

Syllabus

The Physics and Technology of Energy

Physics 200Lxg

2017 Fall

MWF 9-9:50

SGM 226

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Office Hours: MWF 8:00-8:50, and by appointment, during the instructional phase of the semester. (This excludes midterm exam days and finals weeks.) Teaching assistants are available in ACB 431 during most times between 10 and 4 each weekday except Friday, during the instructional phase of the semester.

Course Description: Investigation of energy technologies, including development and implementation issues. Topics include the industrial revolution, electromagnetic induction, power transmission, combustion engines, fission and fusion.

Text: ENERGY – Its Use and the Environment (5th ed.) by Roger A. Hinrichs & Merlin Kleinbach, published in 2012 by Thomson Brooks/Cole, ISBN-13: 978-1-111-99083-1. The text is also available electronically and may be rented. **Do not acquire a previous edition.**

Introduction & Objectives

WELCOME TO PHYSICS 200! This general education course is designed for the non-physics major with little, if any, previous background in the sciences and college-level mathematics. Nevertheless, physics is a quantitative discipline, like finance, and you must utilize your arithmetic and basic algebraic training in this course. This is an evolving course, and this semester its laboratory component may include not only experiments, in which your participation will give you a better understanding of measurements and quantitative reasoning, but possibly also some computer simulations.

The central topic of this course is of energy. Everybody has some idea of what the word energy means. For those who enjoy sports, *energy* has a clear meaning. Although that idea of energy is in common use, in this course we shall restrict its meaning somewhat. One early goal of this course is to develop another intuitive sense of what energy is – the crucial sense from a physicist's perspective. Another goal, supplementing that intuitive sense, is to understand the numbers and units involved in dealing scientifically and technologically with energy. Numbers play an important role because the scale of the energy needed to keep our society functioning, as well as the majority of the population desires, is huge. (How much of the nation's energy supply does a supertanker sitting in San Pedro Harbor represent?) Commercially, energy is measured in strange units - barrels of oil, tons of coal, cubic meters of gas, megawatt hours of electricity, etc., and we need to know the implied assumptions involved in converting such units to a universal standard, such as scientific units.

A third goal of the course is to understand “the energy problem”. Physicists insist that “energy is conserved” as a law of nature. So why do individuals, groups, organizations, nations, and trans-national bodies devote so much attention to “the energy problem” and “conserving energy”?

The most important goal may be to understand why “the energy problem” has not only scientific and technological components, but also environmental and economic components, which drive political components, and to understand the fundamental differences between the

natures of the natural sciences and those of other disciplines such as economics and political science. There are interesting technological and fundamental scientific aspects of “the energy problem” that should be understood by all who wish to participate in the formulation of energy policies. In this vein, we need to address the consequences of energy transformations, such as the depletion of resources, the generation of pollution, and economic development..

Textbook

We will aim to cover the scientific and technological material in the selected textbook: *Energy – Its Use and the Environment* by Hinrichs & Kleinbach (Thomson 5th Edition). You should get a printed copy of the text, or electronic access to it, without delay.

Internet Access

In addition to the text, I will suggest web sites where you should look for further information. **It is especially important that you can access web sites, and have an email account, which you check frequently. If you do not have such Internet access, please see me for assistance.**

I would like to have students on the Internet searching for new and interesting sites. I have accumulated several, but there are many more. I seek feedback on how you feel the course can be improved as we progress. What was interesting and what was not? What do you not understand?

Course Web Site

The primary electronic means of individual communication for this course is email. However, we also will use a site for general course information called “Blackboard”, which is located at <https://blackboard.usc.edu/webapps/login>.

If we change to use this site also as the major site for individual electronic communication, we shall notify all registered students in class and via email.

Laboratory

A laboratory component is included in Physics 200 as part of the university's general education requirement. The lab sections meet for the first time during the week of August 21 and will take place every other week (i.e. the second laboratory meeting will take place during the week of September 04 and so on). The lab workbook and syllabus will be handed out during the first lab session. The lab accounts for 20% of the total course grade. **The grading criteria for the lab will be discussed during the first session. You must pass the lab in order to pass the course.**

For all issues regarding the laboratory component of this course, you should contact the laboratory director, Joseph Vandiver vandiver@usc.edu, 213-740-8889. Or go see him in SGM 309.

Exams & Quizzes

There will be two midterm exams and a final exam. All exams are closed book, although the aid of calculators is encouraged. The midterms will be given during the regular class and will cover material incrementally through the semester, and the final exam will be cumulative over the whole course. **There will be no make-up exams or quizzes given for any tests in this course. A missed exam probably will prevent you from passing unless you have approval from your professor before the exam because of an extreme emergency.**

The exams will be easier if you: 1) show up at all lectures and labs, 2) study very carefully the assigned reading, testing your reading by reviewing the questions at the end of each chapter, and 3) pay attention to the material presented during those sessions, especially my discussions of examples. Did I say show up? I really want you to show up for the lectures. A physics course is definitely not the type of course where you can skip the lectures and cram for the exams, and this course covers material **NOT** in any textbook, because the topic of energy is interdisciplinary, with natural science, engineering, social science, business, and even humanities components.

The examinations are based mainly upon material in the textbook. However, the exams are based not only upon textbook material, but also upon material presented during the lectures **that is not the same as the material in your textbook.** In the lectures, often I shall be presenting material complementary to the material in the textbook, so to achieve a good grade, **it is very important that you study carefully the assigned reading and exercises in the textbook AND pay close attention to the lectures,** in addition, of course, to conscientiously participating in the laboratory sections.

Although attendance in the lectures is not a factor in grading, the quizzes are a factor in grading. They will not be announced in advance, and they will be given randomly. The quizzes will cover material discussed in the current and very recent lectures.

Homework

Reading and homework assignments will be made weekly, on the BLACKBOARD web site. I strongly suggest that you work independently on the homework assignments at the end of each chapter, which I shall delineate. This is the best way for you to master the material, and consequently it is your very best way to prepare for the exams. **Late homework will be accepted, but the score will be reduced as a penalty, unless there exists a strong reason to grant an exception.**

Office hours

I really want to see students during office hours. The office hours are currently those listed at the top of this syllabus. If they are changed, temporarily or permanently, I shall notify students via email and in a class. If these hours don't work for you, please let me know and I may adjust them depending on the needs of the majority. In any case, you can always email me or call me to schedule an appointment.

Grading

The elements of the grade for this class are homework, random quizzes, laboratory performance, midterms and final exam. The percentages for the final grade will be: homework –

25%, random quizzes – 7%, midterm 1 exam – 12%, midterm 2 exam -12%, final exam - 24%, lab work - 20%. **Although the lab component counts for only 20% of the final grade, you cannot pass this course if you fail to pass its laboratory component.**

I am available to discuss the grading of quizzes and exams during office hours.

Deadlines are important, and no makeup exams or quizzes will be given. Without a doctor's explanation, or similar substantiated serious excuse, for a missed deadline or examination, the exam will not be graded, and no provision will be considered to compensate for the missed exam.

In order to receive a passing grade in the course (D and above, or C- and above if you choose the P/NP option) you must receive a passing grade in both the Lecture and the Laboratory portions. Some semesters one or more students fail to complete the laboratory experiments and consequently fail the entire course – please don't let this happen! If you miss a lab, make sure to arrange a lab make-up as soon as possible with your T.A.

Assistance

You have a variety of opportunities for assistance available to you. Please seek it immediately if you are having difficulties with this course.

A) LECTURE: Don't underestimate the value of questions during the lecture period. In large lectures, many students are reluctant to pose questions, which they fear may seem silly to either, their peers or the instructor. Almost always, if one student asks a question, there are several other students who have been bothered by the same question. Often such questions tell the instructor what is not clear to the students. A portion of each week's lecture time will be devoted to illustrative examples including some from the assigned homework. Some of them may also appear later on some of the exams.

B) OFFICE HOURS: You are always welcome to stop by my office should you have any questions. My office hours are listed at the top of this syllabus. However, if you are unable to make those times, please feel free to make an appointment convenient for both you and me, or stop me after class.

C) LABORATORY TAs: All laboratory-teaching assistants are graduate students, usually pursuing a Ph.D. in Physics. They are all capable of answering any questions you have regarding subject material. Usually your lab TA can answer questions immediately, either at the beginning or at the end of the lab period. However, some problems you pose may require some additional thought. In either event, you should regard your TA as a resource not only for the laboratory, but also for the lecture-related questions. Your lab TA will also have office hours for assistance. All lab TA's have office hours in ACB 431 for the assistance of students in all 100 & 200 level physics courses. With only few exceptions, the office will be occupied by at least one TA from 10 a.m. to 4 p.m., Monday through Thursday, during every University working day through the last day of classes. You may ask questions to any TA, not only your own. The schedule of every TA's hours will be constructed during the first week of classes and will be posted outside the room.

Academic Integrity

The use of unauthorized material, communication with others during an examination or quiz, attempting to benefit from the work of another student, and similar behavior that defeats

the intent of an examination quiz, or other class work is unacceptable to the University. It is often difficult to distinguish between a culpable act and inadvertent behavior resulting from nervous tensions accompanying examinations. Where a clear violation has occurred, however, the instructor may disqualify the student's work as unacceptable and assign a failing score on the paper.

You should review the policies and procedures detailed in the section titled "University Sanction Guidelines" in the SCampus publication. These policies, procedures, and guidelines will be assiduously upheld when credible evidence of a violation exists. They protect your rights, as well as those of other students and the faculty. It is particularly important that you are aware of and avoid plagiarism, cheating on examinations and quizzes, fabricating data for a project or lab assignment, submitting a paper to more than one professor, or submitting work authored by anyone but yourself. Violations will result in penalties, which may be severe such as resulting in a failing grade in the course, and will be reported to the Office of Student Conduct. If you have doubts about any of these policies, you must confer with the professor.

Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Retention of Paperwork

Graded paperwork, if not distributed to a student in class, will be available in room 120-H HNB during regular university office hours. Such paperwork, if unclaimed by a student, will be discarded after four weeks and, hence, will not be available should a grade appeal be pursued by a student following receipt of his/her grade.

IMPORTANT DATES

Last Date to change to PASS / NO PASS or drop without a W - September 08

Mid Term Exam # 1 - September 29

Mid Term Exam # 2 - November 03

Last Date to drop with a W - November 10

Last Date of Classes - December 01

Final Exam - December 11

In addition to modifications of the proposed schedule, it may be necessary to make some other adjustments in the syllabus during the semester. The syllabus posted on the course website is the updated syllabus.

PROPOSED SCHEDULE AS OF 2017/08/05

Since no two classes are ever the same, you should expect that there might be changes to the schedule as the needs of the students in this class evolve. You are expected to study the reading assignments carefully before the class meetings.

Week	Reading	Topic	Homework Due Date
Aug 21	Ch 1	Introduction	Aug 30
Aug 28	Ch 2	Energy Mechanics	Sep 06
Sep 04		University Holiday	
Sep 04	Ch 3	Conservation of Energy	Sep 13
Sep 11	Ch 4	Heat and Work	Sep 20
Sep 18	Ch 6	Solar Energy: Characteristics and Heating	Sep 27
Sep 25	Ch 7	Energy from Fossil Fuels	Oct 04
Sep 29 1st Mid-Term Exam on Friday covering Ch 1-4			
Oct 02	Ch 5	Home Energy Conservation and Heat-Transfer Control	Oct 11
Oct 09	Ch 8	Air Pollution and Energy Use	Oct 18
Oct 16	Ch 9	Global Warming, Ozone Depletion, and Waste Heat	Oct 25
Oct 23	Ch 10	Electricity: Circuits and Superconductors	Nov 01
Oct 30	Ch 11	Electromagnetism and the Generation of Electricity	Nov 08
Nov 03 2nd Mid-Term Exam on Friday covering Ch 5-9			
Nov 06	Ch 12	Electricity from Solar Energy	Nov 15
Nov 13	Ch 13	Building Blocks of Matter: the Atom and Its Nucleus	Nov 20
Nov 20	Ch 14-5	Nuclear Power: Fission; Effects and Uses of Radiation	Nov 29
Nov 22-24		University Holiday	
Nov 27	Ch 16	Energy and the Economy; Future Energy Alternatives	
Dec 11 FINAL EXAM on MON, 11 a.m. to 1 p.m. in SGM 226, covering Ch 1-14			

1954-58 Undergraduate, California Institute of Technology, B.S.
1958-62 Graduate Student, California Institute of Technology, Ph.D.
1960-65 Consultant, Rand Corporation
1960-73 Senior Staff Physicist, Hughes Research Laboratory
1962-65 Richard Chase Tolman Research Fellow, California Institute of Technology
1963-65 Lecturer, California Institute of Technology
1965-66 Assistant and Associate Professor of Physics, University of California, Irvine
1966-69 Associate Professor of Physics and of Electrical Engineering, USC
1966-70 Member, University Finance Advisory Committee, USC
1966-67 Member, University Computer Committee, USC
1967-74 Chairman, University Computer Committee, USC
1969- Professor of Physics and of Electrical Engineering, USC
1969-93 General Partner, Exponential Fund
1970-71 Consultant, Janus Management Corporation
1970-71 Member, University Resource Management Committee, USC
1971-73 Chairman, University Resource Management Committee, USC
1971-74 Consultant & Co-Founder, Croesus Capital Corporation
1971- Consultant & Co-Founder, Financial Horizons, Inc
1971- Chairman of the Board, Malibu Securities Corporation
1973-87 Dean of Natural Sciences and Mathematics, USC
1974-82 Allied Member of Pacific Stock Exchange
1974-81 Special Assistant to the President for Automated Record Services, USC
In Automated Record Services there were two units:
University Computing Services (a hundred-plus employees)
Academic Computing
Administrative Computing
Student Administrative Services (a hundred-plus employees)
Admissions Office
Financial Aid Office
Registration & Records Office
Testing Bureau
1979-81 Financial and Computer Consultant, Hollywood Reporter
1980- Who's Who in America
1982- Founder, Program in Neural, Informational, and Behavioral Sciences, USC
1987-89 Dean of Interdisciplinary Programs and Developmental Activities, USC
1987-88 Advisor, Emerging Engineering Technologies Division, National Science
Foundation
2015 International Biographical Centre – Top 100 Educators
2016- Who's Who in the World
2017 Who's Who Lifetime Achievement Award

Book:

Feynman Lectures on Gravitation, by Richard P. Feynman, Fernando B. Morinigo, and William G. Wagner, published by Addison-Wesley-Longman in 1995

Career Summary:

From 1959 to 1969, Dr. Wagner authored thirty-five articles in advanced field theory, elementary particle physics, quantum electronics and optics, in addition to his teaching responsibilities.

From 1969 to 1973, Dr. Wagner was active professionally in high-intensity optical beam research, securities research and investment management, and information system research and development, in addition to his teaching responsibilities.

From 1973 to 1987, Dean Wagner led the Natural Sciences & Mathematics Division of the University of Southern California. During that time, student enrollment in the Division rose 60%, extramural funding on an annual basis rose tenfold, and many outstanding scholars were recruited to the University, including several members of the National Academy.

From 1974 to 1981, Dean Wagner concurrently managed the central computing resources of the university, both academic and administrative, after having served as chairman of the University Computer Committee from 1967 to 1974.

At the end of 1974, Dean Wagner was asked to take charge of the administrative unit Student Administrative Services, because of a crisis in the processing of thousands of new student applications, which threatened the University with multi-million dollar loss. This loss was averted, and the university's entering class in 1975 was better than in 1974 as a result of the actions he devised and directed. For this effort, Dr. Wagner in 1975 was given the University's Award for Extraordinary Service.

Subsequently, until 1981, Dean Wagner continued to supervise the Student Administrative Services unit of USC. During that time, the University's applicant pool rose by more than 100%, academic measures of the student body rose, and automated on-line record systems for admissions, financial aid, and registration were successfully designed, developed, and implemented. These units handle all of the university's more than 25,000 students, undergraduate, graduate, and professional.

From the consideration of major academic issues in 1981, Dean Wagner conceived the idea of the University's Program in Neural, Informational (Cognitive), and Behavioral Sciences. In 1982, he recruited Dr. McClure to direct the Program, and subsequently they have worked closely together to raise private funds for the Program's new building and to recruit extraordinary scholars as the key faculty in the Program. From 1987 to 1989, Dr. Wagner devoted all of his efforts to the expansion of that Program in his role as USC's Dean for Interdisciplinary Programs and Developmental Activities.

In 1989, Dean Wagner returned to research on topics in neuroinformatics and on international finance and economics. In 1990, he returned to the teaching of Conceptual Physics, the Physics and Technology of Energy, Classical Mechanics, Introduction to Thermodynamics and Statistical Physics, Electricity and Magnetism, Advanced Classical Mechanics, Thermodynamics and Statistical Physics, Advanced Electricity and Magnetism, Quantum Mechanics, Advanced Quantum Mechanics, Methods of Computational Physics, and Topics in Current Research, while extending his research to include also cyclic phenomena in the US domestic economic, financial, and investment time series. Research methods developed originally to investigate complex systems in physics, such as the theory of chaos and chaotic dynamical systems, and research methods developed originally to attack problems in computer science and in the brain and behavioral sciences, or more generally in the cognitive sciences, such as adaptive pattern recognition techniques and neuroinformatic techniques (of which neural networks are an example,) are being increasingly applied to add significantly to our knowledge of previously hidden structure as a function of time in important economic, financial, and investment variables. Many of these variables are cyclic, but the cycles do not have fixed lengths, and the analysis of the strong nonlinear coupling between these variables in a dynamical system is crucial to an adequate description of the variability of these cycles.

QUESTIONNAIRE
PHYS 200 Lxg – 2017 Fall 9 a.m. MWF

Please complete and turn in the following:

NAME (printed) _____

NAME (signed) _____

UNIVERSITY ID NUMBER _____

MAJOR _____

USC E-MAIL ADDRESS _____

LOCAL PHONE (optional) _____

MATH COURSES TAKEN IN LAST FOUR YEARS

High school _____

College _____

SCIENCE COURSES TAKEN IN LAST FOUR YEARS

High school _____

College _____

WHAT ARE YOU HOPING TO LEARN IN THIS COURSE?

WHAT ARE YOUR HOBBIES?

HIGH SCHOOL?

CITY?

STATE or COUNTRY?