Course Outline (Higher Education)

School: School of Health and Life Sciences

Course Title: BIOMECHANICS

Course ID: EXSCI1004

Credit Points: 10.00

Prerequisite(s): Nil

Co-requisite(s): Nil

Exclusion(s): Nil

ASCED Code: 10913

Description of the Course :

This course enables students to develop an understanding of the nature of efficient human movement, based on principles of biomechanics. Content: linear and angular kinematics, linear and angular kinetics, fluid mechanics, qualitative analysis of sports techniques and the application of biomechanical principles to fundamental movements, sports techniques, recreational and exercise movement activities.

Grade Scheme: Graded (HD, D, C, etc.)

Program Level:

AQF Level of Program						
	5	**6**	**7**	**8**	**9**	**10**
Level						
Introductory			✔			
Intermediate						
Advanced						

Learning Outcomes:

Knowledge:

K1. Explain the role of biomechanics in human movement and discuss how the discipline has contributed to advancements in technology and improvements in performance.

K2. Summarise the differences between linear and angular kinematics and kinetics using examples from human movement.

K3. Understand, explain and apply Newtons three laws of motion.

K4. Discuss the effects various fluid forces have on an object and how these forces can be manipulated to increase or decrease performance in specific sports.

K5. Identify the mechanical properties of muscles and the effects of loading in human movement and sport specific skills have on the muscle.

Skills:

S1. Demonstrate a sound knowledge of a self selected biomechanical principle, using examples from a variety of sports settings and communicate this information to the other students in the laboratory setting.

S2. Use a range of communication methods and/or technologies, to develop and implement meaningful collaborative and independent learning and study strategies for new material.

Application of knowledge and skills:

A1. Communicate findings from sport related biomechanical principle assessment task to the other students in the laboratory setting.

A2. Participate in problem solving of biomechanical issues within laboratories.

Course Content:

Week	Lecture content	Practical/tutorial content	NUCAP criteria covered
5	**Levers & Torque:** Types of levers; mechanical advantage; torque; moment arms; calculating muscle torques**.**	**Impulse Momentum Relationship:** Understand how a force plate works and the type of data it produces; calibration of the force plate; calculate velocity, impulse, and forces during straight line and curved running.	1.15, 1.18, 1.19, 1.21, 1.51
6	**Centre of Gravity:** Definition of CoG, location and measurement methods for CoG; stability; factors influencing stability. **Mid semester exam Wed 3.30pm**	**Torque :** Review the formula for torque; calculate moment arm and resistance torque using dumbbells at various angles; discuss resistance gym equipment.	1.18, 1.19, 1.20, 1.21, 1.31
7	**Angular Kinematics:** Angular motion; differences between linear and angular; units of measurement; relative and absolute angles; right thumb rule; tangential acceleration; centripetal/radial acceleration. **Angular Kinetics 1:** Planes of motion; axes of motion; moment of inertia; angular momentum.	**Centre of Gravity:** Explore how centre of gravity changes with position/movement; calculation of centre of gravity. ***Group Poster Presentations***	1.7, 1.8, 1.10, 1.11, 1.12, 1.19, 1.20, 1.22, 1.50, 10.1, 10.2
8	**Angular Kinetics 2:** Newtons Laws in angular motion; angular impulse momentum relationship; centripetal and centrifugal forces. **Fluid Mechanics 1:** Aerodynamic fluid forces; buoyancy in air; Magnus effect; angles of attack**.**	**Angular Motion:** Using Dartfish calculate linear and angular motion. ***Group Poster Presentations***	1.8, 1.13, 1.15, 1.22, 1.23, 1.24, 1.25, 1.26, 1.27, 1.28, 1.29, 1.48, 1.52, 10.1, 10.2
Week	**Lecture content**	**Practical/tutorial content**	**NUCAP criteria covered**

Course Outline (Higher Education)

EXSCI1004 BIOMECHANICS

9	**Fluid Mechanics 2:** Hydrodynamic fluid forces; buoyancy in water. **Muscle Mechanics:** Muscle torque; length tension relationship; force-velocity relationship; factors affecting force production, factors affecting force production; effect of fatigue, muscle weakness and neurological fatigue of movement.	**Fluid Dynamics:** Revise Magnus effect; examine the effect of spin, drag and lift forces on balls; table tennis ball machine. ***Group Poster Presentations***	1.26, 1.28, 1.29, 10.1, 10.2
10	**Qualitative Analysis:** Steps/models for biomechanical qualitative analysis; sample theoretical models; observing biomechanical changes in Olympic events.	**Muscle Mechanics:** Force velocity relationship; length tension relationship. ***Group Poster Presentations***	1.43, 10.1, 10.2
11	**Biomechanical Technology:** Methods of quantitatively collecting biomechanical data. **Practical Applications:** Analyses of basic human movement using videos.	**Qualitative Analysis:** Experience breaking down skills biomechanically in the attempt to improve technique; report information back to the group.	1.14, 1.43, 10.1, 10.2
12	**Revision**	**Revision :** Practice exam.	

Values and Graduate Attributes:

Values:

- **V1.** Recognise and evaluate the complexity of the mechanics of the body in all human movement settings
- **V2.** Recognise the need for critical thinking, collaborative discussion and reflection to fully appreciate the role of biomechanics in performance.

Graduate Attributes:

Attribute	Brief Description	Focus
Continuous Learning	Students will be encouraged to build on prior biomechanical knowledge. They will be asked to draw on relevant sporting experiences, and explore how key biomechanical principles apply within these sports. Further, they will be required to discuss the relevance of biomechanical principles in everyday activities, which will enable students to develop a deeper understanding of the underlying mechanical concepts. The applied nature of this course will enable students to adapt and apply their biomechanical knowledge to different settings in their professional life.	Medium

Course Outline (Higher Education)

EXSCI1004 BIOMECHANICS

Attribute	Brief Description	Focus
Self Reliance	Students will develop self reliance through working independently, particularly to develop appropriate learning strategies and revision techniques to enable them to meet the requirements of both the mid-semester and final theory exam. Further, students will also participate in group learning situations which will develop their communication skills; their ability to analyse and synthesise information; and their capacity to solve problems. Successful participation in these tasks will provide students with the self-confidence and skills required to be successful in their academic and professional life.	Medium
Engaged Citizenship	Students will be encouraged to apply biomechanical principles to more fully understand and make meaningful contributions to the activities/sports they participate in. They will also engage with concepts relating to the value of biomechanics for different populations and individuals within the community, including areas such as performance enhancement; equipment development; injury prevention; and rehabilitation.	High
Social Responsibility	Students will understand the ethical expectations and act in a socially responsible manner when conducting quantitative and qualitative biomechanical analysis within laboratory sessions. Further, socially responsible attitudes and behaviours will be enhanced through participation in group activities whereby students will learn to respect the diversity of sporting experiences and skill levels, and work capacities of others	High

Learning Task and Assessment:

Learning Outcomes Assessed	Learning Tasks	Assessment Type	Weighting
K1-K5; A2	Practical attendance and participation. At least 90% attendance and participation in practical sessions	Satisfactory/Unsatisfactory	N/A
K1-K5; A2	Completion of laboratory manual/ workbook on a weekly basis	Satisfactory/Unsatisfactory	N/A
K1-K3; S2	Completion of self-directed study of class content presented in the lectures and labs from week 1-5 in a variety of sports and human movement settings.	Mid semester exam	20-40%
K2-K5; S1-S2; A1	Apply relevant biomechanical principles to a variety of sports settings, and communicate this information to classmates in the laboratory setting.	Sport related biomechanical principle assessment task.	15-30%
K1-K5; S1;	Review of biomechanical principles presented in the lectures and labs from the entire course to a variety of sports and human movement settings.	Final theory exam	40-60%

Course Outline (Higher Education)

EXSCI1004 BIOMECHANICS

Adopted Reference Style:

APA