

## COURSE SYLLABUS -- Physics 4304, *Mechanics*, Spring, 2009

12:00 noon -12:50 pm, Monday, Wednesday, & Friday, Science Room 010

**Instructor: Dr. Charles W. Myles**, Professor of Physics, **Office:** Sc. Rm 18. **Phone:** 742-3768.

**Office Hours:** Right after class plus 3pm-4pm MWF & *by appointment*.

**Web Page:** <http://www.phys.ttu.edu/~cmyles/>. **Email:** [Charley.Myles@ttu.edu](mailto:Charley.Myles@ttu.edu). An email distribution list will be developed & we can have discussions (homework, etc.). I make **important announcements** by email! *It's vital that I have your correct email address & that you check your email DAILY!*

**Course Web Page:** <http://www.phys.ttu.edu/~cmyles/Phys4304/4304.html>. There, you can find this Syllabus, Homework solutions, old exams & solutions, Lectures (Power Point) & **IMPORTANT ANNOUNCEMENTS**. **Please get into the habit of checking this page often!** As TTU students, you can get Power Point & Word for *free or almost free!* The page <http://www.phys.ttu.edu/~cmyles/Phys1306/PPT.txt> tells you how.

**Course Objective:** To introduce students to *classical mechanics* & its applications & for them *to learn the fundamentals of this important topic*. See list of Course Objectives (Learning Outcomes) for more details.

**Student Responsibilities:** *Come to class prepared, do the homework, READ the material BEFORE I lecture over it, and keep up as we go along.*

**Textbook:** *Classical Dynamics of Particles and Systems*, by J.B. Marion & S.T. Thornton (M&T below). Harcourt-Brace, Publishers, 5<sup>th</sup> ed. **This book is REQUIRED!** You must have the latest (5<sup>th</sup>) edition! I use it because it has nice explanations of key concepts. Major portions of the course will use it. Bookstores have it. It is also available from various vendors on-line. Topics will be discussed in approximately the same order as the table of contents, but material from sources other than this book may be used. A search finds new & used copies & hardcover & paperback versions. Google gets 2,120 hits with prices ranging from \$59-\$290!! **I strongly encourage you to shop & find the best price for you!** Given the cost, don't you think you should **READ IT???**

**Supplements:** *Many* books on mechanics at various levels of depth & difficulty exist. In Rm.18, I have a shelf full! The library has more. Mine are available to look at & check out. Just ask! In a **junior-senior majors course, I expect you to go to sources other than the text** to obtain different treatments of the material!

**Physics & Math Level:** This is the standard (nationwide) *junior-senior* mechanics course for Physics & Engineering Physics majors. The math level is that of a junior/senior physics course. Differential equations & vector calculus are assumed. A *goal* is to emphasize physical understanding over math. I may skip some math details in favor of discussing *physics*. This is **NOT** a math course. If there is a math point you don't understand, *please* ask me about it & *read about it on your own!* It is **important** that you not let the math get over your head to the extent that you lose sight of the **PHYSICS**.

**Lectures:** From M&T, sometimes supplemented by material from others. See (& **USE!**) also sections titled "Selected References" & "Bibliography" at end of M&T!!!

**Course Topics:** Topics must be covered rapidly! *An approximate* schedule is below. A *goal* is to cover (some as overview only) Chs. 1-8 & selected topics from Chs. 9-14.

**Grades; Exams:** Grades will be based on: 3 Exams (including Final) = 75% (3 × 25%); Library Research Project & Paper = 25%; Homework = 25%. For 100%, the lowest exam grade will be dropped. For Exams I & II, we'll try to arrange for evening exams, so that more than 1 hour can be taken. The Final is non-comprehensive & counts equally with the others. An Exam is dropped, so ***no make ups will be given!*** Exam material is taken from text, homework, & all topics discussed in class. Homework & Library Research Project will **NOT** be dropped!

**Homework:** (Note the high %!). Problems from our book & from other sources will be assigned regularly. Doing them is your best means of learning physics! It's **IMPOSSIBLE** to do so without working problems! Homework is ***due in my mailbox (or office) at 5pm the due date.*** To keep up, do assignments as soon as the material is covered. Problems are **NON-TRIVIAL!** If you wait to the last minute (or day!) to begin, you likely will run into trouble! ***No late homework will be accepted!*** Homework may be done individually or in consultation with others in the course. **I ENCOURAGE groups; this is how scientists work in real situations!** However, **NO CONSULTATION** with people who had this course previously is allowed! **NO** use of problem solutions posted in previous years is allowed! It does you no good to copy old solutions! Copying solutions will **NOT** teach you physics! On the web, there exist solutions to some or all of the problems in our text. Copying these (or copying solutions from previous years!) & handing them in as your own is **CHEATING!!** Anyone caught cheating will, ***at minimum,*** receive an "F" in this course! TTU has strict policies against cheating & severe penalties for it, including expulsion from the university. Cheating also defeats the purpose of solving problems, ***which is to TEACH you physics.*** You should know by now that the **ONLY** way to learn physics is to

**DO PHYSICS YOURSELF** (or with friends) by **WORKING MANY, MANY, MANY PROBLEMS!!**

**Library Research Project & Paper:** On an advanced mechanics topic or application that we don't have time for in class. Due near semester's end. **Have the topic picked by mid-semester!** Topics must be approved by me before you begin. The paper should be 5-10 typed pages & written in the style of a scientific paper, with all (**several**) sources (mainly from outside the textbook) properly cited. Ideas on topics may be found on the web page containing student papers from 2004:

<http://www.phys.ttu.edu/%7Ecmyles/Phys4304/papers.html>.

**Helpful Hints:** This course is sometimes very difficult for students. This is partially because it is mathematical & partially because it is (in places) abstract. Unless you are a genius, the only way to succeed in this course is by ***very hard work!*** This means devoting ***MANY hours*** outside of class for every hour in class. It also means at **trying** to work all assigned problems!

**Attendance:** I don't take roll & I have no specific attendance policy. However, isn't it obvious that (unless you are a genius) class attendance is required to get a good grade? If attendance appears to become a problem, I reserve the right to institute brief daily quizzes, to be added into the above mentioned homework grade.

**Approximate Grade Scale:**  $100 \geq A \geq 88 > B \geq 75 > C \geq 60 > D \geq 50 > F \geq 0$

**NOTE:** *I reserve the right to slightly alter these cutoffs! I also reserve the right to assign a higher grade to anyone whose efforts may not be reflected in their total points. This decision is mine alone to make. You cannot receive a lower grade than indicated by the total points.*

**General Comments:**

1. Each chapter, we will try to spend at least one-half lecture period working problems.
2. If necessary & desired by the class, we may schedule special problem solving sessions outside of regular class time.
3. The exams will be approximately evenly spaced throughout the semester (see tentative schedule).
4. For the exams, you can bring in an 8½" × 11" sheet with anything written on it.
5. I expect you to come to class prepared, to have read the material before I lecture over it, & to keep up as we go along. No "cramming" before an exam!

**Approximate Lecture Schedule**

<b><u>Chapter, Title</u></b>	<b><u>Approx. No. of Lectures</u></b>
1. Matrices, Vectors, and Vector Calculus (Not covered in detail. <i>Review?!!</i> )	0.5
2. Newtonian Mechanics --- Single Particle	3.5
3. Oscillations	4
4. Non-linear Oscillations and Chaos	3
5. Gravitation	4
6. Some Methods in the Calculus of Variations (overview only!)	1
7. Hamilton's Principle --- Lagrangian and Hamiltonian Dynamics	5
8. Central-Force Motion	4
9. Dynamics of a System of Particles	4
10. Motion in a Noninertial Reference Frame	3
12. Coupled Oscillations	4
14. <u>The Special Theory of Relativity</u>	5
<b>TOTAL</b>	<b>41</b>

Not meant to be rigid, but gives an idea where we are going. Some topics in may be omitted.

**TENTATIVE (!) EXAM DATES:** **Exam I:** Chs. 1-4, Week of Feb. 4; **Exam II:** Chs. 5-8,

Week of March 4; **Final Exam:** Chs. 9, 10, 12, 14, **Tues., May 5, 1:30pm!!!**

**OTHER IMPORTANT DATES:** **Mon, Jan 19:** ML King Day, **NO CLASS!!** **Wed, Feb 4:** Last withdraw date-partial refund. **Wed, March 4:** Mid-Semester. **Wed, March 11:** Last drop/withdraw date. **Sat, March 14-Sun., March 22:** Spring Break, **NO CLASS!!** **Mon, April 13:** "Easter Monday", **NO CLASS!!** **Tues, April 28:** Last class. **Tues, May 5:** Final Exam! **Times I'm gone:** I'll be out of town a few times. I'll try to get a substitute.

**ACADEMIC INTEGRITY:** Academic dishonesty (cheating, plagiarism, etc.) will not be tolerated. Students caught in this type of behavior will be punished to the fullest extent allowed by TTU. See the TTU Student Handbook or the Catalogue.

**CIVILITY IN THE CLASSROOM:** Students are expected to assist in maintaining an environment which is conducive to learning. To assure that all students have an opportunity to gain from class time, students are prohibited from using cell phones/beepers, eating/drinking in class, making offensive remarks, reading newspapers, sleeping or engaging in any other form of distraction. Inappropriate behavior in the classroom shall result in, minimally, a request to leave class.

***Any student who, because of disabling conditions, may require some special arrangements in order to meet the course requirements should contact the instructor as soon as possible so that necessary accommodations can be made. Proper documentation must be presented from the Dean of Students Office!***

### **PARTIAL listing of some World Wide Web resources on Mechanics**

There is a lot of material on the web which is potentially useful for classical mechanics. I've not had time to check out the details of most of these. I list some here just to give you an idea what is out there and to help you to get started searching. You might search on particular topics as we get to them in class. If you do this & find sources that are interesting, please let me and / or the rest of the class know by email or orally in class. Thanks! For example, below, I have used the general topics "Classical Mechanics" and "Classical Dynamics" in the Search engines.

#### **A. General Physics resources which might give useful mechanics links.**

1. **Physics Web** (a web site devoted to all kinds of physics!). Go to <http://physicsweb.org/>. At the top of the page, there is a Physics Search Engine. (This is based in the U.K., so it has a U.K "flavor"). Put in "Classical Mechanics" & click "Find". This gives 81 sources! "Classical Dynamics" gives 90 sources. For both, these range from elementary to advanced.
2. **THE AMERICAN PHYSICAL SOCIETY.** Go to <http://www.aps.org>. Click on [Physics Internet Resources](#). Follow links to Classical Mechanics. There are a lot of other links that can be followed, but I've not taken the time. **NOTE:** APS is a 40,000 + member organization of physicists from around the world. Everyone who wants to be a professional physicist should join! If you are not a member, you should join. There is **NO** excuse for not doing this! **For students, the 1<sup>st</sup> year's membership is free!** (ask the office for an application form). You get free [Physics Today](#), [APS News](#) and discounted journals.
3. **GOOGLE SEARCH ENGINE.** Go to <http://www.google.com/>. Type in "Classical Mechanics". The search engine claims that 273,000 web pages were found! "Classical Dynamics" gave 343,000 web pages! Other search engines are obviously also possible for such a search.

#### **B. Web pages with interactive Java Applets in classical mechanics.**

Below, are a few pages I have found which have Java Applets or "Physlets" which have interactive exercises which might be useful in learning some basic mechanics. These are only the ones which I found after searching for about an hour. There may be others. **I urge you to try some of these out and to try to find others.** If you find some which are particularly interesting, please share them with me & the class! Thanks. These Applets can be fun and entertaining (especially for you, "the video generation"), as well as educational! Unfortunately, most of these that I found are at the elementary (freshman / sophomore) level. Please let me know if you find some more advanced ones.

**Real Time Acceleration and Velocity Applet:** [http://users.erols.com/renau/velocity\\_applet.html](http://users.erols.com/renau/velocity_applet.html)

**Index, Applets by M. Fowler:** [http://www.phys.virginia.edu/classes/109N/more\\_stuff/Applets/home.html](http://www.phys.virginia.edu/classes/109N/more_stuff/Applets/home.html)

These include: Newton's Cannon, projectile motion, two dimensional collisions.

**Pendulum Applet:** <http://monet.physik.unibas.ch/~elmer/pendulum/index.html>