Universidad Rey Juan Carlos

TEACHING GUIDE

BIOMECHANICS

GRADO EN INGENIERÍA BIOMÉDICA (INGLÉS) (3º y 4º curso) (2374)

ACADEMIC YEAR 2026-27

Publication date: 02-07-2026

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I.-Subject Identification	
Type	OBLIGATORIA
Teaching period	4 course, 2Q semester
Nº of credits	3
Language in wich the subject is taught	English

II.-Presentation

The Biomechanics course provides students with a comprehensive and structured understanding of human body movement from an engineering perspective. It explores the mechanical principles that govern motion, posture, and force generation within the human musculoskeletal system. Throughout the course, students will analyze the intricate relationship between anatomical structure and physiological function. Special emphasis is placed on the biomechanical behavior of biological tissues—such as bones, muscles, tendons, and ligaments—and how these tissues interact during various types of movement and physical activity. By integrating theoretical knowledge with practical applications, students will develop the ability to design, model, and evaluate biomechanical systems. This includes identifying and proposing solutions to common dysfunctions or variations in human movement, which is essential for the development of medical devices, rehabilitation strategies, and performance optimization tools.

Prerequisites:
To successfully engage with the course content, students are expected to have a solid foundation in human musculoskeletal anatomy.

III.-Learning outcomes

CB2 . That students are able to apply their knowledge to their work or vocation in a professional manner and have the skills that are typically demonstrated through the preparation and defense of arguments and problem solving within their field of study.
CB5 . That students have developed the learning skills needed to undertake further studies with a considerable degree of autonomy.
CE01 . Understand or acquire the principles of bioelectrical fundamentals, anatomy, physiology or pathophysiology needed to identify the most appropriate processing technologies for a given problem in biomedical engineering
CE15. Solve physical problems in biomedical engineering using knowledge of: kinematics, dynamics, electromagnetism, waves, fluids, bioelectricity and biomechanics.

- Key for degrees not adapted to RD 822/21: **CB** - basic competences, **CG** - generic competences, **CE** - specific competences, **CT** - transversal competences.
- Key for degrees adapted to RD 822/21: **CON** - knowledge, **COM** - competences, **HAB** - skills.

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IV.-Contents

IV.A.-Syllabus

Unit 1. Introduction to biomechanics.

Unit 2. Biomechanics of tissues.

•Bone

•Ligament/joint capsule

•Tendon

•Muscle

Unit 3. Biomechanics of the upper limb. Functions. Orthosis and prosthesis

•Shoulder

•Elbow

•Wrist, hand and fingers

Unit 4. Biomechanics of the spine. Functions. Orthosis and prosthesis

Unit 5. Biomechanics of the lower limb. Orthosis and prosthesis

•Pelvis

•Hip

•Knee

•Ankle and foot

Unit 6. Biomechanics of gait. Application of new technologies in the evaluation and treatment of patients.

•Normal human walking

IV.B.-Training activities

Type	Title
Experimental and/or technological laboratories	Seminars of real cases given by specialized lecturers
Clinical laboratories	Presentation of cases and debate during the masterclasses
Group work	Design and presentation of self-made orthosis or prosthesis

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V.-Student workload	
Theoretical sessions	20
Resolution of exercises, problems, case studies, etc.	4
Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc.	4
Tests and/or exams	2
Academic tutorials	12
Related activities: conferences, seminars, etc.	12
Preparation of theoretical sessions and self-study	16
Preparation of practical tasks, exercises, case studies, projects, etc.	12
Preparation for tests and/or exams	8
Total student workload	90

VI.-Methodology and academic programme		
Type	**Period**	**Content**
Theoretical sessions	Week 1 to Week 13	The methodology of the masterclass is followed with the support of audiovisual media.
Tests and/or exams	Week 6 to Week 7	The FIRST MIDTERM EXAM of the THEORETICAL BLOCK (unit 1 to 3) will be conducted in person during weeks 6 and 7 of the term
Tests and/or exams	Week 15 to Week 15	The SECOND MIDTERM EXAM of the THEORETICAL BLOCK (unit 4 to 6) will be conducted in person during the regular examination period of May 2025.
Group work	Week 13 to Week 15	Conceptualization, design and creation of an orthosis or prosthesis. It will be made in groups of maximum 3-to-4 students. It will consist of a project presented on video or through oral presentation in Powerpoint (or similar) format. It must be sent through the Virtual Classroom before the due date established. The existing anti-plagiarism tools in the University, penalizing those projects with a high percentage of web coincidences.

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VII.-Assessment methods

The general assessment method is continuous as established in the *Regulation for the Assessment of Learning Outcomes* of Rey Juan Carlos University.
All the assessment systems established in the degree report must be employed, except for those that have a minimum weight of 0%, which can be used by professors in the academic years they consider relevant. Each assessment system may be applied through one or more assessment activities, consistent with the system. No assessment activity can exceed individually 60% of the overall grade for the subject.
The sum of non re-evaluable activities cannot exceed 40% of the overall grade for the subject and, in general, should not have an established minimum grade (except for practical activities in which, strictly speaking, the conditions of the ordinary call cannot be reproduced in the extraordinary call).
Those students who do not manage to pass the subject in the ordinary call, or do not attend this first call, may attend the extraordinary call only for failed re-evaluable assessment activities.
The distribution and characteristics of the assessment activities are described below.

VII.A.-Description and weight of the assessment activities

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Evaluation system1	**EVALUATION ACTIVITIES**							
	Activity	**Character**	**Modality (Written/online)**2	**Type**	**Minimum grade**	**Weighing**3	**Period**	**Content**
SE2	First test	Individual	Written	Reassessed	5	30%	Week 6-7	Unit 1-3 Tests of 30-50 test questions, with four possible answers, where only one of them is correct. To pass the exam, the student will have to reach 65% **of the correct answers**, numerical qualificatio n of 5, whereas incorrect answers do not substract any points.

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SE2	Second test	Individual	Written	Reassessed	5	30%	Ordinary official call	Unit 4-6 Tests of 30-50 test questions, with four possible answers, where only one of them is correct. To pass the exam, the student will have to reach 65% **of the correct answers**, numerical qualificatio n of 5, whereas incorrect answers do not substract any points
SE1	Continuous assessment	Individual	Written	No reassessed	NO	10%	Week 1-13	Individual exercises related to the contents of the subject
SE3	Final dissertation project	Group	Written Online	No reassessed	NO	25%	Week 1-14	Oral presentatio n face-toface or on video on one of the topics proposed in class
SE5	Practice report	Individual	Online	No reassessed	NO	5%	Week 12-14	Critical thinking of the practical activities proposed

VII.B. Assessment of students with academic exemption from class attendance

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Having Academic Exemption from Class Attendance (DAAC) does not imply that students are automatically exempt from participating in the continuous assessment activities or in the training activities of compulsory attendance as established in the teaching guide. Once the exemption has been granted, students must contact the subject's teaching staff, who will propose the adaptations he/she may consider relevant, as long as they guarantee the acquisition and adequate assessment of the learning goals established. Students must maintain adequate communication with the teaching staff so that they may provide information on the dates for training and assessment activities, if these are not established in the programme and available for students at the time of achieving the exemption.
Subject with possibility of academic exemption: No.

VII.C. Review of assessment activities

In accordance with the Regulation for the Assessment of Learning Outcomes of Rey Juan Carlos University.

VII.D.-Students with a disability or special educational needs

In order to guarantee equal opportunities, non-discrimination, universal accessibility and academic success, students with disabilities or especial education needs may request curricular adaptations to follow their studies. These adaptations will be provided by the Unit of Attention to People with Disabilities of Rey Juan Carlos University, in accordance with the regulation which regulates the service for the Attention of People with Disabilities at the University. This Unit will issue a report for curricular adaptations, so that students with disabilities or special education needs must contact the service (at e-mail discapacidad.programa@urjc.es) in order to provide relevant information for different educational alternatives.

VII.E.-Academic behaviour, academic integrity and honesty

Rey Juan Carlos University is fully committed to the highest standards of academic integrity and honesty, so studying at the URJC means assuming and subscribing to the values of integrity and academic honesty set out in the University's Ethical Code. To support this process, the University has Rey Juan Carlos University's Academic Conduct Regulation as well as different tools (anti-plagiarism, supervision...) that offer a collective guarantee for the full development of these essential values.

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VIII.-Teaching resources and materials

Basic bibliography

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Biomecánica funcional. Miembros, cabeza y tronco. 2ª Edición. Dufour M. Pillu M. Elsevier 2018
Fisiología articular (6ª Edición) Kapandji, A.I. Médica Panamericana Bases biomecánicas del sistema musculoesquelético. 4ª Edición Nordin M, Frankel V.H. Lippincott Williams & Wilkins 2013
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Biomecánica: Bases del movimiento humano. 4ª Edición. Hamill J., Knutzen K., Derrick T.R. Wolters Kluwer 2017
Biomecánica clínica de la patología del aparato locomotor Miralles, R.; Miralles I. Masson 2007
El libro de los músculos. Valerius - Frank - Kolster - Hamilton - Lafont - Kreutzer. 5ª edición. Ed Médica Panamericana

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Jin, Z. Computational Modelling of Biomechanics and Biotribology in the Musculoskeletal System: Biomaterials and Tissue / Edited by Zhongmin Jin. 1st ed. 2014. Print. Woodhead Publishing Series in Biomaterials; Number 81.

IX.-Professors

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Department	Ciencias Básicas de la Salud
Campus	Fuenlabrada
Category	Profesor/a Asociado/a
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	1
Number of sexennia	0
No. of positive evaluations by Docentia	1
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Department	Ciencias Básicas de la Salud
Campus	Fuenlabrada
Category	Profesor/a Contratado/a Doctor/a
Academic degree	Doctor
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	4
Number of sexennia	1
No. of positive evaluations by Docentia	0
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Department	Ciencias Básicas de la Salud
Campus	Fuenlabrada
Category	Profesor/a Ayudante Doctor/a
Academic degree	Doctor
Person responsible for the subject	Yes
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	0
Number of sexennia	1
No. of positive evaluations by Docentia	0

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