LSC Use Only
Number: _____
Action: _____
Date: _____

UWUCC Use Only
Number: 91-47
Action: _____
Date: _____

CURRICULUM PROPOSAL COVER SHEET
University–Wide Undergraduate Curriculum Committee

I. Title/Author of Change

Course/Program Title: SC 101 - Fundamentals of Physics
Suggested 20 Character Course Title: Fund of Physics
Department: Physics
Contact Person: Norman W. Gaggini

II. If a course, is it being Proposed for:

_____ Course Revision/Approval Only
__X__ Course Revision/Approval and Liberal Studies Approval
_____ Liberal Studies Approval Only (course previously has been approved by the University Senate)

III. Approvals

Richard D. Roberts — Department Curriculum Committee
[signature] — Department Chairperson
[signature] — College Curriculum Committee
[signature] — College Dean *
_____ — Director of Liberal Studies (where applicable)
_____ — Provost (where applicable)

*College Dean must consult with Provost before approving curriculum changes. Approval by College Dean indicates that the proposed change is consistent with long range planning documents, that all requests for resources made as part of the proposal can be met, and that the proposal has the support of the university administration.

IV. Timetable

Date Submitted to LSC: _____
to UWUCC: _____
Semester to be implemented: Spring 1992
Date to be published in Catalog: Fall 1992

LIBERAL STUDIES COURSE APPROVAL, PARTS 1-3: GENERAL INFORMATION CHECK-LIST

I. Please indicate the LS category(ies) for which you are applying:

LEARNING SKILLS:

_____ First Composition Course
_____ Second Composition Course
_____ Mathematics

KNOWLEDGE AREAS:

_____ Humanities: History
_____ Fine Arts
_____ Humanities: Philos/Rel Studies
_____ Social Sciences
_____ Humanities: Literature
_____ Non-Western Cultures
__X__ Natural Sci: Laboratory
_____ Health & Wellness
_____ Natural Sci: Non-laboratory
_____ Liberal Studies Elective

II. Please use check marks to indicate which LS goals are primary, secondary, incidental, or not applicable. When you meet with the LSC to discuss the course, you may be asked to explain how these will be achieved.

Prim	Sec	Incid	N/A	
				A. Intellectual Skills and Modes of Thinking:
X				1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process.
X				2. Literacy--writing, reading, speaking, listening.
X				3. Understanding numerical data.
	X			4. Historical consciousness.
X				5. Scientific Inquiry.
	X			6. Values (Ethical mode of thinking or application of ethical perception).
	X			7. Aesthetic mode of thinking.
X				**B. Acquiring a Body of Knowledge or Understanding Essential to an Educated Person**
	X			**C. Understanding the Physical Nature of Human Beings**
				D. Collateral Skills:
X				1. Use of the library.
			X	2. Use of computing technology.

III. The LS criteria indicate six ways that courses should contribute to students' abilities. Please check all that apply. When you meet with the LSC, you may be asked to explain your check marks.

__X__ 1. Confront the major ethical issues which pertain to the subject matter; realize that although "suspended judgment" is a necessity of intellectual inquiry, one cannot live forever in suspension; and make ethical choices and take responsibility for them.

__X__ 2. Define and analyze problems, frame questions, evaluate available solutions and make choices.

__X__ 3. Communicate knowledge and exchange ideas by various forms of expression, in most cases writing and speaking.

__X__ 4. Recognize creativity and engage in creative thinking.

__X__ 5. Continue learning even after the completion of their formal education.

__X__ 6. Recognize relationships between what is being studied and current issues, thoughts, institutions, and/or events.

IV. A. Science 101, Fundamentals of Physics will be taught by those faculty who have a strong commitment to science education. With two large lecture sections and six laboratory sections, it is essential that those faculty responsible for this course meet periodically to discuss the strategies being used for both lecture and lab. These "teams" are maintained over long periods of time so as to insure consistency and continuity of the methods and philosophy of this course as prescribed in the syllabus. It has been decided by the Elementary Education Committee of this college in cooperation with faculty from Professional Studies in Education that there will be a cooperative effort to interject into the lectures and laboratories those teaching strategies that are inherent to modern teaching methods. Utilization of these strategies will provide the students with concrete examples of those methods being taught in their educational courses.

B. Contributions by minorities and women to the concept areas of physics are noted in the historical perspectives in those content areas when appropriate. Examples would include but not be limited to Lise Meitner (nuclear fission) and Madame Curie (radioactivity). Women in physics were not common until early in this century. Other women and minority contributors to physics and technology will be referenced when appropriate. Women in science need not be limited to those whose professional careers are strictly in those areas that are considered pure science. The course is to be taught in a manner in which the women in the class will be made to realize that they, as future female educators, have the ability to be effective purveyors of scientific concepts and principles, no different from one whose field is pure biology, chemistry, astronomy, or scientific research.

C. In the development of the lab presentations and its accompanying written report, students are required to incur some historical and/or technological information. This requires not only researching the physics concept itself, but additional reading from non-technological sources. Relevant topics can be gleaned from newspaper articles, news magazines, scientific journals, and other sources of this nature. The cumulative readings cited bibliographically should be equivalent to reading an additional book. Specific examples would apply across the syllabus. In the areas of energy, its conservation, its impact on today's and tomorrow's society, sources and production problems, its impact on world politics, recycling, renewable energy sources, new technologies, etc., would be applicable to many areas of physics such as heat, light, nuclear physics, and electricity. Technological developments in more efficient refrigeration and heating systems, automobile engines, lighting, insulation, etc., are brought into context with the appropriate concepts as they are developed.

D. Traditionally , only a very small percentage (less than 10%) of students in this course have had a physics course in high school. We live in a highly technological society, much of which is an extension of the physics concepts being taught in this course. These concepts are developed using students' personal experiences with examples and demonstrations to reinforce those same concepts. This differs significantly from the traditional introductory physics course which is approached almost totally through mathematical investigations and proofs. In lieu of the traditional problem-solving approach that is used in an introductory course, this course will utilize the ideas inherent to the student's ability to inquire and discover those ideas conceptually and recognize and apply them to everyday experiences.

CHECK LIST — NATURAL SCIENCES (Laboratory)

Knowledge Area Criteria which the course must meet:

__x__ Treat concepts, themes and events in sufficient depth to enable students to appreciate the complexity, history and current implications of what is being studied; and not be merely cursory coverage of lists of topics.

__X__ Suggest the major intellectual questions/problems which interest practitioners of a discipline and explore critically the important theories and principles presented by the discipline.

__x__ Allow students to understand and apply the methods of inquiry and vocabulary commonly used in the discipline.

__X__ Encourage students to use and enhance, wherever possible, the composition and mathematics skills built in the Skill Areas of Liberal Studies.

Natural Science Criteria which the course must meet:

__X__ Examine a body of knowledge of natural science that will contribute to an understanding of the natural world.

__X__ Provide an understanding of the development of natural science theories and their modification.

__x__ Teach students to formulate and test hypotheses.

__X__ Provide an understanding of some of the "great moments" in the history of natural science and the individuals, including women and minorities, responsible for them.

Natural Science Laboratory Criteria which the course must meet:

__X__ Provide students with opportunities to learn and apply data–gathering techniques.

__X__ Provide students with opportunities to develop skills in making accurate observations, in formulating concise and appropriate descriptions of natural phenomena, and in producing meaningful systems of classification for natural objects.

__X__ Provide students with opportunities to apply theories to practice in the working world of science.

Additional Natural Science Criteria which the course should meet:

__X__ Encourage an appreciation of the complex interrelationship of natural science with the life of the individual.

__X__ Develop in students the abilities necessary to cope with the consequences of natural science in the modern world.

__X__ Develop an inquiring attitude consistent with the tenets of natural sciences, an attitude that is willing to expose fallacy on the basis of reason, that demands evidence for scientific assertions, and yet is tolerant of hypotheses in the absence of contradictory evidence.

I. CATALOG DESCRIPTION

SC 101 Fundamentals of Physics **2.5 credits**
2 lecture hours
2 lab hours
(2c-2l-2.5sh)

Prerequisite: Instructor Permission

A conceptual course in physics for the non-science major. High school physics is not a prerequisite. Class and lab presentations concentrate upon dispelling naive concepts and developing a better understanding and appreciation of the physical world. The topics of motion, heat, light, sound, electricity, magnetism, and the nucleus are presented in context with our everyday experiences.

II. COURSE OBJECTIVES

1. To develop an understanding of the role of physics in describing the phenomena of nature.
2. To provide the necessary experiences in the laboratory so that the processes of observation, classification and generalization may be used.
3. To be able to explain some of the more common natural phenomena in terms of the physical processes involved .
4. To be able to use mathematics and graphical techniques to arrive at numerical answers for scientific problems.
5. To inculcate an attitude of appreciation for the importance of science in modern society.
6. To furnish a factual background as a foundation for making intelligent judgments concerning the worth of the applications of science.
7. Provide an understanding of some of the "great moments" in the history of physics and the individuals, including women and minorities, responsible for them.
8. To use lectures, demonstrations, films and other audio-visual aids to illustrate physical principles and develop a knowledge of them.
9. To use homework assignments and outside readings to broaden the student's background.

III. COURSE OUTLINE **25 lectures total**

A. Mechanics

1. Kinematics - Galileo (1.5 lectures)
   a. Displacement, Velocity, Acceleration
   b. Free Fall and Air Resistance

2. Dynamics - Newton (2 lectures)
    a. Newton's Laws of Motion - Inertia, Force, and Action-Reaction
    b. Impulse-Momentum
    c. Friction
3. Nonlinear Motion (1 lectures)
    a. Projectiles
    b. Circular motion
4. Energy (2 lectures)
    a. Work and Power
    b. Potential and Kinetic Energies
    c. Simple Machines
    d. Conservation of Energy
5. Gravity and Satellite Motion (.5 lectures)

B. **Properties of Matter** (3 lectures)
1. Atomic Nature of Matter
2. Solids and Density
3. Liquids - Buoyancy in Liquids, Sink and Float
4. Gases and Buoyancy

C. **Heat** (2.5 lectures)
1. Temperature, Heat, and Expansion
2. Heat Transfer - Conduction, Convection, and Radiation
3. Change of State
4. Heat Energy - Sources and Uses

D. **Sound** (2 lectures)
1. Vibrations and Waves
2. Sound, Music, and Hearing

E. **Electricity and Magnetism** (2.5 lectures)

1. Static Electricity
2. Current Electricity and Circuits
3. Electricity and the Body
4. Magnetism
5. Electromagnetic Induction

F. **Light** (3 lectures)

1. Properties of Light
2. Reflection and Mirrors
3. Refraction and Lenses
4. Vision and Color
5. Dispersion and Scattering

G. **Light Waves** (.5 lectures)

1. Interference and Diffraction
2. Polarization

H. **Light Emission** (.5 lectures)

1. Incandescence
2. Fluorescence
3. Phosphorescence

I. **Quantum Physics** (1 lecture)

1. Discovery of the Nucleus
2. Spectra
3. Energy levels

J. **The Nucleus and Radioactivity** (2 lectures)

1. X-Rays and Radioactivity
2. Radiation
3. Isotopes
4. Half-life and Decay
5. Radiation and the Body

K. **Fission and Fusion** (1 lecture)

1. Fission and Reactors
2. Fusion and the Stars

IV. EVALUATION METHODS

The final grade for the course will be determined as follows:

50% TESTS - 3 hourly exams consisting of multiple choice, true-false, matching and short essay - 75 points each, and a final exam of the same format for 75 points. (300 points)

16.7% QUIZZES - Ten 10-point quizzes given during the first lecture of 10 of the weeks. (100 points)

33.3% LAB PERFORMANCE - Two lab presentations at 46 points each (92), 8 lab evaluations at 6 points each (48), and 4 general, mathematical labs at 15 points each (60). (200 points)

V. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS, AND READINGS

Textbook: Hewitt, Paul G., Conceptual Physics, 6th Edition, Scott Foresman, 1989

Additional readings are required for the laboratory reports (both oral and written). These books will be determined by the two concept reports' titles (there are 24 concept areas from which to choose). They can consist of content area texts, biographies of noted physicists, general readings on current technology from sources such as magazines, newspapers, etc.

VI. SPECIAL RESOURCE REQUIREMENTS

In the development of their laboratory presentations, students will be required to provide much of the materials needed for the demonstrations and/or hands-on activities. These will consist of common, inexpensive, everyday "nuts-and-bolts" items found around the home or readily available at local stores.

There is no lab fee associated with this course.

VII. BIBLIOGRAPHY

Victor, Edward, Science for the Elementary Schools 2nd thru 6th Editions

Pine, Ronald, Science and the Human Prospect.

American Institute of Physics, Operation Physics Course Materials, 13 areas of Physics

SYLLABUS ADDENDUM

SC 101 - Fundamentals of Physics - Laboratory

I. LAB OBJECTIVES

1. To promote an understanding of the physical world through the formal investigation of the concepts of physics.

2. To make the student a competent vehicle to disseminate this information to those around him/her.

3. To expose the student to the methodologies of concept development through the manipulation of equipment via demonstrations and/or hands-on activities.

4. To remove the stigma of "intimidation" by the subject of physics.

5. To develop an ability in the student to "improvise" that which is needed to produce effective demonstrations and/or hands-on activities.

6. To replace 8 of the traditional 12 one-concept, quantitative investigation type labs with a non-traditional multiple concept development lab accomplished through individual student presentations.

7. To require individual student presentations that must be developed through referenced investigations, resulting in a written report following a prescribed format.

8. To require that the student presentations contain sufficient demonstrations/hands-on activities that will properly reinforce the concept being developed, utilizing "nuts-and-bolts" apparatus that can be found in their everyday environment.

9. To require that the students present their concept development as an oral presentation before their peers and instructor, while being evaluated by both.

10. To require 4 multi-concept, traditional labs be performed to develop the use of data taking and analysis as a means of making sound conclusions based upon observations and data.

11. To require that the students utilize the processes of science for the purpose of making sound judgements and decisions concerning physical situations.

12. To require an environment that supports cooperative learning among the members of each group, insuring contributions from all who participate.

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COURSE ANALYSIS QUESTIONNAIRE

A. Details of the Course

A1 This course is designed to meet the physics part of the physical science needs of those students majoring in Elementary Education. It is to be included in the Liberal Studies program.

A2 This course does not require any changes in other courses or programs within the department.

A3 This course will be offered as a mixture of lecture and laboratory. The lecture will be of a traditional nature, but the laboratory is a concept development laboratory. This lab is novel in its approach, requiring the performance of four semi-traditional labs in which there is investigation, data acquisition, analysis, and conclusions. The remainder of the lab sequence consists of two concept development presentations by the students on pre-selected physics concepts through both lecture-demonstration and hands-on activities, presented orally before their peers and instructor, both of whom will evaluate the student doing the presentation. Additional requirements for the presentations are that they utilize apparatus of a "nuts and bolts" nature that would be readily available to an elementary teacher and that a complete write-up of the concept being presented (to include bibliography) be presented to the instructor prior to the presentation. This lab program has been developed over the past six years and is currently being used in the SC 105 Physical Science I sections for Elementary Education Majors. The syllabus is available upon request.

A4 An expanded version of this course has in been offered as SC 105, Physical Science I. Changes of credits from 4 to 2.5 and from 3 lectures per week to 2, and the modification of the laboratory program to meet the needs of the clientele, require major modifications in the lecture portion of the course.

A5 This is not a dual level course

A6 This is not a variable credit course.

A7 The lecture portion of this course follows a traditional physical science format, but the laboratory is unique to IUP, being developed here over the past six years.

A8 The content of and/or skills required for this course are not required by any external agency. They are, however, essential for the Elementary Education Major to be able to properly teach those science concepts found in all traditional text series used K-6. Current classes do not provide the method by which the student can develop the necessary strategies and techniques necessary for modern science education at the elementary level.

B. Interdisciplinary Implications

B1 The lecture portion of this course will be taught by one instructor.

B2 No additional or corollary courses will be needed with this course.

B3 This course is one of a sequence of four courses being required of all Elementary Education Majors entering IUP as of September 1991. Other courses consist of SC 102, Fundamentals of Chemistry, SC 103, Earth and Space Science and SC 104, Environmental Biology. These courses were developed through the efforts of representatives from each department, Physics, Chemistry, Geoscience, and Biology as well as representatives from the Department of Professional Studies in the College of Education. Through the efforts of this committee, all decisions were made after thorough discussion at various meetings.

B4 Seats will be available to those students in the School of Continuing Education whose goal is to major in Elementary Education.

C. Implementation

C1 a. The faculty needed to teach this course are currently in place.

b. Room 344 in Weyandt Hall currently serves as the laboratory for the Elementary Education Majors taking SC 105. It will subsequently be the SC 101 lab. Lectures will continue in Weyandt 107.

c. The uniqueness of this lab does not require the addition of equipment to the program.

d. Current requirements for supplies and other consumables is on the order of $100 to $150 per year. This will not change.

e. New sets of K-6 textbook series from all publishers were placed in the library during 1990. They should last some 5-7 years at the minimum. Other references required for the laboratory written paper are currently available at the library.

C2 None of the resources for this course are grant funded.

C3 This course is offered each semester and should be offered at least once during the summer sessions.

C4 To satisfy the needs of the current freshmen class, and assuming no drastic increase in enrollments, the current 2 sections per semester will suffice to meet the needs of all Elementary Education Majors.

C5 A typical lecture section will be 72 students, providing for 3 laboratory sections of 24 each.

C6 No professional society limits the enrollments for a lecture of this nature.

C7 This course will be one of the four science courses required of those students declaring Elementary Education as their major. This will have no effect on the number of free electives available to these majors, nor will it cause an increase in the 124 credit program for these students. Currently they are required for their major to take three-4 credit lab science courses for a total of 12 credits. Under the new requirements, they will take four-2.5 credit science courses and one-2 hour science methods course in the College of Education for the same 12 hour commitment.

D. Miscellaneous

The current status of science education in the United States is one of serious deficiency. One recognizable cause of this deficiency is the lack of science courses required for pre-service teachers at the elementary level. Research shows that if a student is not "turned on" to science by the fifth grade, the probability of them ever pursuing a career in the sciences or a related field is minimal to say the least. Since it is very common to find students who major in elementary education to be required to take only one science course, most generally a biology course, and in some cases, without an accompanying laboratory, it is no wonder that students at the elementary level are not stimulated or challenged scientifically by their teachers! If one just scans the scope and sequence charts in an elementary science text, it is always partitioned into three topic areas, Life Science, Physical Science, and Earth and Space Science. If we as an educational institution are to provide our students with a comprehensive background and a proper level of competency to function in an elementary school, then it is inherent that we provide a complete program in science as well as the other content areas. When one provides inservice workshops for elementary teachers in Western Pennsylvania, it becomes quite evident how much they lack in the physical science concept areas. Common topics for discussion usually always include the question, "When are you people going to offer summer workshops for us at your school?" They are to be commended for recognizing their shortcomings, but we should be commended for providing a curriculum that eliminates these same shortcomings. Adoption of this course and the others in the sequence is essential for the proper science education of our current and future Elementary Education Majors.