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CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Dennis Whitson and W. Larry Freeman Phone 7-4593/4592

Department Physics

II. PROPOSAL TYPE (Check All Appropriate Lines)

X **COURSE** Modern Physics
Suggested 20 character title

_____ New Course* _____
Course Number and Full Title

X Course Revision PHYS 331 Modern Physics
Course Number and Full Title

_____ Liberal Studies Approval+ for new or existing course _____
Course Number and Full Title

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_____ Course Deletion _____
Course Number and Full Title

_____ Number and/or Title Change _____
Old Number and/or Full Old Title

_____
New Number and/or Full New Title

_____ Course or Catalog Description Change _____
Course Number and Full Title

PROGRAM: _____ Major _____ Minor _____ Track

_____ New Program* _____
Program Name

_____ Program Revision* _____
Program Name

_____ Program Deletion* _____
Program Name

_____ Title Change _____
Old Program Name

_____
New Program Name

III. Approvals (signatures and date)

Kenneth E. Hrudman 11/18/00
Department Curriculum Committee

Richard D. Roberts 11/16/00
Department Chair

College Curriculum Committee 01/12/01

John D. Ed 1/12/01
College Dean

_____
+Director of Liberal Studies (where applicable)

_____
*Provost (where applicable)

1993

Syllabus of Record for PHYS 331

I. Catalog Description

PHYS 331 Modern Physics

3 lecture hours
0 lab hours
3 credits
(3c-01-3sh)

Prerequisites: PHYS 112 or 116 or 132; MATH 122 or 124

The history of modern physics will be covered. Particle and wave properties of matter will be explored using the ideas of quantum mechanics. Systems examined using the ideas of quantum and classical mechanics are atomic structure, solid state, and nuclear physics. The special theory of relativity will also be covered. Some of the problems will be solved using computers.

II. Course Objectives

Upon successful completion of this course, the student will be able to:

1. Discuss and recall the history of physics from the early 1900's to present day and differentiate what is commonly known as classical physics from modern physics.

2. Describe and discuss the effect of size on the physics of the quantum world, i.e. when does a particle behave like a wave?

3. Solve and calculate problems dealing with simple quantum mechanical systems such as atomic structure, solid state, and nuclear physics.

4. Analyze, discuss, and calculate problems dealing with the special theory of relativity.

5. Investigate problem solutions using computers.

6. Discuss some of the great moments in the history of physics and of the individuals responsible for them.

III. Course Outline (42 hrs)

1. A discussion of the time during which science emerged from the era of classical physics to the beginning of quantum physics and relativity. (2 hrs)

2. A discussion of the concepts of special relativity including length contraction, time dilation, simultaneity, etc. (5 hrs)

3. The quantum concept of matter. A discussion beginning with the Heisenberg uncertainty principle, leading through the concepts of treating matter as a wave, and

the Schroedinger equation for the wave function. The concepts of the particle in the box, quantum oscillator, hydrogen atom, and tunneling will be discussed from a physical perspective without the full mathematical discussion. The emphasis is to be placed upon the student obtaining a sound grasp of the concepts of quantum mechanics without the mathematical detail. (14 hrs)

4. Topics from solid states physics are to be discussed, again, from the viewpoint of the student obtaining a physical understanding of the material. Topics such as laser, superconductivity, semiconductor devices, and other subjects of current interest may be discussed. (10 hrs)

5. Topics for nuclear physics and particle physics are to be introduced. Students are to be exposed to basic concepts and to topics of current discussion in this field. (10 hrs)

Testing (1 hr)

IV. Evaluation Methods

The final grade for the course will consist of the following:

40% Tests. One examination during the semester and a final examination both consisting of problem solutions and discussion questions.

20% Paper. This is a Type II (department required) writing intensive course. A ten page paper, typewritten, double-spaced will be required. The topic of the paper must be approved by the second week of the semester. A rough draft of the paper is due by the fourth week of classes. A preliminary version of the paper will be due by the end of the eighth week of class. By that time, the paper is to have been read by at least two other students from the class with comments added. The final paper is due one week before examinations. This paper will give the student the opportunity to explore, from a historical perspective, the root of some scientific discovery and its impact upon science and society in general. This paper will, of course, require additional reading beyond the text.

Note: Physics education majors will be required to address in this paper the ethical and human implications of some contemporary issues such as nuclear power plant sites and wastes disposal, or the effects of radiation on living systems.

20% Notebooks. An extensive set of edited notes are to be kept and will be collected at least three times each semester for grading. Students will be required to keep a detailed set of notes from class lectures, working on these notes between classes to fill-in or expand upon the topics presented in class.

20% Homework and class discussion. Students will be expected to participate in the discussion of problems, offering solutions to problems for the other students.

Grading Scale:
90-100% : A; 80-89% : B; 70-79%: C; 60-69% : D; below 60% F.

Attendance Policy: The attendance policy will conform to the University wide attendance criteria.

V. Required Textbook

Thornton, S., and Rex, A., *Modern Physics for Scientists and Engineers*, Saunders College Publishing, 2000

VI. Special resource requirements

None

VII. Bibliography

Beiser, A., *Concepts of Modern Physics*,5th Ed., McGraw Hill Publishing Co., 1995

Harris, R., *Nonclassical Physics, Beyond Newton's View*, Addison Wesley, 1998

Lederman, L. and Schramm, D. *From Quarks to the Cosmos*, Scientific American Library, 1995

Ohanian, H., *Modern Physics*, 2nd Ed., Prentice Hall, Englewood Cliffs, NJ, 1995

Rohlf, J., *Modern Physics from α to Z^0*, John Wiley & Sons, 1994

Sandin, T., *Essentials of Modern Physics*, Addison Wesley, 1989

Serway, R., Moses, C., and Moyer, C., *Modern Physics*, 2nd Ed., Saunders College Publishing, 1997

Tipler, P. and Llewellyn, R., *Modern Physics*, 3rd Ed., W. H. Freeman and Co., New York, 1999

Summary of Proposed Revisions

The only changes are in the prerequisites for PHYS 331, Modern Physics; PHYS 116 is added to the list and MATH 128 is deleted from the list.. The change is from

Prerequisites: PHYS 112 or 132; MATH 122, 124, or 128
to
Prerequisites: PHYS 112 or 116 or 132; MATH 122 or 124

Justification/rationale for the revision

The proposed Electro-Optics program is the reason for this change. In this program two new physics courses are proposed, PHYS 115, Physics I for Electro-Optics, and PHYS 116, Physics II for Electro-Optics. If a student transfers to the main campus after finishing the Associate in Science in Electro-Optics degree he/she can then work on the Applied Physics degree with an Electro-Optics track. Modern Physics is required in this track and the relevant prerequisite is PHYS 116.

MATH 128 is being deleted from the list because the students who used to take this course now take MATH 124. MATH 128 was last offered in Spring 1998. The Mathematics Department program revision, that was effective in the 1998-99 catalog, no longer requires MATH 128. It was not deleted as a course so it is still listed as a prerequisite for courses in other programs.

The old syllabus of record:

COURSE SYLLABUS

I. Catalog Description

PHYS 331 Modern Physics — 3 credits
Prerequisites: PHYS 112 or 132; MATH 122, 124 or 128 — 3 Lecture hours

An introduction to particle and wave properties of matter, atomic structure, relativity, solid state, and nuclear physics.

II. Course Objectives

1. Students are to be introduced to a broad range of topics that cover the time period from the early 1900's to present day. Those topics include the subjects that differentiate what is commonly known as classical physics from modern physics.

2. The students are to acquire some ease at calculation in this area. Particular emphasis will be given to the sizes of quantities that one deals with in this quantum world.

3. Since this is also intended to be a writing intensive course, special emphasis will be placed upon the following:
   a) Notetaking. Students will be required to keep a detailed set of notes from class lectures, working on these notes between classes to fill-in or expand upon the topics presented in class.
   b) A paper will be required of the students. This paper will give the student the opportunity to explore, from a historical perspective, the root of some scientific discovery and its impact upon science and society in general. This paper will be brought through several stages of development, before it is accepted for the course. This paper will, of course, require additional reading beyond the text.

   Note: Physics education majors will be required to address in this paper the ethical and human implications of some contemporary issues such as nuclear power plant sites and wastes disposal, or the effects of radiation on living systems.

4. The students will also be required to investigate problem solutions using computers.

5. Provide an understanding of some of the great moments in the history of physics and of the individuals, including women and minorities, responsible for them.

III. Course Outline

1. A discussion of the time during which science emerged from the era of classical physics to the beginning of quantum physics and relativity. (3 lectures)

2. A discussion of the concepts of special relativity including length contraction, time dilation, simultaneity, etc. (4 lectures)

3. The quantum concept of matter. A discussion beginning with the Heisenberg uncertainty principle, leading through the concepts of treating matter as a wave, and the Schroedinger equation for the wave function. The concepts of the particle in the box, quantum oscillator, hydrogen atom, and tunneling will be discussed from a physical perspective without the full mathematical discussion. The emphasis is to be placed upon the student obtaining a sound grasp of the concepts of quantum mechanics without the mathematical detail. (14 lectures)

4. Topics from solid states physics are to be discussed, again, from the viewpoint of the student obtaining a physical understanding of the material. Topics such as laser, superconductivity, semiconductor devices, and other subjects of current interest may be discussed. (10 lectures)

5. Topics for nuclear physics and particle physics are to be introduced. Students are to be exposed to basic concepts and to topics of current discussion in this field. (10 lectures)

IV. Evaluation Methods

The final grade for the course will consist of the following:

40% Tests. Two examinations consisting of problem solutions or discussion questions.

20% Paper. A ten-page paper, typewritten, double-spaced will be required. The subject matters must be approved by the second Friday of the semester. A rough draft of the paper is due by the fourth Friday of classes. A preliminary version of the paper will be due by the end of the eighth week of class. By that time, the paper is to have been read by at least two other students from the class with comments added. The final paper is due one week before examinations.

20% Homework and class discussion. Students will be expected to participate in the discussion of problems, offering solutions to problems for the other students.

V. Required Textbook

Concepts of Modern Physics, Beiser, McGraw Hill Publishing Co., 5th ed., 1995

Suggested readings:

a) Rutherford - Recollections of the Cambridge Days, Mark Oliphant, Elsevier Pub. Co.

b) Quarks - The Stuff of Matter, Harald Fritzsch, Basic Books, Inc.

c) My Life - Recollections of a Nobel Laureate, Max Born, Charles Scribner's & Sons.

d) Scientists Under Hitler, Alan Beyerchen, Yale University Press.

Dr. Dennis Whitson
Physics Department
IUP

Dear Dr. Whitson:

The Mathematics Department supports the deletion of MATH 128 as a prerequisite for PHYS 222 and PHYS 331 since there are no plans to teach the course again.

Sincerely Yours

Gerald Buriok 11/17/00

Dr. Gerald Buriok
Chair, Mathematics Department