PHYS-BIOL-1060H-A: Physics for the Life Sciences
2021WI - Peterborough Campus

Instructor:

Instructor: Aaron Slepkov
Email Address: aaronslepkov@trentu.ca
Phone Number: 705-748-1011 x6216
Office: SC212
Office Hours: Wednesday 13:10-14:30, or by appointment. Via zoom with link to be supplied at start of term

Meeting Times:

Please check https://www.trentu.ca/registrar/timetable/undergraduate to confirm times and locations.

Lectures:

MONDAY: 16:00-17:50 [Zoom via Blackboard]
THURSDAY: 10:00-11:50. [Zoom via Blackboard]

Tutorials (All remote via Zoom):

W01: Mondays, 18:00 - 19:50 (Tutorial Leader: Kirubha Elangovan)
W02: Tuesdays, 16:00 - 17:50 (Tutorial Leader: John MacMillan-Jones)
W03: Tuesdays, 08:00 - 09:50 (Tutorial Leader: Kirubha Elangovan)
W04: Fridays, 13:00 - 14:50 (Tutorial Leader: John MacMillan-Jones)
W05: Fridays, 16:00 - 17:50 (Tutorial Leader: John MacMillan-Jones)
W06: Mondays, 12:00 - 13:50 (Tutorial Leader: George Olaniyan)
W07: Thursdays, 12:00 - 13:50 (Tutorial Leader: Kirubha Elangovan)

Co-instructors and Teaching Assistants:

Course Assistant:

Amany Raslan. (email: amanyraslan@trentu.ca)

The course assistant manages tutorial scheduling, homework submissions, student accommodations, and general course administration. When in doubt, students should email the course instructor before they reach out to the professor.

Department:

Academic Administrative Assistant: Colleen Berrigan

Email Address: physics@trentu.ca
Phone Number: 7715
Office: SC327

Description:

This course is geared towards students who will continue studies in the life sciences, and any students interested in learning about the physical origins of biological processes, laboratory techniques, and everyday phenomena. Topics covered include physical properties of biomaterials such as elasticity and compressibility; physical limits on sizes and speeds in living systems; fluids: viscosity, surface tension, and how these affect the mobility of organisms; diffusion, thermal motion of molecules, sedimentation, heat flow, and energy.

Learning Outcomes:

By the completion of the course, successful students should be able to

1. Identify a wide array of theoretical and experimental physics considerations and tie them to common biological phenomena.
2. Identify the most relevant physics principles underlying a broad range of biological and biomedical phenomena.
3. Use simple heuristics (rough mental tricks) such as orders-of-magnitude, ratios, arithmetical estimates, dimensional analysis, and simplifications for rapid problem solving in biophysics and beyond.
4. Gauge the sensibility of generated answers based on renewed physical intuition, everyday experience, and common-sense.

5. Both view and work with physics/biophysics formulae as formal relationships between physical parameters and phenomena, rather than just as a proscriptive quantitative recipe for "solving" a given parameter.
6. Distinguish physical phenomena from similarly-named colloquial ideas; define, explain, and use the physics meaning of words that are common in everyday language, but which may mean something grossly (or subtly) different than it does scientifically.

For dozens of content-specific learning objectives, please see Learning Objectives document uploaded to the Blackboard course site.

Course Fees:

There is no course fee, but students are required to procure/purchase an iReef account for synchronous class participation.

Texts:

Printed course notes are available from the bookstore for $11. "Coursepack for PHYS 1060: Introductory Physics for the Life Sciences (CUSTOM)"

These notes are also offered free as a .pdf document on the Blackboard course site.

There is no required textbook to purchase. Weekly readings will be assigned from the course notes as well as occasional supplemental textbook passages uploaded to Blackboard.

- Online class notes, available through Blackboard. These notes will represent the primary source for course materials and class organization.
- Further reading: Williams et al., "Physics for the Biological Sciences", 5th edition, Nelson, 2011. This textbook was the course textbook for the past few years. It is a simple and clear textbook, recommended as a secondary text
- The purchase of a iReef account for use with a personal response device (i.e. cellphone) is required. For students in Section B (in-person lectures), it is recommended that you purchase a physical iClicker device from the Bookstore as an alternative to using an iReef account on your cellphone.

Assessments, Assignments and Tests:

Problem Sets: There are five problem-sets to be completed throughout the term. Instructions for accessing the problem sets will be posted on Blackboard at least two weeks prior to when they are due. The problem sets consist of a variety of questions ranging from conceptual in nature to in-depth computational problems. These questions are designed to deepen your understanding of the concepts covered in class. The problem set questions will form the basis for the term tests and final exam. Making sure you understand the solutions (not just the answers) to the homework problems, and could reproduce those solutions ON YOUR OWN should be your top studying priority.

Pre-lecture 'just in time' quizzes: Prior to each lecture, you will need to complete a JIT quiz online through the Blackboard Learning System. The quiz will consist of 3–4 simple questions based directly on the required readings for that week. Your lowest 4 JIT quiz scores will be dropped. The last question on each quiz gives all students a free-form opportunity to flag difficult concepts or other material that they are struggling with. The following lecture will then be customized toward addressing the most common issues raised in the JIT quiz.

Clicker/PRD participation: It is anticipated that clickers (or other personal response device, PRD) will be used live in lectures to "poll" the class on collective understanding and intuition. We will then use the results of such polls to guide subsequent in-class discussion. You are expected to participate synchronously (remote or in person) with PRD voting in each class. You receive full marks for any class in which you voted in at least 75% of the questions. Otherwise you receive zero for participation in that lecture. Your three lowest marks will be dropped before the final grade is calculated, to allow for weak batteries, equipment malfunction, illness, etc. You may ONLY use your own PRD. As PRD records are used in this course to compute a portion of course grades, the use of a personal response device other than your own is an academic offence. In lecture or tutorial, possession of more than one PRD, or that of another student, WILL be interpreted as intent to commit an academic offence.

Tutorial Attendance: Tutorial sessions are listed as "labs" on the course schedule. These 2 hour sessions will be used to give homework help, math remediation, and mini-lectures. Attendance is mandatory. If you cannot attend a tutorial session, you are expected to notify your tutorial leader as soon as possible. To allow for illness or unforeseen circumstances, two unexplained absences will be allowed without penalty.

Grading:

- Problem Sets (WebWork): 15% (~bi-Weekly)
- Lecture Clicker participation: 20% (~every class)
- Tutorial attendance: 5% (cumulative mark for weekly attendance at tutorial sessions)
- Pre-Lecture JIT quizzes: 10% (before every class, administered on Blackboard)
- Term Test 1: 10% (Saturday, Feb 13, 2021--Online on WeBWork)
- Term Test 2: 10% (Saturday, March 13, 2021--Online on WeBWork)
- Final Exam: 30% (exam period; April 12-23, 2021. Online on WeBWork, proctored)

Grade Total by Withdrawal Date:

By the class drop-date of March 15, 2021, it is expected that you will know approximately 25% of your final grade.

Schedule:

Week 1 Jan. 11–15 Lectures (Course intro + Dimensional Analysis / Dimensional Anal. Scaling and Proportionality); Tutorial (None in first week)
Week2 Jan. 18–122 Lectures (Mechanics: Basic need-to-know for course / Gravity and Weight); Tutorial (Math diagnostic Test)
Week 3 Jan. 25–29 Lectures (Bioengineering, elastic moduli and elastic energy); Tutorial (Mini-lecture and worked example)
Week 4 Feb. 01–05 Lectures (Geometric Scaling and allometry / Pressure: Basics and hydrostatic pressure); Tutorial (Mini-lecture and worked example)
Week 5 Feb. 08–12 Lectures (Buoyancy / Surface tension); Tutorial (Mini-lecture and worked example)

Feb. 15–19 **READING WEEK --NO CLASSES**

Week 6 Feb. 22 – 26 **Lectures** (Surface Tension & Capillairty / Surface-tension and buoyancy: Interface life); **Tutorial** (Mini-lecture and worked example)
Week 7 Mar. 01 – 05 **Lectures** (Viscosity and Hydrodynamics/ Hydrodynamics and viscosity); **Tutorial** (Test-1 follow-up)
Week 8 Mar. 8–12 **Lectures** (Life at low Reynolds Number / **Mid-term test**); **Tutorial** (Mini-lecture and worked example)
Week 9 Mar. 15–19 **Lectures** (Kinetic theory and Temperature / Laws of diffusion); **Tutorial** (Mini-lecture and worked example)
Week 10 Mar. 22–26 **Lectures** (Centrifugation & Biol. aspects of diffusion / Barometric formula and sedimentation); **Tutorial** (Test-2 follow-up)
Week 11 Mar. 29. – Apr. 2 **Lectures** (Heat and heat capacity / Thermal expansion, heat flow, insulation); **Tutorial** (Mini-lecture and worked example)
Week 12 Apr. 5. – Apr. 9 **Lectures** (Heat Transfer Mechanisms & radiative heating / Biothermal regulation); **Tutorial** (Mini-lecture and worked example)

Course Guidelines:

Academic Misconduct, Cheating, and Chegg:

Uploading any course material to a third party (e.g. Chegg, Course Hero, StuDocu) is forbidden on two counts: 1) the Trent Academic Integrity policy definition of "cheating" includes "knowingly permitting one or more other individuals to copy from one's own test, examination paper, lab report, or assignment". 2) A student who "shares or distributes course content in any way that breaches copyright legislation, privacy legislation, and/or this [the Trent University sharing] policy, will be subject to disciplinary actions under the Student Charter of Rights and Responsibilities or the relevant Academic Integrity Policy". Students who upload material from BIOL-, OR PHYS-listed courses will be investigated and charged with academic misconduct. It is department policy that **the distribution of course material be considered a MAJOR offence,** punishable by a mark of zero in the course, and receiving a note on the student's transcript.

University Policies:

Academic Integrity

Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offence and carries penalties varying from failure on an assignment to expulsion from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's *Academic Integrity Policy*. You have a responsibility to educate yourself – unfamiliarity with the policy is not an excuse. You are strongly encouraged to visit Trent's Academic Integrity website to learn more: www.trentu.ca/academicintegrity.

Access to Instruction

It is Trent University's intent to create an inclusive learning environment. If a student has a disability and documentation from a regulated health care practitioner and feels that they may need accommodations to succeed in a course, the student should contact the Student Accessibility Services Office (SAS) at the respective campus as soon as possible.

Sharing and Distribution of Course Content

Students in this class should be aware that classroom activities (lecture, seminars, labs, etc.) may be recorded for teaching and learning purposes. Any students with concerns about being recorded in a classroom context should speak with their professor. If a student shares or distributes course content in any way that breaches copyright legislation, privacy legislation, and/or this policy, the student will be subject to disciplinary actions under the Student Charter of Rights and Responsibilities or the relevant Academic Integrity Policy, at a minimum, and may be subject to legal consequences that are outside of the responsibility of the university. More details on sharing of course content are described in the policy found here: https://www.trentu.ca/artsci/sites/trentu.ca.artsci/files/documents/Policy%20on%20Sharing%20and%20Distribution%20of%20Course%20Content%202020-08-14.pdf

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