity and Sport	6	1/2
		Sport Psychology	6	1/2
		Statistics and Data Processing	6	2/2
		Technology Applied to Physical Activity and Sport	6	1/1



## Learning outcomes

Al finalizar la asignatura, el estudiante deberá demostrar haber adquirido los siguientes resultados de aprendizaje:

**R4 - Describe various sports modalities and gestures through biomechanical analysis.**

Learning outcomes of the specified title

**Type of AR:** Habilidades o Destrezas

- Apply the principles derived from the concept of integral ecology in your proposals or actions, whatever the scope and area of knowledge and the contexts in which they are proposed.
- Develop theoretical-practical responses based on the sincere search for the full truth and the integration of all dimensions of the human being when faced with the great questions of life.
- Identify, communicate and apply scientific anatomical-physiological and biomechanical criteria at an advanced level of skills in the design, development and technical-scientific evaluation of appropriate procedures, strategies, actions, activities and guidelines; to prevent, minimize and/or avoid a health risk in the practice of physical activity and sport in all types of population.
- Know how to guide, design, apply and technically-scientifically evaluate physical exercise and physical condition at an advanced level, based on scientific evidence, in different areas, contexts and types of activities for the entire population and with emphasis on specific populations. special such as: older people (seniors), schoolchildren, people with disabilities and people with pathologies, health problems or assimilated (diagnosed and/or prescribed by a doctor), taking into account gender and diversity.
- Know, prepare and know how to apply the ethical-deontological, structural-organizational conditions, professional performance and the regulations of professional practice of Graduates in Physical Activity and Sports Sciences, in any professional sector of physical activity and sport (teaching formal and informal physical-sports; physical and sports training; physical exercise for health; as well as being able to develop multidisciplinary work
- Understand, know how to explain and disseminate the functions, responsibilities and importance of a good professional Graduate in Physical Activity and Sports Sciences as well as analyze, understand, identify and reflect critically and autonomously on their identity, training and professional performance to achieve the purposes and benefits of physical activity and sport in an adequate, safe, healthy and efficient manner in all physical-sports services offered and provided and in any professional sector of physical activity and sport.



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**Type of AR: Competencias**

- Analyze, review and select the effect and effectiveness of the practice of research methods, techniques and resources and scientific work methodology, in solving problems that require the use of creative and innovative ideas.
- Articulate and deploy with rigor and a scientific attitude the justifications on which to constantly and professionally prepare, support, substantiate and justify all acts, decisions, processes, procedures, actions, activities, tasks, conclusions, reports and professional performance.
- Promote education, dissemination, information and constant guidance to people and leaders on the benefits, significance, characteristics and positive effects of the regular practice of physical and sports activity and physical exercise, and the risks and harms of inadequate practice. and the elements and criteria that identify its adequate execution, as well as information, guidance and advice on the possibilities of appropriate physical activity and sport in its environment in any sector of professional intervention.

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**R5 - Ground motor behavior in physical laws.**

Learning outcomes of the specified title

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**Type of AR: Habilidades o Destrezas**

- Apply the principles derived from the concept of integral ecology in your proposals or actions, whatever the scope and area of knowledge and the contexts in which they are proposed.
- Articulate and deploy procedures, processes, protocols, own analysis, with rigor and scientific attitude on matters of a social, legal, economic, scientific or ethical nature, when necessary and relevant in any professional sector of physical activity and sport (formal education and informal physical-sports; physical and sports training; physical exercise for health; direction of physical activity and sport).
- Identify, communicate and apply scientific anatomical-physiological and biomechanical criteria at an advanced level of skills in the design, development and technical-scientific evaluation of appropriate procedures, strategies, actions, activities and guidelines; to prevent, minimize and/or avoid a health risk in the practice of physical activity and sport in all types of population.
- Know how to guide, design, apply and technically-scientifically evaluate physical exercise and physical condition at an advanced level, based on scientific evidence, in different areas, contexts and types of activities for the entire population and with emphasis on specific populations. special such as: older people (seniors), schoolchildren, people with disabilities and people with pathologies, health problems or assimilated (diagnosed and/or prescribed by a doctor), taking into account gender and diversity.



- Know, prepare and know how to apply the ethical-deontological, structural-organizational conditions, professional performance and the regulations of professional practice of Graduates in Physical Activity and Sports Sciences, in any professional sector of physical activity and sport (teaching formal and informal physical-sports; physical and sports training; physical exercise for health; as well as being able to develop multidisciplinary work
- Respect and put into practice the ethical principles and action proposals derived from the objectives for sustainable development, transferring them to all academic and professional activities.
- Understand, know how to explain and disseminate the functions, responsibilities and importance of a good professional Graduate in Physical Activity and Sports Sciences as well as analyze, understand, identify and reflect critically and autonomously on their identity, training and professional performance to achieve the purposes and benefits of physical activity and sport in an adequate, safe, healthy and efficient manner in all physical-sports services offered and provided and in any professional sector of physical activity and sport.

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**Type of AR:** Competencias

- Analyze, review and select the effect and effectiveness of the practice of research methods, techniques and resources and scientific work methodology, in solving problems that require the use of creative and innovative ideas.
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**R6 - Apply different technologies and procedures to assess sports and athletes from a biomechanical perspective.**

Learning outcomes of the specified title

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**Type of AR:** Habilidades o Destrezas

- Identify, communicate and apply scientific anatomical-physiological and biomechanical criteria at an advanced level of skills in the design, development and technical-scientific evaluation of appropriate procedures, strategies, actions, activities and guidelines; to prevent, minimize and/or avoid a health risk in the practice of physical activity and sport in all types of population.



- Know how to guide, design, apply and technically-scientifically evaluate physical exercise and physical condition at an advanced level, based on scientific evidence, in different areas, contexts and types of activities for the entire population and with emphasis on specific populations. special such as: older people (seniors), schoolchildren, people with disabilities and people with pathologies, health problems or assimilated (diagnosed and/or prescribed by a doctor), taking into account gender and diversity.
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### **Type of AR: Competencias**

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## Assessment system

### Modalidad presencial

Assessed learning outcomes	Granted percentage	Assessment tool
R4, R5, R6	60,00%	Written and/or practical tests.
R5, R6	30,00%	Exercises and Practices in the Classroom.
R4, R5, R6	10,00%	Non-face-to-face autonomous work.

### Observations

This course is NOT eligible for a single assessment request in accordance with Article 10.3 of the GENERAL REGULATIONS FOR ASSESSMENT AND GRADING OF OFFICIAL COURSES AND UCV DEGREE PROGRAMS.

Students may keep the assessment instruments they have passed for three years after their first enrolment.

It is necessary to obtain 50% in all assessment instruments to pass the subject.

Attendance at all practical sessions indicated in the schedule is compulsory. If students do not attend 80% of these sessions, they will fail both exam sessions for the course and will have to retake them in the following enrollment period.

If any of these criteria are not met, students will be graded with a maximum of 4.5.

### SPECIFICATIONS OF THE EVALUATION INSTRUMENTS

#### Written and/or practical tests

This consists of a single final exam on the dates of the official exam dates.

·Written test (35%): 25 multiple-choice questions with 4 answer options, each correct answer is worth 0.4. 3 wrong answers subtract one good answer (1 wrong answer subtracts 33.3%, i.e. 0.13).





A 5 out of 10 is required to obtain an average.

·Practical Test (25%): Problem solving. There are 5 practical problems worth 2 points each. A score of 5 out of 10 is required to obtain an average.

### **Classroom Exercises and Practical Exercises**

Assessment of the practical context applied, with delivery of written practices by platform. Pass / Fail on delivery. A 5 out of 10 is required to obtain an average.

### **Autonomous work not in the classroom**

Autonomous tasks and questionnaires delivered by platform. Pass / Fail by delivery.

*The detailed explanation (procedure for the assignments) as well as the assessment tools (worksheets or rubrics) for each section will be posted on the platform of each group at the student's disposal.*





## Use of Artificial Intelligence Tools in the CAFD Degree Program

Use of Artificial Intelligence tools in the CAFD degree program In the Bachelor's Degree in Physical Activity and Sports Sciences (CAFD), the use of Artificial Intelligence (AI) tools is permitted in a complementary and responsible manner, as long as it contributes to active learning, the development of critical thinking, and the improvement of students' professional skills. Under no circumstances should AI replace personal effort, direct practice, or independent reflection, which are fundamental pillars of this degree program.

### Permitted Uses of AI:

- Obtaining alternative explanations of theoretical or methodological concepts.
- Generating outlines, concept maps, or summaries to support study.
- Simulating interviews, questionnaires, or training sessions as part of methodological or research practices.
- Receiving feedback on report writing, provided that the original content is the student's own.
- Supporting the search for bibliography or scientific references, always contrasting with reliable and real academic sources, and respecting the CAFD regulations for the presentation of university work.

### Prohibited Uses of AI:

- Writing complete sections of academic papers, classroom exercises and practices, internship reports, journals, or portfolios, as well as the Final Degree Project.
- Formulating hypotheses, objectives, or conclusions for academic work.
- Replacing qualitative or quantitative data analysis with automated tools without human validation.
- Creating videos, presentations, or avatars with AI as a substitute for the student's oral or practical presentation.
- Obtaining automatic answers to tests, rubrics, or assessable activities through the use of AI.

### Citation and Attribution Guidelines:

- Any use of AI tools must be explicitly acknowledged in the submitted document (e.g., in a footnote or appendix).
- The name of the tool, the purpose of use (e.g., grammatical review, organization of ideas, interview simulation), and where it was used in the work must be indicated.
- Responsible use of AI will be evaluated within the framework of originality, academic honesty, and digital competence.

### Additional recommendations:

Students are encouraged to combine the use of AI with traditional methods (manual problem solving, practical session design, direct observation, etc.) to ensure the comprehensive development of their skills.



If there are any doubts about the permitted use of AI in a specific activity, students should consult the faculty responsible for the course.

## Actividades formativas

The methodologies to be used so that the students reach the expected learning outcomes will be the following:

- M1 Attendance at practices.
- M2 Resolution of problems and cases.
- M3 Discussion in small groups.
- M4 Practical laboratories.

### IN-CLASS TRAINING ACTIVITIES

ACTIVITY	RELATIONSHIP WITH THE COURSE LEARNING OUTCOMES	METHODOLOGY	HOURS	ECTS
<b>THEORETICAL CLASS:</b> Presentation of contents by the teacher. Competency analysis. Demonstration of capabilities, skills and knowledge in the classroom.	R4, R5, R6	Attendance at practices.	46,00	1,84
<b>PRACTICAL CLASS / SEMINAR:</b> Group dynamics and activities. Resolution of problems and cases. Practical laboratories. Data search, computer classroom, library, etc. Meaningful construction of knowledge through student interaction and activity.	R4, R5	Discussion in small groups.	10,00	0,40



EVALUATION: Set of oral and/or written tests used in the evaluation of the student, including the oral presentation of the final degree project.	R4, R5	Discussion in small groups. Practical laboratories.	4,00	0,16
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<b>TOTAL</b>			<b>60,00</b>	<b>2,40</b>
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## TRAINING ACTIVITIES OF AUTONOMOUS WORK

ACTIVITY	RELATIONSHIP WITH THE COURSE LEARNING OUTCOMES	METHODOLOGY	HOURS	ECTS
GROUP WORK: Problem solving. Preparation of exercises, memoirs, to present or deliver in classes and/or in tutoring.	R4, R5	Discussion in small groups. Practical laboratories.	10,00	0,40
SELF-EMPLOYED WORK: Study, Individual preparation of exercises, assignments, reports, to present or deliver in classes and/or in tutoring. Activities in platform or other virtual spaces.	R4, R5	Resolution of problems and cases. Discussion in small groups.	80,00	3,20
<b>TOTAL</b>			<b>90,00</b>	<b>3,60</b>



## Description of contents

Descripción de contenidos necesarios para la adquisición de los resultados de aprendizaje.

### Theoretical content:

Block of content	Contents
1. CONCEPT AND STUDY AREAS OF BIOMECHANICS	Study of the basic concepts of biomechanics such as:-The historical background and precursors.-The objectives of sports biomechanics.-The areas of application.-Sports biomechanics in Spain.-The disciplines related to biomechanics.
2. MATHEMATICAL AND PHYSICAL BASES FOR HUMAN ANALYSIS	General conceptualisation: Measurement, units of measurement, errors, magnitudes and trigonometric functions. Solving basic mathematical problems: vector operations, trigonometric operations
3. HUMAN MOVEMENT: BASES OF MECHANICS.	Study and analysis of mechanics, its applications and components: - Kinematics (linear and angular). Concepts and application by solving problems and practical cases.-Dynamics (kinetics and statics). Concepts, resolution of practical cases, and laws that compose it.
4. FLUID DYNAMICS: THE AERIAL AND AQUATIC ENVIRONMENT.	Basic concepts: Shape coefficient, boundary layer and profiles - Assessment of resistance - Types of resistance - Lifting forces (aerial) - Ascensional forces (aquatic).
5. ENERGETICS OF MOVEMENT: WORK, POWER AND ENERGY.	Study, analysis and conceptual evaluation:-Work.-Power.-Potential, kinetic and elastic energy.-Mechanical efficiency.-Simple machines: levers and pulleys.-Kinetic c
6. MECHANICAL CHARACTERISTICS OF MATERIALS.	Study and mechanical analysis of materials:-Basic concepts: Deformation, tension, elasticity, rigidity, flexibility, restitution and fatigue.-Mechanical characteristics of biological materials.-Biomechanical aspects of sports flooring.-Classification of flooring.-Theoretical aspects to be considered in normative tests.



### Temporary organization of learning:

Block of content	Sessions	Hours
1. CONCEPT AND STUDY AREAS OF BIOMECHANICS	2	4,00
2. MATHEMATICAL AND PHYSICAL BASES FOR HUMAN ANALYSIS	2	4,00
3. HUMAN MOVEMENT: BASES OF MECHANICS.	14	28,00
4. FLUID DYNAMICS: THE AERIAL AND AQUATIC ENVIRONMENT.	5	10,00
5. ENERGETICS OF MOVEMENT: WORK, POWER AND ENERGY.	5	10,00
6. MECHANICAL CHARACTERISTICS OF MATERIALS.	2	4,00



## References

### BASIC BIBLIOGRAPHY:

- Aguado, X. (1993). Eficacia y eficiencia deportiva: análisis del movimiento humano. Barcelona: INDE.
- Bartlett, R. (1999). Sports Biomechanics: Reducing Injury and Improving Performance. London: Taylor&Francis.
- Bosch, F., & Cook, K. (2015). *Strength training and coordination: an integrative approach*. 2010 Publishers.
- Cleather, D. (2021). *Force: The biomechanics of training*. Independently published. Gutiérrez, M. (1998). Biomecánica deportiva: bases para el análisis. Madrid: Síntesis. Hay, J.G. (1993). The biomechanics of Sport techniques. New Jersey: Prentice may. Hewitt, P. (2004). Física Conceptual. 9ª edición. México: Pearson Educación.
- Levangie, P. K., & Norkin, C. C. (2019). *Joint structure and function: A comprehensive analysis* (6th ed.). F.A. Davis Company.
- Izquierdo, M. (2008). Biomecánica y Bases Neuromusculares de la Actividad Física y el Deporte . Madrid: Editorial Médica Panamericana.
- Kreighbaum, E. y Barthels, K. M. (1990). Biomechanics. A qualitative approach for studying human movement. (3ª ed.) New York: Ed. Mcmillan.
- Neumann, D. A. (2016). *Kinesiology of the musculoskeletal system* (3rd ed.). Mosby. Okuno, E. y Fratin, L. (2014). Biomechanics of the Human Body. New York: Springer.
- Neumann, D. A., & Serra Año, P. (2022). *Cinesiología del sistema musculoesquelético: Fundamentos para la rehabilitación* (P. Serra Año, Trad.). Editorial Médica Panamericana S.A.
- Plas, F., Viel, E., & Blanc, E. (1984). *La marcha humana: cinesiología dinámica, biomecánica y patomecánica* (1a ed.). Masson.
- Uchida, T. K., & Delp, S. L. (2021). *Biomechanics of movement: The science of sports, robotics, and rehabilitation*. The MIT Press.
- Vigotsky, A. D., Zelik, K. E., Lake, J., & Hinrichs, R. N. (2019). Mechanical misconceptions: Have we lost the “mechanics” in “sports biomechanics”? *Journal of Biomechanics*, 93, 1-5.
- Zatsiorsky, V. M., & Prilutsky, B. I. (2012). *Biomechanics of skeletal muscles*. Human Kinetics.

### COMPLEMENTARY BIBLIOGRAPHY:

- Abbot, A. V. y Wilson, D. G. (1995). Human-Powered vehicles. Champings, IL: Human Kinetics.
- Aguilar, M. (2000). Biomecánica: la física y la fisiología. Textos universitarios: CSIC.
- Baumler, G., y Schneider, K. (1989). Biomecánica deportiva; fundamentos para el estudio y la práctica. Barcelona: Martínez Roca.
- Blazevich, Anthony. Biomecánica deportiva. Manual para la mejora del rendimiento humano. 1.a ed. Barcelona: Paidotribo, 2014.
- Campos, J. (coord.). (2001). Biomecánica y deporte. Ayuntamiento de Valencia: Colección aula deportiva técnica.
- C.S.D. (1996). Análisis biomecánico de las técnicas deportiva: salto de altura, lanzamiento de jabalina y carreras de velocidad. Serie ICD de investigación en ciencias del deporte.



- Donskoi, D. y Zatsiorski, V. (1988). Biomecánica de los ejercicios físicos: manual. La habana: Pueblo y educación.
- Dugan, S. A. y Bhat, K. P. (2005). Biomechanics and analysis of running gait. Phys Med Rehabil Clin N Am, 16, 603-621.
- Durá, J.V., Gil, S., Ramiro, J. y Vera, P. (1996). Los pavimentos deportivos en España. C.S.D (Consejo Superior de Deportes) e I.B.V (Instituto de Biomecánica de Valencia).
- Forti, A.M. y Duarte, M. (2011). Utilização da plataforma de força para aquisição de dados cinéticos durante a marcha humana. Brazilian Journal of Motor Behaviour, 6(1), 56-61.
- Fucci, S., Benigni, M. y Formasari, V. (2003). Biomecánica del aparato locomotor aplicada al acondicionamiento muscular. Madrid: Elsevier.
- Khan Academy. «Física Khan Academy». Khan Academy. Accedido 20 de julio de 2017. <https://es.khanacademy.org/science/physics>.
- Llana Belloch, S. y Pérez Soriano, P. (2014). Biomecánica básica: Aplicada a la actividad física y el deporte. Barcelona: Paidotribo.
- Peterson, D. R. y Bronzino, J. D. (2008). Biomechanics. Principles and Applications. Boca Ratón Florida : Taylor & Francis Group.
- Sánchez, J. y Prat, J. (1993). Biomecánica de la marcha humana, normal y patológica. Valencia: IBV.