PHYSICS AND BIOMECHANICS OF HUMAN MOVEMENT

Course ID: MED/11

ECTS: 4

1nd Year: 1st semester

Teacher: PROF. DUGGENTO Andrea

Objectives

This course is designed to present an integrated, principle based, and problem solving approach to the biomechanics of human movement. At the end of the course, the student will be able to explain: the mechanical construction and movements of the body's joints with emphasis on torque, stability, and flexibility, analyze the forces at a skeletal joint for various static and dynamic human activities; calculate the energy expenditure and power required to perform an activity; analyze the stresses and strains in biological tissues, given the loading conditions and material properties; understand the biomechanical basis for sport technique and health-related applications.

Program:

Units and physical quantities; SI Units; Converting units; Dimensions and dimensional analysis; Vectors and scalars; Addition of vectors-graphical methods; Subtraction of vectors and multiplication of a vector by a scalar; Adding vectors by components; Kinematics in Two Dimensions and Vectors Displacement; Average velocity; Instantaneous velocity; Acceleration; Motion at constant acceleration; Dynamics: Newton's Laws of Motion; Forces; Newton's First Law of Motion; Mass Center of Mass (CM) ; Newton's Second Law of Motion; Newton's Third Law of Motion; Weight-The Force of Gravity and the Normal Force; Solving Problems with Newton's Laws: Free-Body Diagrams; Problems Involving Friction, Inclines Circular Motion; Gravitation Kinematics of Uniform Circular; Motion Dynamics of Uniform Circular Motion; Angular Quantities; Constant Angular Acceleration; Torque; Rotational Dynamics; Torque and Rotational Inertia; Work and Energy; Work Done by a Constant Force; Work Done by a Varying Force; Kinetic Energy; and the Work-Energy Principle; Potential Energy; Conservative and Nonconservative Forces; Mechanical Energy and its Conservation; Power Static Equilibrium and Levers; The Conditions for Equilibrium Levers; Applications to Muscles and Joints; Elasticity and Fracture Elasticity; Stress and Strain Work Done by a Muscle Fracture in Bones

Textbooks: N. Özkaya, M. Nordin, "Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation", Springer, 2012.

Exam method: written exam