General Education Course Proposal

Proposed Course: Phys (Prefix) 100 (No.) Concepts of Modern Physics (Title) **Units** 3

Department: Physics **School:** Natural Sciences

GE Category (Indicate one category only):

Foundation: A1___; A2___; A3___; B4___

Breadth: B1___; B2___; C1___; C2___; D___; E___

Integration: B X ; C___; D___; International/Multicultural___

Existing Course___; **Revised Course**___; **New Course** X

Course Included in Current GE Program___

New courses require the Undergraduate Course Proposal form in addition to this form.

Revised courses require the Undergraduate Course Change Request in addition to this form.

Proposed catalog description: Limit course description to 40 words using succinct phrases. Include prerequisites, limitations, lecture/lab hours. Indicate former course number, e.g., (Former Biol 105)

Prerequisites: General Education Quantitative Reasoning and Area B Breadth Requirements. Conceptual development of relativity and quantum theory. Demonstration of abstract concepts with mechanical analogues, visualization with diagrams. Satisfies general education upper division science requirement. Integration Area B (3 lecture hours)

Enrollment limit per section: 40

Expected number of sections per semester – Year 1 1 ; Year 3 2

Attachments:

1. A statement presenting the ways in which this course meets the Specifications provided in the appropriate section of the General Education Policy as well as in the Policies for Inclusion and Evaluation of General Education Courses.
2. A statement of elements common to all sections of this course, identifying content, objectives, required student activities, grading policy, representative texts, and an approximate schedule for the course. Required student activities include such things as papers, research projects, homework, laboratory and/or studio performance, recitations, participation, attendance, and exams.
3. A typical syllabus for a particular offering of the course.
4. Any special cost factors associated with this course.

Approval for Inclusion in General Education

M. J. Zender — 9/11/98
Department Chair — Date

[signature] — 9/21/98
School Curriculum Committee — Date

Stanley M. [signature] — 9/22/98
School Dean — Date

[signature] — 12/15/98
General Education Subcommittee — Date

Brandt Kehoe — 12/22/98
Associate Provost — Date

1/14/98

Attachment # 2: General Syllabus

PHYS 100—Concepts of Modern Physics **SYLLABUS** Semester, Year
4 units Schedule #12345
Prerequisites: General Education Quantiative Reasoning and Area B Breadth Requirements.

Catalogue description: Conceptual development of relativity and quantum theory. Demonstration of abstract concepts with mechanical analogues, visualization with diagrams. Satisfies **General Education** upper division science requirement. Integration Area B (3 lecture hours).

Instructor: Name **Office Hours**: Instructor's office hours
Office: Instructor's office; Phone: Intructor's phone (Min: 5/week)
email: Instructor's email address
Department: MCL 169; Phone 278-2371

Texts: Abraham Pais, *Subtle is the Lord : A Scientific Biography of Albert Einstein* (Scribner)
Max Jammer, *The Conceptual Development of Quantum Mechanics* (McGraw-Hill)

Course Objectives: Two theories—relativity and quantum—have revolutionized physics early this century. Practical aspects range from nuclear bombs to lasers and transistors. The theories are very abstract, require advanced mathematics, and are highly counterintuitive, though. This course will demonstrates the concepts with mechanical analogues. Quantiative aspects are illustrated with diagrams. This prevents distractions by the many, highly mathematical technicalites and keeps the underlying concepts in focus. The development of the theories is presented in the historical and philosophical context. The close relationship with chemistry is emphasized.

Course Topics: Electricity, Magnetism, EM field dynamics, Light waves, Ether, Relativity Principle, Rel. length & time, Rel. mass & energy, Ideal gas, Kinetic theory, Statistical mechanics, Quantum states, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution, Heat radiation, Black-body spectrum, Quantized action, Photovoltaics, Line spectra, Bohr and Sommerfeld atom, Laser, Spin, Exclusion Principle, Correspondence Principle, Schrödinger Eqn, Particle in a box, Tunnel effect, Electron orbitals, Chemical bond, Electron gas, Semiconductors, Superconductivity Uncertainty Principle, Copenhagen Interpretation.

Homework: Doing your homework will give you important feedback to your understanding of the material and will prepare you for the exams. The instructor's homework policy is ...

Exams: Exams test memory, understanding and mastery of the material. The instructor's exam policy is ...

Term paper: A 4000-word term paper is due during the semester. Three drafts must be submitted as announced in the schedule. For more details see the write-up *Term Paper*.

Cheating and plagiarism will be dealt with according to University Policy *(Schedule of Courses)* Tape recording of lectures is allowed. If you have a **disability** affecting your performance in this course, please let me know so that accommodation can be made. If you **miss** a **class**, make certain you get class notes from another student. It is your responsibiliy to remain informed about schedule changes, homework solutions, etc.

Weighting:

Homework ..... Instructor's policy
Exams ..... Instructor's policy
Other ..... Instructor's policy
Term paper 30%
100%

Letter Grade:
Instructor's policy

Attachment #2, continued

TERM PAPER

A 4000-word term paper (about 14 double-spaced typed pages) is due during the semester. In order for the instructor to provide guidance and feedback, three drafts must be submitted on the corresponding due dates announced in the schedule. A 5% penalty (from the maximum of 30% for the paper) will be taken off for each late draft.

The 1st draft, must have (1) an outline of the paper, (2) a written introduction to the topic, (3) a bibliography of references at the end, and (4) a photocopy of one page from your major reference (clearly labeled). The draft will be returned with comments and suggestions for development and improvement.

The 2nd draft, *with the 1st draft attached,* must be the complete 4000-word paper along the outline of the 1st draft. The outline should *not* be repeated in the 2nd draft, as its purpose was only to structure the paper. Mistakes or deficiencies, noted by the instructor on the 1st (attached) draft, should be corrected and the comments for development and improvement should be followed. If not, points will be taken off correspondingly. The 2nd draft will be returned in Lab 11 with comments for further improvement.

The 3rd draft, *with the 2nd draft attached,* is the finished paper. Points will be taken off if suggested improvements, noted by the instructor on the 2nd draft, were not made.

PLAGIARISM, a prime academic sin, is when the *exact words* or *trivially rearranged words* from a literature source are used without attribution, that is, without quoting the source. If several students have identical or almost identical terms papers, obtained by copying from one another, than all those students will get no credit for their term papers and the procedure of plagiarism (which can lead to expulsion from college, see *Schedule of Courses*) will be invoked.

A GRADE of maximum **30 points** can be obtained for the term paper, depending on
STYLE (correct spelling, correct punctuation and clear syntax) and
FORMAT (title [=topic] of term paper, course, author [=your name], bibliography at the end, and one photocopied page of the major reference (with source clearly labeled).
Points will be taken off for deficiencies in style and format of the final (= 3rd) draft and for failures to make corrections as noted on previous drafts.

SUGGESTED TOPICS (use the library)
- Biography and contriution of a great modern physicist (Max Planck, Madame Curie, Albert Einstein, Arnold Sommerfeld, Ernest Rutherford, Niels Bohr, Paul Ehrenfest, Max Born, Werner Heisenberg, Wolfgang Pauli, Erwin Schrödinger, Paul Dirac, Lise Meitner, Lev Landau, Maria Goeppert-Mayer, Richard Feynman, ...)

Attachment # 3: Typical Syllabus

PHYS 100—Concepts of Modern Physics SYLLABUS Fall 1999
4 units Schedule #2535
Prerequisites: General Education Quantiative Reasoning and Area B Breadth Requirements.
MCL 162; MWF 9:10—10:00

Catalogue description: Conceptual development of relativity and quantum theory. Demonstration of abstract concepts with mechanical analogues, visualization with diagrams. Satisfies **General Education** upper division science requirement. Integration Area B (3 lecture hours).

Instructor: Dr. Manfred Bucher
Office: MCL 261; Phone: 278-2357
email: manfredb@csufresno.edu
Department: MCL 169; Phone 278-2371

Office Hours: T 11-12 & 3-4,
Th 2-4, F 2-3

Texts: Abraham Pais, *Subtle is the Lord : A Scientific Biography of Albert Einstein* (Scribner)
Max Jammer, *The Conceptual Development of Quantum Mechanics* (McGraw-Hill)

Course Objectives: Two theories—relativity and quantum—have revolutionized physics early this century. Practical aspects range from nuclear bombs to lasers and transistors. The theories are very abstract, require advanced mathematics, and are highly counterintuitive, though. This course will demonstrates the concepts with mechanical analogues. Quantiative aspects are illustrated with diagrams. This prevents distractions by the many, highly mathematical technicalites and keeps the underlying concepts in focus. The development of the theories is presented in the historical and philosophical context. The close relationship with chemistry is emphasized.

Homework: Doing your homework will give you important feedback to your understanding of the material and will prepare you for the exams. You should turn in HW from the HW manual on the assigned due days at the beginning of class. Mark your answers on Scantron Form 882 and write your name *(1st name 1st)*, Phys 100, set number, and class hour (but not your ID number and date) on the form. An answer&explanation key will be posted on the bulletin board left of MCL 175. Late HW will not be accepted. Your graded HW will be returned to you but no credit will be given. HW contributes only indirectly to your grade as it (1) prepares you for the exams and (2) some exam questions will be selected from the HW.

Exams: The mini exam, two midterm exams, and the comprehensive final exam are scheduled on p. 1. For each exam you need a Scantron Form 882, a #2 pencil and a plastic eraser. On the day of each exam, seating/version charts will be posted by the doors to the classroom. Exams are without textbook and without notes. If you have to miss one exam (except the final exam) for emergency reasons, then you will be automatically given the weighted average score of all your other exams —determined at semester end—for the missed exam.

Term paper: A 4000-word term paper is due during the semester. Three drafts must be submitted as announced in the schedule. For more details see the write-up *Term Paper*.

Cheating and plagiarism will be dealt with according to University Policy *(Schedule of Courses)* Tape recording of lectures is allowed. If you have a **disability** affecting your performance in this course, please let me know so that accommodation can be made. If you **miss** a **class**, make certain you get class notes from another student. It is your responsibiliy to remain informed about schedule changes, homework solutions, etc.

Weighting:

Homework	0%
Mini Exam	5%
Midterm Exams (2)	40%
Final Exam	25%
Term paper	30%
	100%

Letter Grade:

90% ≤	A ≤ 100%
77% ≤	B < 90%
64% ≤	C < 77%
50% ≤	D < 64%
	F < 50%

Attachment #3, continued

Monday	Wednesday	Friday
Sept 1 Intro PHYSICS 100	Sept 3 Electricity Assignment: Set 1	Sept 5 Magnetism Assignment: Set 2
Sept 8, No HW due EM field dynamics	Sept 10, Due: Set 1 Light waves Assignment: Set 3	Sept 12, Due: Set 2 Ether Assignment: Set 4
Sept 15 Relativity principle	Sept 17, Due: Set 3 Rel. length & time Assignment: Set 5	Sept 19, Due: Set 4 Rel. mass & energy Assignment: Set 6
Sept 22 **Mini Exam** on material covered in Sets 1-3	Sept 24, Due: Set 5 Ideal Gas Assignment: Set 7	Sept 26, Due: Set 6 Kinetic theory Assignment: Set 8
Sept 29 Statistical Mechanics	Oct 1, Due: Set 7 Quantum states Assignment: Set 9	Oct 3, Due: Set 8 MB distribution Assignment: Set 10
Oct 6 **1st Exam** on material covered in Sets 1-6	Oct 8, Due: Set 9 FD distribution Assignment: Set 11	Oct 10, Due: Set 10 BE distributions Assignment: Set 12
Oct 13, Due: 1st draft Heat radiation	Oct 15, Due: Set 11 Black-body spectrum Assignment: Set 13	Oct 16, Due: Set 12 Quantized action Assignment: Set 14
Oct 19 Photovoltaics	Oct 21, Due: Set 13 Line spectra Assignment: Set 15	Oct 23, Due: Set 14 Bohr atom Assignment: Set 16
Oct 26 Sommerfeld atom	Oct 28, Due: Set 15 Laser Assignment: Set 17	Oct 30, Due: Set 16 Spin Assignment: Set 18
Nov 2 **2nd Exam** on material covered in Sets 7-14	Nov 4, Due: Set 17 Exclusion Principle Assignment: Set 19	Nov 6, Due: Set 18 Correspondence Principle Assignment: Set 20
Nov 9, Due: 2nd draft Schrödiger Eqn.	Nov 11, Due: Set 19 Particle in a box Assignment: Set 21	Nov 13, Due: Set 20 Tunnel effect Assignment: Set 22
Nov 16 Electron orbitals	Nov 18, Due: Set 21 Chemical bond Assignment: Set 13	Nov 20, Due: Set 22 Electron gas Assignment: Set 14
Nov 23 Semiconductors	Nov 25	Nov 27
Nov 30, Due: Final draft Superconductivity	Dec 2 Uncertainty Principle	Dec 4 Copenhagen Interpretation
Final Exam on material covered in Sets 15-22 + comprehensive questions on the most importent concepts from the whole semester	on Day, Dec 7, from **3:30**-5:30 PM	

PHYS 100 Concepts of Modern Physics

Congruency with Area B Objectives for an Upper Division, Integrated Course

GE Specification	Content Topics	Sample Readings	% Time
Fundamental Principles	Relativity Principle	DL*, Chap 3	3%
	Quantized-action Principle	MJ**, Chap 4	3%
	Exclusion Principle	MJ, Chap 7	3%
	Correspondence Principle	MJ, Chap 11	2%
	Uncertainty Principle	MJ, Chap 21	3%
Scientific Method	Michelson Experiment	DL, Chap 2	2%
	Blackbody Radiation	MJ, Chap 1	3%
	Photoelectric Effect	DL, Chap 6	3%
	Line Spectra	MJ, Chap 3	4%
	Tunnel Effect	MJ, Chap 15	2%
Mathematical Methods	Lorentz Transformation	DL, Chap 4	3%
	Bohr-Sommerfeld Model	MJ, Chap 4	3%
	Schrödiger Equation	MJ, Chap 6	3%
Influence of Science on Society, Environment, Qualtity of Life	Nuclear Power	Phys. Today, May 1989	3%
	Solar Power	Phys. Today, July 1994	3%
	Radar, Microwave	Phys. Today, Oct 1987	3%
	Laser	Phys. Today, Jan 1997	2%
	Semiconductors	Phys. Today, Sept 1992	4%
	Computer Revolution	NY Review, March 26, 1998	2%
	Electromagnetic Interference	NY Review, April 9, 1998	2%
Historical Context	Crisis of Classical Physics	MJ, Chap 1	5%
	Planck, Einstein	DL, Chap 1	3%
	Bohr, Sommerfeld	MJ, Chap 4	3%
	Heisenberg, Pauli	MJ, Chap 5	3%
	Schrödinger, Dirac	MJ, Chap 6,7	3%
Ethical Issues	Nuclear Bomb	DL, Chap 17	3%
	Electronic Warfare	NY Review, Oct 8, 1991	1%
Integration of Area and Subarea Goals	Psychology of Misperceptions	Psych. Today 18, 52 (1984)	2%
	Health Aspects of Radiation	Phys. Today, Feb 1993	3%
	Chemical Bond	MJ, Chap 18	4%
	Historical Devel. of Mod. Phys.	MJ, Chaps 1-21	9%
	Philosophy of the Copenhagen Interpretation of Quant. Mech.	MJ, Chap 22	3%

*David Lindley, *The End of Physics* (BasicBooks, NY, 1993)

**Max Jammer, *Conceptual Development of Quantum Mechanics* (McGraw-Hill, NY, 1966)