15-85
LSC App-12/2/15
UWUCC App 2/9/16
Senate app-3/1/16

REVISION APPROVAL COVER SHEET FOR CONTINUATION OF W-DESIGNATION

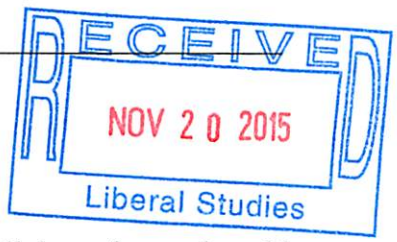
TYPE II DEPARTMENT COMMITMENT

Professor John Bradshaw

Department Physics

Email john.bradshaw@iup.edu

Course PHYS 331 Modern Physics



Please provide answers to these questions on the next page:

1. Include the most recent syllabus for the Type II course.

   Addendum: This does not have to be the syllabus of record, since the syllabus of record could potentially be rather dated. These syllabi are not meant to replace the syllabus of record; rather they represent how the department is currently teaching a particular Type II W course. These syllabi **do not** have to be revised using the Liberal Studies objective format.

2. Include a new "Statement Concerning Departmental Responsibility". The statement of departmental responsibility" explains how the department will ensure that the writing component is present regardless of who is teaching the course. It needs to identify the specific department group or individual who is responsible for ensuring this.

   Addendum: This section should show how the department is going to support the W nature of a Type II course, not repeat what is being taught in the course. For example, there is no need to repeat the writing criteria (5000 words, essays exams, research papers etc.) in this section as the type of writing and/or assignments might change over the years. The responsibility relies on the department and they should explain how it will be supporting the W course to ensure that it is being taught in the proposed manner. That may be creating a community of writers within the department or a yearly meeting(s) to discuss Type II offerings. It might also be associated with particular outcomes from the course (often in accredited programs).

Approvals:	**Signature**	**Date**
Professor (s)	John L Bradshaw	11/19/2015
Department Chair		11/19/2015
College Dean		11/19/15
Director of Liberal Studies		~~11/30~~ 12/7/15
UWUCC Co-chair(s)	Gail Sechrist	2/9/16

TYPE II DEPARTMENT COMMITMENT

Professor John Bradshaw Department Physics

Course PHYS 331 Modern Physics

Statement Concerning Department Responsibility

Modern Physics is a pivotal course for all programs in Physics. The content is fundamental in the development of Physics. While there is a strong mathematical component to this class, the concepts that are established make for excellent paper topics. The "philosophical" aspect of modern physics, the nature of time and the models of the universe constructed by humans. These topics make for perfect writing assignments.

As part of the departmental commitment to maintain quality and consistency in the writing activities required during this course, the department will perform the following: Instructors who are assigned to teach PHYS 331 will be strongly encouraged to attend one of the Liberal Studies sponsored writing workshops. The writing intensive courses will be structured so students will have multiple opportunities to receive feedback on their writing.

Most writing intensive courses will follow the following time-line for the major writing assessment: 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.

We will also form a committee of about three to four Physics faculty who have completed the writing intensive workshop. This committee will meet on a regular basis to discuss the writing assignments in this course as well as other departmental writing intensive courses. The committee members will review papers written by students and apply a writing rubric, similar to the one attached at the end of this document. It is anticipated that most students in the class will be at the level of practitioner.

Potential rubric for assessing writing assignment offered in Physics department writing intensive course

	Scientific Tools and Technologies *(Lab course only)*	Scientific Procedures and Reasoning Strategies	Scientific Communication/Using Data	Scientific Concepts and Related Content
Novice	Did not use appropriate scientific tools or technologies (e.g., rulers, multi-meter, power supply, computer, reference materials, etc.) to gather data (via measuring and observing).	No evidence of a strategy or procedure, or used a strategy that did not bring about successful completion of task/ investigation. No evidence of scientific reasoning used. There were so many errors in the process of investigation that the task could not be completed.	No explanation, or the explanation could not be understood, or was unrelated to the task/ investigation. Did not use, or inappropriately used scientific representations and notation (e.g. symbols, diagrams, graphs, tables, etc.). No conclusion stated, or no data recorded.	No use, or mostly inappropriate use, of scientific terminology. No mention or inappropriate references to relevant scientific concepts, principles, or theories (big ideas). No evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Apprentice	Attempted to use appropriate tools and technologies (e.g., rulers, multi-meter, power supply, computer, reference materials, etc.) to gather data (via measuring and observing) but some information was inaccurate or incomplete.	Used a strategy that was somewhat useful, leading to partial completion of the task/investigation. Some evidence of scientific reasoning used. Attempted but could not completely carry out testing a question, recording all data and stating conclusions.	An incomplete explanation or explanation not clearly presented (e.g., out of sequence, missing step). Attempted to use appropriate scientific representations and notations, but were incomplete (e.g., no labels on chart). Conclusions not supported or were only partly supported by data.	Used some relevant scientific terminology. Minimal reference to relevant scientific concepts, principles, or theories (big ideas). Some evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Practitioner	Effectively used some appropriate tools and technologies (e.g., rulers, multi-meter, power supply, computer, reference materials, etc.) to gather and analyze data.	Used a strategy that led to completion of the investigation/task. Recorded all data. Used effective scientific reasoning. Framed or used testable questions, conducted experiment, and supported results	A clear explanation was presented. Effectively used scientific representations and notations to organize and display information. Appropriately used data to support conclusions.	Appropriately used scientific terminology. Provided evidence of understanding of relevant scientific concepts, principles or theories (big ideas). Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Expert	Accurately and proficiently used all appropriate tools and technologies (e.g., rulers, multi-meter, power supply, computer, reference materials, etc.) to gather and analyze data.	Used a sophisticated strategy and revised strategy where appropriate to complete the task. Employed refined and complex reasoning and demonstrated understanding of cause and effect. Applied scientific method accurately: (framed testable questions, designed experiment, gathered and recorded data, analyzed data, and verified results).	Provided clear, effective explanation detailing how the task was carried out. The reader does not need to infer how and why decisions were made. Precisely and appropriately used multiple scientific representations and notations to organize and display information. Interpretation of data supported conclusions, and raised new questions or was applied to new contexts. Disagreements with data resolved when appropriate.	Precisely and appropriately used scientific terminology. Provided evidence of in depth, sophisticated understanding of relevant scientific concepts, principles or theories (big ideas). Revised prior misconceptions when appropriate. Observable characteristics and properties of objects, organisms, and/or materials used went beyond the task/investigation to make other connections or extend thinking.

Syllabus for PHYS 331

Catalog Description

PHYS 331 Modem Physics
3 lecture hours
0 lab hours
3 credits
(3c-01-3sh)

Prerequisites: PHYS 112 or 116 or 132; MATH 122 or 126

The history of modem 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.

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 modem 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.

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 Schrodinger equation for the wave function.	(14 hrs.)

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.

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.)

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, 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.