

## 25610 - Biomechanics and movement analysis

### Syllabus Information

**Academic Year:** 2019/20

**Subject:** 25610 - Biomechanics and movement analysis

**Faculty / School:** 127 - Facultad de Ciencias de la Salud

**Degree:** 275 - Degree in Physiotherapy

**ECTS:** 9.0

**Year:** 2

**Semester:** Annual

**Subject Type:** Basic Education

**Module:** ---

### 1.General information

#### 1.1.Aims of the course

#### 1.2.Context and importance of this course in the degree

#### 1.3.Recommendations to take this course

### 2.Learning goals

#### 2.1.Competences

#### 2.2.Learning goals

#### 2.3.Importance of learning goals

### 3.Assessment (1st and 2nd call)

#### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

### 4.Methodology, learning tasks, syllabus and resources

#### 4.1.Methodological overview

#### 4.2.Learning tasks

#### 4.3.Syllabus

The course will address the following topics:

#### SECTION 1: MECHANICS

1. Theoretical exposition in a large group

2. Troubleshooting seminars

#### CONTENTS

Topic 1.1 INTRODUCTION TO MECHANICS AND BIOMECHANICS. Static and dynamic. Kinetics and kinematics.

Topic 1.2.- FORCES. Representation of forces. Net force. Units of measurement. Composition and decomposition of forces. Torque. Application to human movement.

Topic 1.3.- MASS AND WEIGHT. Force of gravity. Concept of mass and weight. Center of gravity of the human body. Determination of center of gravity of the human body. Segmental centers of gravity.

Topic 1.4.- STATIC. Line of gravity. Support base. Balance. Calculation of muscle forces involved to maintain balance and joint reaction forces in a certain position. Stability of equilibrium: factors influencing this stability.

Topic 1.5.- DYNAMICS: Kinematics. Movement. Reference systems. Types of movement. Linear kinematics. Angular

kinematics. Relationship between linear and angular motion. Application to the analysis of movement.

Topic 1.6.- DYNAMICS: Kinetics. Momentum. Impulse. Conservation of momentum. Transfers of angular momentum. Application to body motion. Forces that modify the movement. Reaction force. Friction. Fluid dynamics: floating, resistance, pressure. Application to the study of human motion.

Topic 1.7.- WORK, POWER, ENERGY. Work. Units of measurement. Positive and negative work. Energy: potential energy, kinetic energy. Law of conservation of energy. Power. Units of measurement. Application to the analysis of movement.

Topic 1.8.- SIMPLE MACHINES. a) Anatomical Levers. Modification of effort and resistance torque. Applications. b) Inclined plane. Applications. c) Pulleys. Types of pulleys. Anatomical pulleys. Applications.

## SECTION 2: STRUCTURAL BIOMECHANICS

1. Theoretical exposition in large group

2. Practical application in small groups

### CONTENTS

Topic 2.1.- MECHANICAL BEHAVIOR OF TISSUES. Types of loads. Stress-strain curves. Parts of the curve. Mechanical properties.

Topic 2.2.- BIOMECHANICS OF MUSCULOSKELETAL SYSTEM I: Bone. Mechanical properties. Factors influencing the mechanical behavior of bone. Bone fractures.

Topic 2.3.- BIOMECHANICS OF MUSCULOSKELETAL SYSTEM II: Joints. Mechanical properties of articular cartilage. Joint lubrication. Mechanical properties of ligaments and tendons. Menisci. Mechanical properties and function of menisci. Elementary motion of the joint surfaces. Joint kinetic chains.

Topic 2.4.- BIOMECHANICS OF MUSCULO SKELETAL SYSTEM III: Biomechanical properties of skeletal muscle. Mechanical behavior of muscle. Functional classification of muscles according to their structure. Types of muscular work. Muscle chains.

Topic 2.5.- MUSCULAR STRENGTHENING. Methods of dynamic, isometric and isokinetic muscle strengthening. Muscular endurance. Resistance assessment and exercises to increase it.

Topic 2.6.- BIOMECHANICS OF MUSCULOSKELETAL SYSTEM IV: Mechanical behavior of the peripheral nervous system.

## SECTION 3: JOINT BIOMECHANICS

1. Theoretical exposition in a large group

2. Practical application in small groups

### CONTENTS

Topic 3.1.- BIOMECHANICS OF THE UPPER EXTREMITY. Biomechanics of the shoulder joint complex: kinematics; kinetics. II) Biomechanics of the elbow joint: kinematics; kinetics. III) biomechanics of the wrist and hand: kinematics; kinetics.

Topic 3.2.- BIOMECHANICS OF THE LOWER EXTREMITY. Biomechanics of the hip joint: kinematics; kinetics. II) Biomechanics of the knee joint: kinematics; kinetics. III) Biomechanics of the ankle joint and foot: kinematics. Kinetics.

Topic 3.3 BIOMECHANICS OF THE TRUNK. Biomechanics of the spine. General. Biomechanics of the pelvic girdle. Thoracolumbar spine biomechanics: kinematics; kinetics. Chest: respiratory mechanics. Cervical spine biomechanics: kinematics; kinetics.

## SECTION 4: ANALYSIS OF HUMAN MOVEMENT

1. Theoretical exposition in a large group

2. Lab practices

3. Research work

### CONTENTS

Topic 4.1.- ANALYSIS OF HUMAN MOVEMENT. Biomechanical analysis of human movement; application and purpose. Methods to be used for the analysis of human movements: description of the movement, anatomical analysis, mechanical analysis, conclusions.

Topic 4.2.- MOTION HUMAN ANALYSIS TECHNIQUES. Kinematic analysis techniques: direct and indirect. Anthropometric variables. Techniques for kinetic analysis. Kinesiological electromyography.

Topic 4.3.- POSTURE BIOMECHANICAL ANALYSIS. Adaptations of the human body in the way to the upright position. General mechanisms for maintaining an upright posture. Elements are responsible for maintaining erect posture at each joint level involved therein. Principles of good posture.

Topic 4.4.- GAIT BIOMECHANICAL ANALYSIS. The gait cycle: phases and periods. Energy expenditure during walking. Gait kinematics. Gait kinetics. Muscle actions during walking. Plantar supports.

Topic 4.5.- NORMAL GAIT IN SPECIFIC SITUATIONS. Gait in the child: acquisition and characteristics. Gait in the elderly. Other factors that modify the normal gait: sex, type of footwear, type of terrain, slope.

## 4.4.Course planning and calendar

## 4.5.Bibliography and recommended resources