PHYS 4750: Physics of Sports

Class Meeting: MWF at 9:05 to 9:55 in 313 Watt

Office hours are tentative and subject to change and posted on the main Canvas page.

Amy Pope, PhD
306 Kinard Lab
amyj@clemson.edu
864-656-4349

Course Description:

PHYS 4750: Physics of Sports (3) Introductory course for students interested in understanding the role physics plays in the sporting world around us. This course covers such topics as mechanics, forces, energy, waves, fluids, and thermal physics and how these physical quantiles influence performance, rules of the game, equipment, safety and best practices. Emphasis put on sports as a demonstration of the physics concepts. Any MATH course or a score of 50 or higher on the Clemson Math Placement Test.

Course Learning Outcomes:
1. The student will demonstrate the ability to think critically and to use appropriate concepts to analyze sports data, sporting situations and player performance using the lens of physics.
2. The student will demonstrate the ability to use appropriate mathematical techniques and concepts to obtain quantitative solutions to performance of athletes and athletic equipment using physics.
3. The student will develop the ability to read, evaluate, and interpret numerical and general sports data and apply physical principles to real-world sporting situations then communicate effectively the physical principles that are governing the motion.

Students may vary in their competency levels on these abilities. You can expect to acquire these abilities only if you honor all course policies, attend class regularly, complete all assigned work in good faith and on time, and meet all other course expectations of you as a student.

It is important to develop critical thinking ability rather than mere memorization of facts. This it is a vital skill set for your successful career in various fields. To develop these skills you will work on in-class activities and homework assignments that involve defining and analyzing problems related to physics, identifying and evaluating options, inferring likely outcomes and probable consequences, then evaluating and explaining the reasons. I have high expectations but I will provide scaffolded assistance so you can be successful. Students are expected to review materials daily, practice many problems and seek out assistance in a timely manner.

Academic Continuity Plan for this Class:

Clemson has developed an academic continuity plan for academic operations. Should University administration officially determine that the physical classroom facility is not available, class will be conducted in a virtual (online) format. The University issues official disruption notifications through email/ www/ test notification / social media. When notified, use one of the following links to navigate for Clemson Canvas, where you will find important information about how we will conduct class:

- Primary access link: www.clemson.edu/canvas
- Secondary access link, if needed: https://clemson.instructure.com/
- You can also use the Canvas Student App.

Our activities for teaching and learning will occur through our Canvas course. This includes: watching recorded videos in Canvas and answering questions pertaining to the lecture.

Course Content:

Topic 1: Introduction

Units, dimensional analysis, significant figures, converting units, order of magnitude calculation, center of mass, vectors, scalers and trigonometry as applied to accuracy in sporting data.

Topic 2: Kinematics

One dimensional kinematics will be used to understand motion of object from the runner to the path of the swimmer. Emphasis will be placed on position, velocity and acceleration of the athlete.

Topic 3: 2D Kinematics

Motion in two dimensions will be addressed by looking at the motion of various balls in flight.

Topic 4: Newton's Laws of Motion and Applications

Newton's laws will be applied to understand the role forces play in athletics.

Topic 5: Newton's Laws Applied

Football, baseball, swimming and are evaluated through the lens of applied forces

Topic 6: Momentum and Collisions

Linear momentum, impulse, conservation of linear momentum, elastic and inelastic collisions are evaluated in several contact sports.

Topic 7: Work, Energy and Power

Work, energy and power are evaluated in powerlifting, football and nutrition.

Topic 8: Rotational Motion

The role of rotational motion will be discussed through the conservation of angular momentum of the dancer to the procession of a football spiral.

Topic 9: Oscillations

Periodic and simple harmonic motion are investigated through the sweet spot on a bat and heavy ropes.

Topic 10: Fluids

Density, pressure, buoyancy will be investigated through swimming gear, river rafting and deflate gate.

Topic 11: Gravity

Newton's law of universal gravitation, local gravity, and the effects of gravity will be investigated by redesigning sporting facilities based on local gravitation

Course Schedule

Jan 8		Topic 1: Introduction
Jan 10		Topic 1: Introduction
Jan 13		Topic 1: Introduction
Jan 15		Topic 1: Introduction, CASE STUDY reaction time
Jan 17		Topic 2: Kinematics
Jan 20 – MLK Holiday		
Jan 22		Topic 2: Kinematics
Jan 24		Topic 2: Kinematics
Jan 27		Topic 2: Kinematics, CASE STUDY Swimming

Course Schedule continued

Jan 29		Topic 3: 2D Kinematics
Jan 31		Topic 3: 2D Kinematics
Feb 3		Topic 3: 2D Kinematics
Feb 5		Topic 3: 2D Kinematics, CASE STUDY Pop Fly to Midfield
Feb 7		TEST 1
Feb 10		Topic 4: Newton's Laws of Motion and Applications
Feb 12		Topic 4: Newton's Laws of Motion and Applications
Feb 14		Topic 4: Newton's Laws of Motion and Applications
Feb 17		Topic 4: Newton's Laws of Motion and Applications, Case Study Cheer-
Feb 19		Topic 5: Newton's Laws Applied * academic continuity exercise day
Feb 21		Topic 5: Newton's Laws Applied
Feb 24		Topic 5: Newton's Laws Applied
Feb 26		Topic 5: Newton's Laws Applied, CASE STUDY Paralympics
Feb 28		Topic 6: Momentum and Collisions
Mar 2		Topic 6: Momentum and Collisions
Mar 4		Topic 6: Momentum and Collisions
Mar 6		Topic 6: Momentum and Collisions, CASE STUDY Breaking the Bat
Mar 9		TEST 2
Mar 11		Topic 7: Work, Energy and Power
Mar 13		Topic 7: Work, Energy and Power
Mar 16-20 Spring Break		
Mar 23		Topic 7: Work, Energy and Power
Mar 25		Topic 7: Work, Energy and Power, CASE STUDY Weightlifting
Mar 27		Topic 8: Rotational Motion
Mar 30		Topic 8: Rotational Motion
Apr 1		Topic 8: Rotational Motion
Apr 3		Topic 8: Rotational Motion, CASE STUDY bobsledding
Apr 6		Topic 9: Oscillations
Apr 8		Topic 9: Oscillations, CASE STUDY Battle Rope
Apr 10		Topic 10: Fluids
Apr 13		Topic 10: Fluids, Case Study Deflategate
Apr 15		TEST 3
Apr 17		Topic 11: Gravity
Apr 20		Topic 11: Gravity
Apr 22		Topic 11: Gravity, PROJECT design your sport on another planet or
Apr 24		Topic 11: Gravity, PROJECT design your sport on another planet or

Attendance Policy:

Attendance **is** required. Because of the pace at which material is covered and because of the cumulative nature of the principles involved it is recommended that students not miss a class unless there is a compelling reason. Students are requested to wait 10 minutes in the unlikely event that your instructor is late for class.

Exams:

There will be four exams during the semester including one final exam. Each exam is worth 10% of your final course grade with the lowest of the 4 exam grades being dropped which makes the three regular exam and the final exam worth a total of 30% of your total grade. For the first exam that you are unable to complete, you will have to use the missed exam as your dropped exam grade. In the extremely unlikely case that more than one exam is missed, you must obtain an excuse which may be verified by University sources before a makeup exam will be granted.

You may use a calculator during the tests as well as all class notes, online resources and course material. The test will include data interpretation and assessment. You will need to bring your computer to your assigned testing room. The test will be administered through Canvas. Students who turn in a paper copy of the exam will have **5 points deducted** from their exam grade.

"Nothing comes close to the precision with which physics enables you to understand the world around you." Neil deGrasse Tyson

Class Presentation:

Students will sign up for a physics of sports topic to present. Students will prepare a multimedia presentation detailing the physics used in a sport or an action performed in a sport. Students will research to find scholarly articles that support the assertations in their presentation and pull facts from the paper that are included in their presentation. Presentations will be 5 minutes long and presented on an assigned date throughout the semester. The class presentation is worth 10% of your final course grade. The grading rubric and further assignment details are located in Canvas.

Engagement/Quiz:

Engagement/Quiz grades are worth a total of 30% of your final class grade. ***Each engagement grade is worth the same amount of credit (regardless of the number of raw points).*** Engagement questions will be administered using iClicker. Engagement questions will be administered throughout each class period. Quizzes will be administered at various intervals during the course. These quizzes are unannounced and will pertain to the material learned during the precious class(es). These quizzes are open noted, open book and you will work on them in collaboration with your peers. These quizzes are designed to cause you to critically assess the material we are learning as well as teach you how to interpret data.

Case Study:

Case studies are worth a total of 30% of your final class grade. During each topic studied in this course, students will be given data to interpret and synergize to determine what is physically happening in a given case study. Each case study will be done in conjunction with your peers.

Final Examination:

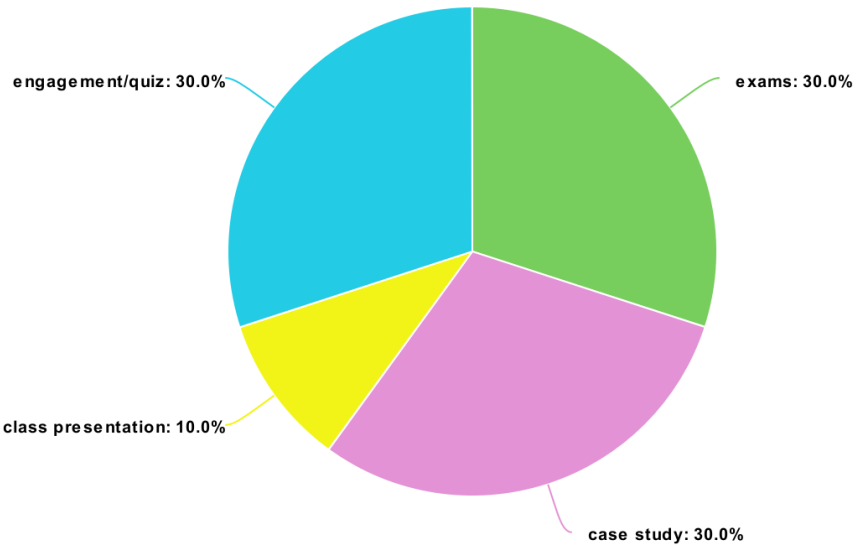
The final examination will be cumulative and given during the exam period set for this course. The final exam is open notes, open book.

Determination of Final Grade:

Letter grades are calculated by the weighting provided in the syllabus. Your average in Canvas will provide your given grade. No further changes to grades will be made after the last day of class. Grading breakdown as follows:

3 test & final	highest 3 grades at 10% = 30% of course grade
Class Presentation	10%
Engagement/Quiz	10%
Case Study	30%
Total	100%

The following scale will be used:
A: 90%-100%
B: 80% to 89.99%
C: 70%-79.99%
D: 60% - 69.99%
F: 0-59.99%



Clemson Thinks2:

This course is designed to be part of the Clemson Thinks2 (CT2) program. “Critical thinking is reasoned and reflective judgment applied to solving problems or making decisions about what to believe or what to do. Critical thinking gives reasoned consideration to defining and analyzing problems, identifying and evaluating options, inferring likely outcomes and probable consequences, and explaining the reasons, evidence, methods and standards used in making those analyses, inferences and evaluations. Critical thinking is skeptical without being cynical, evaluative without being judgmental, and purposefully focused on following reasons and evidence wherever they may lead.” http://www.insightassessment.com/FAQ/FAQs-General-Critical-Thinking/What-is-Critical-Thinking CT2

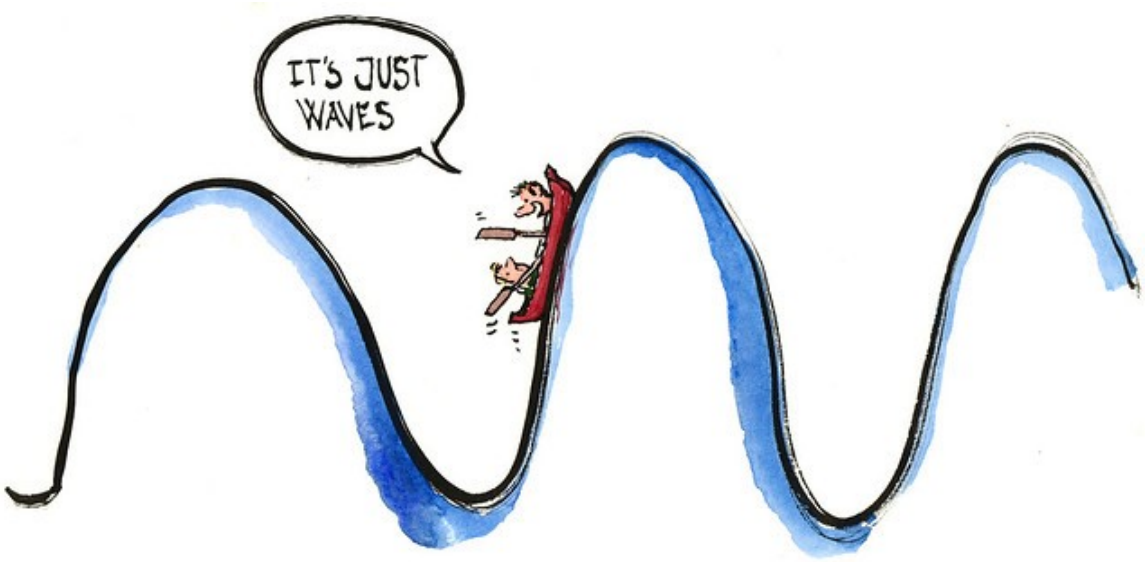
Critical Thinking Methods of Teaching:

Critical thinking requires students to be active learners who engage in the material. Students need to be making decisions about what to believe or how to evaluate information. Critical thinking gives reasoned consideration to all aspects of a problem.

Critical Thinking Artifacts:

A variety of assignments (quizzes, homework and exams) in this course can be utilized as artifacts to demonstrate your refinement of critical thinking skills over the term. Case studies may be used to demonstrate your ability to critically assess a realistic scenario, draw inferences from data sets, journal articles and propose an appropriate solution.

Your class presentation will also be a critical thinking artifact. Collected data will be evaluated by the student and inferences made. A successful project will demonstrate a students ability to read, evaluate, and interpret numerical and general scientific information and apply physical principles to a real-world sports problems then communicate effectively the reasoning behind the solution.



Required Materials:

The following materials are required for successful participation in the course:

- Download OpenStax Urone and Hinrichs College Physics (ISBN-10: 1-947172-01-8) **$0.00**
- An internet device such as a laptop, tablet or cell phone with Respondus Lockdown browser installed. Respondus must be installed through the Clemson University offered download.
- Calculator (Any scientific calculator is fine.)
- Adobe Reader (free) or Adobe Creative Cloud Acrobat (free through Clemson)
- Ancillary information (texts, videos, audio, slides, notes) is provided in my Canvas course.
- Logger Pro 3 should be downloaded on your computer. This program is available through Clemson CCIT on the downloads page.
- An iClicker Reef account can be attained by downloading the mobile app via the App Store or Google Play, or by visiting the iClicker Reef student website. A two week free trial is offered after which point you will have to purchase the app. A one semester subscription to REEF costs the student **$14.99**, a one year subscription costs **$23.99.**

iClicker REEF:

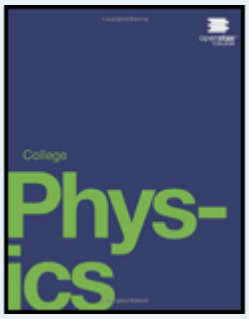
I will be using iClicker Cloud this semester to conduct engagement quizzes in class. It is your responsibility to properly register your iClicker Reef device in a timely fashion. We will be using them for credit on the first Tuesday of class. It is also your responsibility to regularly check your iClicker grades for any discrepancies and bring them to my attention quickly.
Regardless of which device you use in class, you must create an iClicker Reef account–or use your existing Reef account if you already have one–to ensure that your grades sync to my iClicker gradebook. You can do this by downloading the mobile app via the App Store or Google Play, or by visiting iclicker.com.

Then, you must connect your Reef account within our learning management system. To do this, you must navigate to the iClicker Reef registration link in Canvas, click the link, then sign into your Reef account from the window that opens. This will automatically add our class to your Reef account. It is also recommended that you enter your Clemson email (without the g ex. amyj@clemson.edu) accurately in the Student ID field of your Reef profile.

Upon signing up with iClicker Reef, you will have a 2 week free-trial period. After that point, you will need to purchase a Reef subscription ($14.99 for 6 months) if you want to participate in iClicker sessions with your mobile device, tablet, or laptop. Click here to learn about your options for purchasing a Reef subscription.

iClicker support is found by visiting iclicker.com/support at any time. If you continue to experience issues, please contact iClicker support via phone (866.209.5698) or email (support@iclicker.com). Live support is available Monday - Thursday from 9AM - 11PM, ET and Friday from 9AM - 9PM, ET.

Make Sure you Have These



Download OpenStax Urone and Hinrichs College Physics
FREE

Vernier Logger Pro 3
FREE

iClicker REEF app
$14.99

General Policies and Procedures:

Students are expected to adhere to all policies and procedure outlined by Clemson University at: University Policies: http://www.clemson.edu/administration/student-affairs/student-handbook/universitypolicies/index.html.

Academic Integrity:

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

A simple definition of plagiarism is when someone presents another person's words, visuals, or ideas as his or her own. The instructor will deal with plagiarism on a case-by-case basis. The most serious offense within this category occurs when a student copies text from the Internet or from a collective file. This type of academic dishonesty is a serious offense that will result in a failing grade for the course as well as the filing of a formal report to the University.

See the Undergraduate Academic Integrity Policy website for additional information about academic integrity and Clemson procedures and policies regarding scholastic dishonesty.

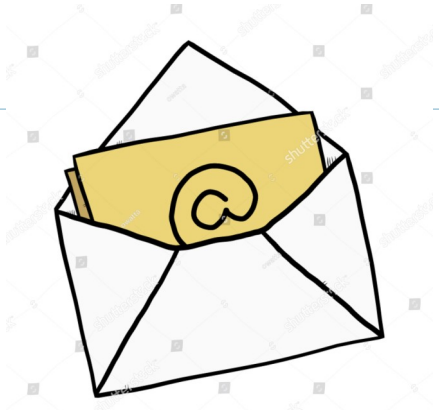
Engagement activities fall under the provisions of our campus's academic honesty policy. Students must not engage in academic dishonesty while participating in in-class engagement activities. This includes but is not limited to answering polling questions while not physically in class, looking at other students' devices while answering live questions, or using more than one ExpertTA account at a time.

Title IX:

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at http://www.clemson.edu/campus-life/campus-services/access/title-ix/. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 110 Holtzendorff Hall, 864.656.3181 (voice) or 864.656.0899 (TDD).

"My investment of time, as an educator, in my judgement is best served teaching people how to think about the world around them. Teach them how to pose a questions, how to judge what one thinks is true versus another. What the laws of physics say."
Neil deGrasse Tyson

Email Communication:



Because of privacy regulations, University faculty and staff may email students only through Clemson email. Therefore, you must use your Clemson email account in this course for all email communications. Check your Clemson account at least five times per week for important messages. You will want to have your canvas announcement forwarded to your email or check your Canvas messages with a frequency of 5 times per week. Please make sure that your emails are professional in nature.

Student Disability Services:

Student Disability Services coordinates the provision of accommodations for students with disabilities in compliance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990.

Reasonable and specific accommodations are developed with each student based on current documentation from an appropriate licensed professional. All accommodations are individualized, flexible, and confidential based on the nature of the disability and the academic environment. Housing accommodations for a disability or medical condition are also coordinated through this office.
Visit the Student Disability Services website for location, contact information, as well as official policies and procedures. To learn more information or request accommodations contact Student Disability Services (SDS) at sds-l@clemson.edu or 864.656.6848 or visit SDS's website: http://www.clemson.edu/campus-life/campus-services/sds/about.html. It is expected that the student will test in the proctor center.

Academic Support Services:

Students may access a variety of academic support services to support your learning in the online classroom. Here are links to services available:
Academic Success Center http://www.clemson.edu/asc/staff.html
The Writing Center http://www.clemson.edu/centers-institutes/writing/
Clemson Online Library Guides http://libguides.clemson.edu/distanceed
Online Library Resources http://www.clemson.edu/library/
CCIT (Tech Support) http://www.clemson.edu/ccit/help_support/ or CCIT (Tech Support) email: ithelp@clemson.edu
Academic Advising http://www.clemson.edu/academics/advising/index.html
Registrar http://www.registrar.clemson.edu/html/indexStudents.htm

Copyright Notice:

The materials found in this online course are strictly for the use of students enrolled in this course and for purposes associated with this course; they may not be retained or further disseminated. Clemson students, faculty, and staff are expected to comply fully with institutional copyright policy as well as all other copyright laws.

Available Assistance:

In addition to the instructor's availability outside of regular class time, there are other opportunities for students to get help on course materials.
Tutoring Information: This course is supported by the Academic Success Center tutoring program. The ASC tutors have completed and done well in this course, and they understand the concepts well enough to help you work through questions you have. For more information visit https://www.clemson.edu/asc/courses/tutoring/index.html.
Additional Course Support: If you discover that you would like additional support to meet your success goals for this course, contact the Academic Success Center using their "Request for Course Assistance" form (http://www.clemson.edu/asc/courses/index.html).
I am available during office hours to answer any questions that you may have about the course or the course content. Please see me privately if you have special needs or accommodations required in this course.

Inclement Weather:

Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless the instructor contacts students. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the weather related cancellation.