

# Minnesota State University Moorhead

## EXS 420: Biomechanics

### A. COURSE DESCRIPTION

Credits: 3

Lecture Hours/Week: 3

Lab Hours/Week: 0

OJT Hours/Week: \*.\*

Prerequisites:

EXS 320 - Anatomical Kinesiology

Corequisites: None

MnTC Goals: None

This course is designed to develop an understanding of the mechanical principles that govern the effectiveness with which physical education and sport skills are performed. The prerequisite can be waived with the consent of the instructor.

**B. COURSE EFFECTIVE DATES:** 02/03/2022 - Present

### C. OUTLINE OF MAJOR CONTENT AREAS

1. Biomechanics
2. Kinematic concepts for analyzing human motion
3. Kinetic concepts for analyzing human motion
4. Linear and angular kinematics of human movement
5. Linear kinetics of human movement
6. Equilibrium and human movement
7. Angular kinetics of human movement
8. Human movement in a fluid motion

#### **D. LEARNING OUTCOMES (General)**

1. Define the terms biomechanics, statics, dynamics, kinematics, and kinetics, and explain the ways in which they are related. Distinguish between qualitative and quantitative approaches for analyzing human movement.
2. Identify Newton's laws of motion and gravitation, and describe practical illustrations of the laws. Explain what factors affect friction, and discuss the role of friction in daily activities and sports. Define impulse and momentum, and explain the relationship between them. Explain what factors govern the outcome of a collision between two bodies. Discuss the relationships among mechanical work, power, and energy.
3. Identify the angular analogues of mass, force, momentum, and impulse. Explain why changes in the configuration of a rotating airborne body can produce changes in the body's angular velocity. Identify and provide examples of the angular analogues of Newton's laws of motion. Define centripetal force, and explain where and how it acts.
4. Provide examples of linear, angular, and general forms of motion. Identify and describe the reference positions, planes, and axes associated with the human body. Define and appropriately use directional terms and joint movement terminology. Explain how to plan and conduct an effective qualitative human movement analysis.
5. Define and identify common units of measurement for mass, force, weight, pressure, volume, density, specific weight, torque, and impulse. Identify and describe the different types of mechanical loads that act on the human body. Distinguish between vector and scalar quantities.
6. Define torque, quantify resultant torques, and identify the factors that affect resultant joint torques. Identify the mechanical advantages associated with the different classes of levers, and explain the concept of leverage within the human body. Define center of gravity, and explain the significance of center of gravity location in the human body. Explain how mechanical factors affect a body's stability.
7. Discuss the interrelationships among kinematic variables. Correctly associate linear kinematic quantities with their units of measure. Identify and describe the effects of factors governing projectile trajectory. Explain why the horizontal and vertical components of projectile motion are analyzed separately. Distinguish between average and instantaneous quantities and identify the circumstances which each is a quantity of interest.
8. Distinguish angular motion from rectilinear and curvilinear motion. Discuss the relationships among angular kinematic variables. Correctly associate angular kinematic quantities with their units of measure. Explain the relationships between angular and linear displacement, angular and linear velocity, and angular and linear acceleration.
9. Explain the ways in which the composition and flow characteristics of a fluid affect fluid forces. Define buoyancy and explain the variables that determine whether a human body will float. Define drag, identify the components of drag, and identify the factors that affect the magnitude of each component. Define lift and explain the ways in which it can be generated. Discuss the theories regarding propulsion of the human body in swimming.

#### **E. Minnesota Transfer Curriculum Goal Area(s) and Competencies**

None

#### **F. LEARNER OUTCOMES ASSESSMENT**

As noted on course syllabus

#### **G. SPECIAL INFORMATION**

None noted