# Course guide
# 820023 - BMB - Biomechanics

**Last modified:** 04/06/2026

**Unit in charge:** Barcelona East School of Engineering
**Teaching unit:** 702 - CEM - Department of Materials Science and Engineering.

**Degree:** BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

**Academic year:** 2026 **ECTS Credits:** 6.0 **Languages:** Catalan

## LECTURER

**Coordinating lecturer:** DANIEL RODRÍGUEZ RIUS

**Others:** Primer quadrimestre:
JUDIT BUXADERA PALOMERO - Grup: M11, Grup: M12
JORDI LLUMA FUENTES - Grup: M13, Grup: M14, Grup: M15
DANIEL RODRÍGUEZ RIUS - Grup: M11, Grup: M12, Grup: M13, Grup: M14, Grup: M15

## REQUIREMENTS

FISIOLOGIA - Prerequisit
SISTEMES MECÀNICS - Prerequisit

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
CEBIO-260. Analyse and reduce the loads applied to a biomechanical system. Assess the kinematic behaviour and strength of a joint and the strength behaviour of human tissue.

**Transversal:**
5. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
6. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
7. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

## TEACHING METHODOLOGY

There are weekly master sessions. Each one is dedicated to one of the content blocks. In the lectures the student adopts a receptive role.
The practices and the final experimental work of the subject, which will be in teams, will be carried out in the seminar sessions.
The purpose of the seminars is for students to share the practical experiences developed both inside and outside the classroom, in addition to carrying out the experimental part of the subject. In these sessions an active aptitude of the student is requested where, in part, he/she will be the emitter of contents.

## LEARNING OBJECTIVES OF THE SUBJECT

1. Acquire the basic concepts and knowledge of biomechanics.
2. To know the structure, function and movement of the human body and the various joints.
3. To know the kinematic behavior of human joints and tissues.
4. To know the bioinstrumentation used for the analysis of biomechanics.

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Hours small group | 22,5 | 15.00 |
| Self study | 90,0 | 60.00 |
| Hours large group | 37,5 | 25.00 |

**Total learning time:** 150 h

## CONTENTS

### Introduction

**Description:**
Introduction to the subject.

**Specific objectives:**
Learn the key elements of the knowledge of biomechanics.

**Full-or-part-time:** 3h
Theory classes: 1h
Laboratory classes: 0h 30m
Self study : 1h 30m

### Fundamentals of biomechanics

**Description:**
Kinematics.
Kinetics.
Control of the movement.
Joint stability.

**Specific objectives:**
Learn the basics and dynamic mechanical analysis and its application to the human body movement and the measurement tools.

**Related activities:**
Lab practice.
Experimental work.
Problems.

**Full-or-part-time:** 15h
Theory classes: 6h
Self study : 9h

**Tissue biomechanics of the musculoskeletal system**

**Description:**
Bone biomechanics
Biomechanics of cartilage
Biomechanics of tendon and ligament
Biomechanics of muscle
Biomechanics of nervous tissue
Biomechanics of blood

**Specific objectives:**
Learn the key elements that make up the basics of biomechanics of tissues and be able to apply the methods to the study of musculoskeletal biomechanics .

**Related activities:**
Lab practice and experimental work.

**Full-or-part-time:** 22h
Theory classes: 8h 30m
Self study : 13h 30m

**Joint biomechanics**

**Description:**
Biomechanics of the hip
Biomechanics of the knee
Ankle Biomechanics
Foot Biomechanics
Shoulder Biomechanics
Biomechanics of the elbow
Biomechanics of the wrist

**Specific objectives:**
Learn the key elements that make up the basics of biomechanics of the joint structures and be able to apply the methods to the study of musculoskeletal biomechanics.

**Related activities:**
Lab practices
Problems
Experimental work

**Full-or-part-time:** 32h 30m
Theory classes: 7h
Laboratory classes: 6h
Self study : 19h 30m

### Biomechanics of the spine

**Description:**
Biomechanics of the spine

**Specific objectives:**
Learn the key elements that make up the basics of biomechanics of the spine and be able to apply the methods of biomechanics to study the locomotor system.

**Related activities:**
Lab practices
Problems
Experimental work

**Full-or-part-time:** 12h 30m
Theory classes: 3h
Laboratory classes: 2h
Self study : 7h 30m

### Human gait

**Description:**
Normal human gait

**Specific objectives:**
To learn the cycle of normal human gait and to determine, based on the same patterns, the role of each of the joints and tissues.

**Related activities:**
Lab practices
Experimental work

**Full-or-part-time:** 10h
Theory classes: 4h
Self study : 6h

### Applied biomechanics

**Description:**
Pathological human gait
Analysis of forces and pressures. Parameters of human gait
Motion analysis system. Parameters of human gait
Electromyography. Parameters of human gait

**Specific objectives:**
To learn about the instruments and biomechanical analysis of human gait and analyze their results.

**Related activities:**
Lab practices.

**Full-or-part-time:** 55h
Theory classes: 8h
Laboratory classes: 14h
Self study : 33h

## GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

The grade is based on:
- Evaluation of lab practices: 21.5%
- Group reports: 18.5%
- Partial test: 20%
- Final test: 40%

Attendance to Lab sessions and seminars is mandatory to pass this subject
This subject does not include a reevaluation test.

## EXAMINATION RULES.

The use of devices with communication capabilities is not allowed.

## BIBLIOGRAPHY

**Basic:**
- Proubasta, I; Planell, J. A.; Gil, F. X. Fundamentos de biomecánica y biomateriales. Madrid: Ergon, DL 1997. ISBN 848983413x.
- Fung, Y. C. Biomechanics : mechanical properties of living tissues. 2nd ed. New York [etc.]: Springer-Verlag, cop. 1993. ISBN 0387979476.

**Complementary:**
- Kerr, Andrew. Introductory biomechanics. Edinburgh: Churchill Livingstone, 2010. ISBN 9780443069444.
- Simon, Sheldon R.; Buckwalter, Joseph A. Orthopaedic basic science : biology and biomechanics of the musculoskeletal system. 2nd ed. Rosemont, Illinois: American Academy Orthopedic Surgeons, 2000. ISBN 089203176X.

## RESOURCES

**Hyperlink:**
- OpenSim. Biomechanical modeling software (free)