CAMOSUN COLLEGE

School of Arts & Science
PHYSICS DEPARTMENT

Course Outline

PHYS 160 BIOMECHANICS OF SPORT

This course is an introduction to Newtonian Mechanics in the context of human movement and the optimization of motor skills. The sequence of topics includes: terminology of biomechanics, Newton's Laws of motion, forces, linear kinematics, work and energy, power momentum, rotational kinematics, hydrostatics, biomechanical analysis of sport.

OFFERED:	Winter Semester
CREDIT:	3
IN-CLASS WORKLOAD:	4 lecture/seminar, 2 lab (alt.weeks),
PRE-/CO-REQUISITES:	Math11, or Math 172 and Math 073, or assessment

REQUIRED MATERIALS:
Text: "Biomechanics of Sport and Exercise", P. M. McGinnis, 2nd ed.
Physics 160 Lab Manual
Scientific calculator
Graph paper (must be either 10 lines/inch or millimeter graph paper)

DEPARTMENT POLICIES REGARDING TESTING:

1. Students must write quizzes, tests, midterm tests, etc., on the date and time assigned by the instructor. Missed exams normally receive a zero grade. In exceptional circumstances such as medical issues or a documented illness, a make-up exam may be given or the test may be waived at the discretion of the instructor. The instructor should be notified prior to the exam.

2. The final exam will cover the entire course and will be 3 hours long. As stated in the current college calendar (p. 39) "students are expected to write all term tests and final exams at the scheduled time and place." Exceptions will only be considered for emergency circumstances as outlined in the calendar. Excursions, holidays, or scheduled travel flights are not accepted.

3. Cell phones are not permitted in the exam room during tests or the final exam.

DEPARTMENT POLICIES REGARDING LABS:

1. Lab exercises will be done on a bi-weekly basis during the scheduled lab period. Attendance is mandatory and you will be required to "sign in" at the beginning of each one. As you complete the exercise your instructor will discuss your results with you and mark your work.

2. All assigned laboratory exercises and reports must be completed with an overall grade of 60% in order to obtain credit for this course. Attendance is required for all lab

exercises at the scheduled times. A lab may be made up at a later time only in the case of documented illness or other extenuating circumstances.

3. At the discretion of the instructor, a student who is repeating this Physics course may not be required to complete the laboratory exercises a second time if an average lab grade of 70% or better was obtained.

STUDY TIME

It is recommended that between 5 and 10 hours per week be spent studying for this course outside of class time.

LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College Calendar, Registrar's Office or the College web site under "Getting Your Coursework Done" at

http://www.camosun.bc.ca/services

ACADEMIC CONDUCT POLICY

There is an Academic Conduct Policy which includes plagiarism. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, Registration, and on the College web site in the Policy Section.

www.camosun.bc.ca/divisions/pres/policy/2-education/2-5.html

GRADING

The standard mark distribution for this course is as follows:

Final Exam	50%
Midterms and other work	50%
Lab Reports	(completion required)
	100%

OUTLINE:

Part I Introduction, Forces and Human Motion

1. **Introduction to Biomechanics**

   1.1 The study of Biomechanics
   1.2 Definitions and history

2. Terminology for Biomechanics in Sport and Exercise
   2.1 The skeletal system and body segments
   2.2 Bones and joints
   2.3 Muscles
   2.4 Anatomical system for describing limb movements- direction, planes, and axes of motion.
   2.5 Joint actions

3. **Fundamentals for Studying Mechanics**
   3.1 Measurement, units, basic dimensions and fundamental quantities
   3.2 Accuracy and calculation
   3.3 Graphical analysis – plotting graphs, fitting curves to the data, analysis and interpretation

4. Forces
   4.1 The organization of mechanics
   4.2 Newton's laws of motion
   4.3 Defining forces – magnitude and direction
   4.4 Types of forces
   4.5 Addition of forces – resultant force
   4.6 Resolution of forces
   4.7 Equilibrium

5. Linear Kinematics – Describing Objects in Linear Motion
   5.1 Motion and definitions
   5.2 Linear kinematics
   5.3 Uniform acceleration and projectile motion

6. Linear Kinetics – The Causes of Linear Motion
   6.1 Newton's First Law and inertia
   6.2 Newton's Second Law and acceleration
   6.3 The concepts of impulse and momentum
   6.4 Newton's Third Law – Action and reaction forces
   6.5 Newton's Law of Universal Gravitation

7. Work, Energy and Power
   7.1 Definition of Work
   7.2 Energy - Kinetic and Potential
   7.3 Work and energy - The Work-Energy Theorem, Conservation of Energy
   7.4 Power

Part II Angular Motion and Fluid Mechanics

8. Torques – Maintaining Equilibrium or Changing Rotational Motion
- 8.1 Defining torques – Forces and lever arms
- 8.2 Equilibrium
- 8.3 Center of Gravity

9. Angular Kinematics – Describing Angular Motion
- 9.1 Angular position, displacement, velocity, and acceleration
- 9.2 Linear and angular quantities
- 9.3 Planes and axes for describing body and limb movements

10. Angular Kinetics - Causing or Changing Angular Motion
- 10.1Angular inertia
- 10.2Angular momentum, angular impulse
- 10.3Newton's 3 laws applied to angular motion

11. Fluids - Motion in Water and Air
- 11.1Buoyant force
- 11.2Dynamic fluid forces
- 11.3Drag

Part III Internal Biomechanics - Body Structure and Movement

12. Mechanical Properties of Biological Materials
- 12.1Stress
- 12.2Strain
- 12.3Stress-strain relation
- 12.4Mechanical properties of the musculoskeletal system

13. The Skeletal System
- 13.1Bones and joints

14. The Muscular System
- 14.1Muscle structure
- 14.2Muscle action – the contraction force

15. The Nervous System
- 15.1Neuron
- 15.2Motor unit
- 15.3Receptors and reflexes

16. Applications of Biomechanical Principles in Technique and Training