Italian code: ING-INF/06 **Credits: 6**
Course: Sport Biomechanics
Main language of instruction: Italian
Other language of instruction: English

Head instructor
Professor Riccardo BORZUOLA - riccardo.borzuola@unicusano.it

Objectives

The course in SPORT BIOMECHANICS is dedicated to the study of the principles of anatomy, physiology, and biomechanics of the musculoskeletal system in the sports context. Specifically, the Sport Biomechanics course aims to outline the fundamental aspects of movement analysis, delving into tools and measurement techniques applicable in the field of sports. Furthermore, sport biomechanics aims to prevent injuries and evaluate athletes' performance, providing coaches, trainers, and athletes themselves with objective assessment tools.

Course structure

- Principles of basic biomechanics
- Movement analysis: understanding the reasons for studying gait and its importance
- Measurement tools and errors in measurement
- Equipment and instrumentation used in a movement analysis laboratory
- Biomechanics of swimming, running, and weightlifting
- The spine and loads
- Impacts and aerodynamics
- Sports footwear
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Competencies

A. Knowledge and understanding:

The student will have acquired knowledge and understanding of the fundamental principles of movement analysis, gait analysis, and will be familiar with the

technologies underlying the measurement tools used in a movement analysis laboratory.

B. Making judgements:

The student will be able to interpret results from various quantitative movement evaluation techniques and will be proficient in drafting a report.

C. Communication skills:

The student will have developed appropriate technical language, enabling them to clearly articulate the technical knowledge acquired in the proposed and analyzed topics.Learning skills:

D. Learning skills:

The knowledge and the key methodological tools that will be useful in subsequent advanced professional training in the areas of sport training and rehabilitation.

Syllabus

MODULE I – FOUNDATIONS OF BIOMECHANICS AND INTRODUCTION TO MOVEMENT ANALYSIS

Introduction to the course
Basics of biomechanics
Sports biomechanics: general considerations
Introduction to movement analysis, Part 1: history and evolution
Introduction to movement analysis, Part 2: measurement tools (1)
Introduction to movement analysis, Part 3: measurement tools (2)

MODULE II – GAIT ANALYSIS AND JOINT KINEMATICS

Anatomical planes of movement
Gait analysis, Part 1: importance of evaluation
Gait analysis, Part 2: the gait cycle
Gait analysis, Part 3: foot rockers, center of mass, and ground reaction forces
Joint kinematics, Part 1: hip, ankle, and knee
Joint kinematics, Part 2: head, trunk, and pelvis

MODULE III – MEASUREMENT TOOLS IN A MOVEMENT ANALYSIS LABORATORY

Stereophotogrammetry, Part 1
Stereophotogrammetry, Part 2
Inertial sensors

MODULE IV – MEASUREMENT TOOLS IN A MOVEMENT ANALYSIS LABORATORY (practical application)

Electromyography
fNIRS (functional near-infrared spectroscopy)
Force plates

MODULE IV – SPINE AND LOADS, SPORTS FOOTWEAR, AND SWIMMING BIOMECHANICS

Spine and loads, Part 1
Spine and loads, Part 2
Sports footwear, Part 1
Sports footwear, Part 2
Swimming biomechanics, Part 1
Swimming biomechanics, Part 2

MODULE VI – BIOMECHANICS OF RUNNING AND WEIGHTLIFTING, IMPACTS AND AERODYNAMICS

Biomechanics of running
Biomechanics of weightlifting
Impacts and aerodynamics, Part 1
Impacts and aerodynamics, Part 2

Evaluation system and criteria

The exam will generally consist of either a written test or an oral exam (a verification method that can be conducted at the main campus in Rome), aimed at assessing analytical skills, command of language, and the ability to re-elaborate acquired concepts.

The written test includes 30 multiple-choice questions covering the entire course syllabus. Each correct answer to the multiple-choice questions is worth 1 point.

The oral exam consists of an interview designed to assess the student's level of preparation. This typically involves 3 questions (theoretical and/or applied in nature) covering the entire course syllabus. Each question is equally weighted, with a maximum score of 10 points per question.

In both exam formats, particular attention is given to evaluating the student's ability to re-elaborate, apply, and present the material available on the platform with proper use of technical language.

In addition, one e-tivity, consisting of reviewing a scientific paper regarding sport biomechanics, is compulsory. This needs to be sent to the instructor in advance of the examination. The e-tivity will contribute a maximum of 3 points toward the total score of 30 points.

Bibliography and resources

1. *Materials to consult*

Notes written by the instructor are available in Italian (part of the notes are also available in English).

2. *Recommended bibliography*

Suggested readings are:

1. Gait Analysis: normal and pathological function. J.Perry and J.Burnfield, 1992.
2. Sports Biomechanics: The Basics: Optimising Human Performance. A.Blazevich, A. & C. Black, 2019 edition.
3. Science And Practice of Strength Training. Zatiorsky and Kraemer, second edition.