# PHY303K Engineering Physics

First Day Handout Spring 2019

**C**lass: Unique numbers 54915, 54920, 54925, 54930. Class meets MWF 10-11 in PAI 2.48. One hour discussion sections meet Tuesday evenings between 6 and 10 in RLM 7.114 depending on unique number.

**Instructor:** Greg O. Sitz, Office: RLM 10.313, Office Hours: Wednesday 1-2 and Thursday 10-11:30 or by appointment. Phone: 471-0701, email: `gositz@physics.utexas.edu`

**Graduate Teaching Assistant**: TBA **Undergraduate Teaching Assistant**: TBA

**Prerequisites**: Credit with a grade of at least C- or registration in one of the following: Mathematics 408D, 408L, or 408S; and Physics 103M. PHY103M is a seperate course that must be taken concurrently with PHY303K.

**Text** - *Matter and Interactions, Volume 1, 4th Edition*, by *Chabay and Sherwood*. The website (https://matter and interactions.org) has useful, suplementary information.

**Course Content** This course introduces four fundamental principles that form the foundation of science and engineering: momentum, energy, angular momentum and entropy. Frequent connections are made between the microscopic and macroscopic phenomena that illustrate these principles. The course also touches on concepts from quantum physics and special relativity.

**Grading** - The breakdown is: Homework 12% (due twice weekly), midterm exams (best 3 of 4): 15% each, Final Exam 30%, discussion section attendence 8%, and in-class Instapoll questions 5%. The final coures grade will be determined based on this weighting will be assigned as follows: $S \geq 90 \Rightarrow$ A; $90 > S \geq 80 \Rightarrow$ B; $80 > S \geq 70 \Rightarrow$ C; $70 > S \geq 60 \Rightarrow$ D; $60 > S \Rightarrow$ F. The raw score will not be rounded, that is 89.99 is less than 90. Plus/minus grading will not be used.

**Homework** - Homework will be adminstered using the Quest system (https://quest.cns.utexas.edu/). Homework will be due twice each week on Thursday and Sunday evenings. Assignments will be posted at least one week in advance of their being due whenever possible. There will be a total of 23 homework assignments, the lowest two scores will be dropped.

**In-class Concept Quizzes** At least once a lecture, in class concept quizzes will be administered using the Instapoll app on Canvas. This means you will need some way to access Canvas during class (phone, tablet or laptop). These quizzes will not be scored for accuracy, but only for participation and will be used to monitor attendance. They are intended to help you understand the concepts being covered in class by practising.

**Exams** - There will be four midterm exams, given Monday evenings on Feb. 18, Mar. 11, Apr. 15 and May 6 from 7-9 PM in RLM 4.102 plus a final exam. The lowest of the 4 midterms will be dropped in computing your course grade. The final exam is required and is scheduled for Saturday May 18, from 2-5 PM. After dropping your lowest midterm, if your final exam score exceeds the lowest remaining test score, your final exam score will replace that lowest score.

The exams will be closed book and closed notes, and no calculators, smart phones, tablets or other aids of any type are allowed. A cover sheet with relevant formulas and constants will be provided. This cover sheet will be made available in advance of the exams. The final exam will be cumulative, and the best way to prepare for the final is to keep up with the material as it is covered in class. This means being prepared for and taking all the midterm exams.

If you are absent from a examination for the observance of a religious holy day you may complete the work missed within a reasonable time after the absence, if proper notice has been given. Notice must be given at least seven days prior to the exam.

**Academic Dishonesty:** You are encouraged to seek and provide assistance freely in working on homework assignments. However, the work that you submit must represent *your own* knowledge and understanding. DO NOT COPY from any source and submit it as your own work.

**Other:** February 6 is the last day to drop the course with a possible refund. April 8 is the last day an undergraduate student may, with the dean's approval, withdraw from the University or drop a class except for urgent and substantiated, nonacademic reasons.

If you are absent for the observance of a religious holy day you may complete the work missed within a reasonable time after the absence, if proper advance notice has been given.

Unless a *substantial* illness or family emergency is documented with a note from a physician or the dean's office, no make-up exams will be given. Any potential absences must be discussed with Dr. Sitz *prior* to the exam in order to have a make-up.

This course carries the Quantitative Reasoning (QR) flag. As per the Registrar:

> Courses with the Quantitative Reasoning Flag help you build skills necessary for understanding quantitative arguments in your adult and professional life and engaging critically with our data-rich world. Courses carrying the Quantitative Reasoning Flag use real-world examples to help you understand numbers and use them to reason at a sophisticated level.

This course also qualifies as a Core Component, specifically the natural science and technology part I or II.

The University of Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, see:

`http://ddce.texas.edu/disability/about/`

or contact Services for Students with Disabilities at 512-471-6259.

## Quotes

"All things are made of atoms - little particles that move around in perpetual motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another. In that one sentence ... there is an enormous amount of information about the world. " - Richard Feynman

"In classical physics it was always assumed that clocks in motion and at rest have the same rhythm, that rods in motion and at rest have the same length. If the velocity of light is the same in all coordinate systems, if the relativity theory is valid, then we must sacrifice this assumption. It is difficult to get rid of deep-rooted prejudices, but there is no other way." - Albert Einstein (1938)

"In the autumn of (1905) ... Einstein published a paper which set forth the relativity theory of Poincare and Lorentz with some amplifications, and which attracted much attention" - E. T. Whittaker (1953)

"How often have I said to you that when you have eliminated the impossible, whatever remains, however improbable, must be the truth?" - Authur Conan Doyle

"Je n'avais pas besoin de cette hypothése-lá". -Pierre-Simon Laplace

| Syllabus | | | | |
|---|---|---|---|---|
| Week | Day | Book | HW/Exam | Topics |
| Jan. 21 | M | | | no class |
| | W | 1.1-1.3 | | Kinds of matter, interactions |
| | F | 1.4-1.7 | | Newton's First Law |
| | Su | | HW 0 math review | Velocity, Acceleration |
| Jan. 28 | M | 1.8-1.10, 2.1 | | Momentum |
| | W | 2.2-2,5 | | Prediction of motion |
| | Th | | HW 1 1.1-1.10 | |
| | F | 2.6, 2.8, 2.10, 4.10 | | springs, changing forces |
| | Su | | HW 2 2.1-2.5 | |
| Feb. 4 | M | 3.1-3.5 | | fundamental forces |
| | W | 3.7-3.9, 3.13-3.17 | | electric, strong, weak forces |
| | Th | | HW 3 2.6, 2.8, 2.10, 4.10, 3.1-3.5 | |
| | F | 3.10-3.12 | | collisions |
| | Su | | HW 4 3.7-3.9, 3.13-3.17 | |
| Feb. 11 | M | 4.1-4.7 | | atomic concept of materials |
| | W | 3.7-3.9, 4.8, 4.9, 4.14 | | friction |
| | Th | | HW 5 3.10-3.12, 4.1-4.7 | |
| | F | | | review |
| | Su | | Practice Exam | |
| Feb. 18 | M | 4.11-4.13 | Exam One | harmonic motion |
| | W | 4.15-4.17 | | harmonic motion |
| | Th | | HW 6 4.8, 4.9, 4.14 | |
| | F | 5.1-5.14 | | free-body diagrams |
| | Su | | HW 7 4.11-4.13, 4.15-4.17 | |
| Feb. 25 | M | 5.5-5.7 | | changing momentum |
| | W | 5.8-5.10 | | curving motion |
| | Th | | HW 8 5.1-5.4 | |
| | F | 6.1-6.3 | | energy, work |
| | Su | | HW 9 5.5-5.10 | |
| Mar. 4 | M | 6.4-6.6 | | energy, work |
| | W | 6.7-6.9 | | potential energy |
| | Th | | HW 10 6.1-6.6 | |
| | F | | | review |
| | Su | | Practice Exam | |
| Mar. 11 | M | 6.10-6.14 | Exam Two | potential energy |
| | W | 7.1-7.3 | | spring potential energy |
| | Th | | HW 11 6.7-6.14 | |
| | F | 7.4-7.7 | | internal energy, heat capacity |
| Mar. 18 | M-F | Spring Break | Spring Break | Spring Break |
| | Su | | HW 12 7.1-7.3 | |
| Mar. 25 | M | 7.8-7.10, 7.12 | | energy and air drag |
| | W | 8.1-8.3 | | photons, energy levels |
| | Th | | HW 13 7.4-7.10, 7.12 | |
| | F | 8.4-8.10 | | vibration and rotation, lasers |
| | Su | | HW 14 8.1-8.10 | |
| Apr. 1 | M | 9.1-9.2, 9.5 | | center of mass, rotation |
| | W | 9.2-9.4, 9.6 | | moment of inertia |
| | Th | | HW 15 9.1, 9.2, 9.5 | |
| | F | 10.1-10.5 | | collisions |
| | Su | | HW 16 9.2-9.4, 9.6 | |

| Syllabus (continued) | | | | |
|---|---|---|---|---|
| Week | Day | Book | HW/Exam | Topics |
| Apr. 8 | M | 10.6-10.8,, 10.10-10.12 | | collisions, Rutherford scattering |
| | W | 11.1-11.2 | | angular momentum |
| | Th | | HW 17 10.1-10.8, 10.10-10.12 | |
| | F | | | review |
| | Su | | Practice Exam | |
| Apr. 15 | M | 11.3-11.4 | Exam Three | torque |
| | W | 11.5-11.6 | | angular momentum |
| | Th | | HW 18 11.1-11.4 | |
| | F | 11.7 | | statics |
| | Su | | HW 19 11.5-11.6 | |
| Apr. 22 | M | 11.8-11.9 | | rotational dynamics |
| | W | 11.8-11.9 | | rotational dynamics |
| | Th | | HW 20 11.7 | |
| | F | 11.11-11.13 | | quantization, Bohr atom, spin |
| | Su | | HW 21 11.8-11.9 | |
| Apr. 29 | M | 12.1-12.2 | | statistical mechanics |
| | W | 12.3-12.4 | | thermal equilibrium, entropy |
| | Th | | HW 22 11.11-.13, 12.1-.2 | |
| | F | Review | | |
| | Su | | Practise Exam | |
| May 6 | M | 12.5-12.6 | Exam Four | temperature |
| | W | 12.8-12.9 | | Boltzmann distribution |
| | Th | | HW 23 12.3-.6, 12.8-.9 | |
| | F | Review | | |