**Engineering Physics I (PHYS 213)** **Spring 2022** **Kansas State University**

**Overview:** This first half of Engineering Physics introduces fundamental topics in Mechanics (kinematics, forces, accelerated motion, momentum, energy, rotation, static equilibrium, gravity, fluids) and Thermodynamics (temperature, heat, engines, refrigeration).

Since many of you are planning on an engineering or related career, we are hoping this course will not only enlighten your view of the world but actually be useful to you in your work some day, especially considering the wide range of technology we use that is based on mechanical and thermal phenomena.

The course is a combination of lectures with demos plus studios with lab demos and problem solving, homework, and exams. As well as a Lecture section and the Quiz section, you must be enrolled in one of the studio sections that meet twice per week. Any material from the lectures or the studios may appear on the Exams.

**Text:** The free OpenStax *University Physics*, Volume 1 (Chs. 1–14) & Volume 2 (Chs. 1–4).

**Instructor:** Prof. Gary Wysin, Cardwell 309, wysin@ksu.edu, `http://www.phys.ksu.edu/personal/wysin/`, Office Hours: MW 2:30-4:20, and F 2:00-4:00 on exam days, see the Schedule, or by appointment.

**Course websites:**
See `http://www.phys.ksu.edu/personal/wysin/EPI/` for lecture summaries.
See `http://theexpertta.com` for information about online homework system ExpertTA.
See `http://k-state.instructure.com` for current information, scheduled actitivites, grades, and announcements.

**Grading:** On a 1000 point scale, this is the grading system.

| **Points Allocation:** | | **Grade Assignment:** | |
|---|---|---|---|
| Homework | 200 | 1000 – 901 | A |
| Studio labs | 100 | 900 – 801 | B |
| Studio problems | 100 | 800 – 701 | C |
| Chapter Exams | 400 | 700 – 601 | D |
| Final Exam | 200 | 600 – 0 | F |
| Total points | 1000 | | |

**Lectures:** Lectures (MW 12:30 or 1:30) are important. They contain an overview of the topics, some demos and some problem solving. They let me know whether you are understanding things. You may not be able to do the homework or studio activities if you don't get the basic information from lectures. Summaries of the ideas are available at the website listed above.

**Studios:** You must be enrolled in a studio (various times). Each **studio** session involves completion of a hands-on lab activity and short report, completion of problem(s) worked out in studio, and examples of problem solutions or explanations of concepts by your studio instructor. Your studio instructor will describe what you need to do there.

**Homework:** There are online homework assignments in ExpertTA associated with each lecture/studio combination. Consider them as a review of what you learned. Access them through the homework assignment links inside Canvas, so that your grades will be synchronized correctly. **Do Not** login directly to the Expert TA website. When you access the first homework assignment through Canvas, you will be taken to an Expert TA registration page.

**Exams:** The best 4 out of 5 **Chapter Exams** (some Fridays in CW at 4:30) will contribute to your grade. You must take the comprehensive **Final Exam** (Thursday, May 12, 6:20–8:10 p.m.) to pass the course. **No makeup exams will be given.** On all Exams, make sure you give a clear presentation of your work, make sure numerical answers have the correct units! If you feel something has been graded unfairly, you can request regrades of your **exams** by your studio instructor within 5 school days of receiving the graded exams. Your studio instructor has the option either to regrade part or all of your exam. Please be reasonable and avoid making frivolous requests.

**Problem Solutions:** For solving problems, you should include the following strategic elements:

1) Diagram of the situation, showing masses, forces, velocities, accelerations, etc.
2) Known & Unknown quantities, including their Symbols & Units.
3) Concepts needed and their associated Symbolic Equations.
4) Solutions of those equations algebraically or with calculus.
5) Calculation of the Unknowns (insert numbers with units into your solution).
6) Discuss/Check whether the answer makes sense, or is it too big? Too small? Strange? Reasonable?

We ask you to use your algebra skills. That means using Symbols for physical quantities, and solving the problems

symbolically, and then only inserting numbers at the end. This provides a much more useful solution that can then be applied to different situations just by changing the numbers. It is better for an engineering way of thinking.

**Suggestions & Getting Help:**

- Ask questions in your lecturer's and studio instructor's office hours, we are there to help.
- Grad students answer questions in a help room in the Physics Department (see schedule in Canvas).
- Try not to get behind. Get to the homework quickly after lectures.
- There are old exams and quizzes with solutions on the lecturer's web site.

We hope you will find this a stimulating and challenging course. When in doubt about something (procedures or physics questions!) please make the most of all of your KSU resources; ask your lecturer or your studio instructor questions, after all, this is what you are paying for.

**Semester Schedule**

| Date | Lectures, Chapter & Topic (MW) | Date | Studio Lab Demos (TU \| WF) |
|---|---|---|---|
| Jan 19 | 1 Ch1 Measurements, units, uncertainties | Jan 20,21 | 1.1,1.3 Measurements and errors |
| Jan 24 | 2 Ch3 Straight-line motion & acceleration | Jan 25,26 | 2.1 Uniform acceleration |
| Jan 26 | 3 Ch3 Constant 1D acceleration, free fall | Jan 27,28 | 2.3 Acceleration due to gravity |
| Jan 28 | Exam 1 on V1 Chs 1,3 | | |
| Jan 31 | 4 Ch2 Vectors, addition, components | Feb 1,2 | 3.1,3.2,3.3 Vector operations |
| Feb 2 | 5 Ch4 2D, 3D & circular motion | Feb 3,4 | 4.1,4.3 2D & Projectile motion |
| Feb 7 | 6 Ch5 Forces, Newton's 1st & 2nd Laws | Feb 8,9 | 5.1,5.2 Static forces & normal forces |
| Feb 9 | 7 Ch5 Applying all of Newton's Laws | Feb 10,11 | 5.3,5.4 Two-body accelerated motion |
| Feb 14 | 8 Ch6 Friction forces | Feb 15,16 | 6.1,6.2,6.3 Friction on a mass |
| Feb 16 | 9 Ch6 Forces in circular motion | Feb 17,18 | 6.4,6.5,6.6 2-body motion; centripetal force |
| Feb 18 | Exam 2 on V1 Chs 2,4,5,6 | | |
| Feb 21 | 10 Ch7 Work and kinetic energy | Feb 22,23 | 7.1 Work and kinetic energy |
| Feb 23 | 11 Ch7 Work due to various forces | Feb 24,25 | 7.2a Spring energy to kinetic energy |
| Feb 28 | 12 Ch8 Conservation of mechanical energy | Mar 1,2 | 8.1,8.2 Gravitational potential energy |
| Mar 2 | 13 Ch8 Overall conservation of energy | Mar 3,4 | 8.4 Various energy transformations |
| Mar 4 | Exam 3 on V1 Chs 7,8 | | |
| Mar 7 | 14 Ch9 Center of mass; linear momentum | Mar 8,9 | 9.1,9.2 Center of mass |
| Mar 9 | 15 Ch9 Impulse, elastic & inelastic collisions | Mar 10,11 | 10.2,10.3 Momentum & linear collisions |
| Mar 14 | Spring Break - No Classes | Mar 14–18 | Spring Break - No Classes |
| Mar 21 | 16 Ch10 Rotational motion & acceleration | Mar 22,23 | 11.1,11.3 Rotational inertia, acceleration |
| Mar 23 | 17 Ch11 Rolling without slipping | Mar 24,25 | 12.1 Rolling |
| Mar 28 | 18 Ch11 Angular momentum $\vec{\mathbf{L}}$ | Mar 29,30 | 12.3,12.4 Conservation of $\vec{\mathbf{L}}$ |
| Mar 30 | 19 Ch12 Objects in static equilibrium | Mar 31, Apr 1 | 13.1,13.2 Equilibrium of objects |
| Apr 1 | Exam 4 on V1 Chs 9,10,11 | | |
| Apr 4 | 20 Ch12 Elasticity: Stress and strain | Apr 5,6 | 13.4 Elastic modulus |
| Apr 6 | 21 Ch13 Newton's gravity; orbits | Apr 7,8 | 14.1b,14.2 Orbital motion; weightlessness |
| Apr 11 | 22 Ch14 Fluid statics: pressure, buoyancy, etc. | Apr 12,13 | 15.1,15.2 Density; air pressure |
| Apr 13 | 23 Ch14 Fluid flow & energy conservation | Apr 14,15 | 15.3,15.4 Buoyancy, floating |
| Apr 18 | 24 Ch14 Fluid dynamics: viscosity | Apr 19,20 | 15.5,15.6 Bernoulli effects |
| Apr 20 | 25 V2 Ch1 Temperature and heat | Apr 21,22 | 19.1,19.2 Expansion; mechanical heat |
| Apr 22 | Exam 5 on V1 Chs 12,13,14, | | |
| Apr 25 | 26 V2 Ch2 Ideal gases & kinetic theory | Apr 26,27 | 20.1,20.2 Ideal gas laws [$p(T)$ and $V(T)$] |
| Apr 27 | 27 V2 Ch3 Energy, 1st Law of Thermodyn. | Apr 28,29 | 19.3,19.4 Latent heat, heat capacity |
| May 2 | 28 V2 Ch4 Entropy, 2nd Law of Thermodyn. | May 3,4 | 20.4 Adiabatic compression |
| May 4 | 29 V2 Ch4 Entropy, engines, refrigeration | May 5,6 | 19.7 Brayton heat engine |
| May 12 | Comprehensive Final Exam, 6:20–8:10 p.m. | | |

**Required University Statements about behavior in class**

KSU requires various statements on course syllabi. Please inform yourself on the full statements at `https://www.k-state.edu/provost/resources/teaching/course.html`. Here they are in highly condensed form:

**Academic Honesty:** Do your course work honestly and without unauthorized aid. If you cheat it can have serious negative consequences for your academic career and beyond.

**Disabilities:** If you need classroom accomodations for a wide range of disabilities please contact your instructors and the Student Access Center at accesscenter@k-state.edu, 785-532-6441.

**Classroom Conduct:** Don't disrupt the class.

**Mutual Respect & Inclusion:** Students (and instructors) all come from different backgrounds but we all want to be treated equally, fairly and with respect. Be open to receiving and giving diverse points of view and ideas.

**Face Coverings:** The KSU policy on face coverings keeps changing. As of early January Kansas State University requires that everyone must wear masks while indoors on university property, unless alone in their own private offices or workspaces.

**Other Statements about behavior in class**

**More on Academic Honesty:** Use of any kind of **solution manual**, online websites, online apps, online sites where problems are solved for you by others, or copying or posting of solutions to/from online sites, for doing homework, labs, recitations, quizzes, or exams is an **unauthorized aid**. These are serious violations of the honor code and the damage to your career for such violations is much greater than any possible advantage you might get from using them. Remember that digital data has a lot of tracking. These websites also have an honor code and they share data with KSU, so you can be caught. You are training to be a professional and your personal integrity is at stake. Don't jeopardize your future for a few points, it is not worth it in the long run. It is better to be honest, and do your own work. Someone has to know something, and be the expert, why not you?

**Academic Freedom:** Discussion of new, controversial, or non-mainstream ideas is a way to find new knowledge and is embraced in a University environment.

**Mental Health:** Many events or stresses in university life may lead to mental health issues that interfere with a productive life. If you are struggling, please seek assistance, such as at Kansas State University Counseling Services (`https://k-state.edu/counseling/`) and other services.