

General Education Summit Program - War & Peace Cluster
Fall 2016
Engl 3550 - Physics section

Introduction

War & Peace is one of the clusters in the Upper Division Summit Program for the General Education Requirement. It consists of two classes, which when taken together satisfy sections F1 and F2 of Area F, and also Area G.

- Engl 3550 - *Years of War, Days of Peace: Post 1945 Literature and Film*. Satisfies area F2 (Humanities.) Offered in Fall.
- Phys 3550 - *Physics for War, Physics for Peace*. Satisfies area F1 (Mathematics and Natural Sciences.) Offered in Spring

Faculty

- Dr. Scott Davis, Department of English (Phone 667-3883, email: sdavis@csustan.edu)
- Dr. Ian M. Littlewood, Department of Physics (Phone: 667-3466, email: ilittlewood@csustan.edu)

Schedule of classes

Despite the chronological order of the classes listed above, we will be teaching both Physics and English in each of the Fall and Spring semesters. During the Fall semester the class dates in the first half of the semester will be devoted to Physics. The dates in the second half of the semester will be devoted to English.

- Physics – August 24 through October 5
- English - October 19 through December 7 (except November 23)

A similar arrangement will also hold for the Spring semester. Details will be announced at the beginning of that semester.

Office Hours

My office hours are flexible. Fixed office hours are 10-10:50 pm MWF, and 4-5 pm W. However you are welcome to come at any time, particularly if you can give me advance notice.

Course books

Physics

There are no assigned texts for the physics section of this cluster, either in the Fall or Spring. Instead, we will be using the Library and the Internet as our main source of information. In

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In addition to the regular library holdings, some texts which are used in our introductory physics classes have been placed on reserve in the library for you to refer to when necessary. For Internet resources, please see the main web page for this class (<http://physics.csustan.edu/WarAndPeace/index.htm>) for an extensive set of links to relevant material. The use of search engines (Yahoo, Google, etc.) will undoubtedly reveal more sources.

English

Please see the syllabus handed out by Dr. Davis.

Course Objectives - Physics

As a result of studying the physics of nuclear power and weapons, at the end of the semester you should

- Define correctly the terms which are used in Nuclear Physics.
- Be able to understand and explain the basic concepts and principles of nuclear physics.
- Be able to make a rational argument both in favor of and against the use of nuclear power stations.
- Be able to make a rational argument both in favor of and against the use of nuclear weapons.
- Be able to understand and evaluate references to nuclear power stations and weaponry in literature and film.
- Be able to evaluate data presented in numerical form, and to apply quantitative reasoning to understand its implications.

Basic Knowledge - Physics

I am going to assume that you have some basic knowledge coming into this class. Since you all come from a wide variety of backgrounds, it is quite possible that you have not seen some of the material, or need some refreshment. In that case I will be happy to help with study session(s) at time(s) to be arranged. I will be assuming the following:

Mathematics

- Basic knowledge of algebra.
- Basic geometry.
- Functions, especially the exponential and logarithmic functions. It will be helpful to you if you have a basic scientific calculator when working with these functions.

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History

- World War II, especially the bombing of Hiroshima and Nagasaki which brought about the end of the Pacific Theater in August 1945.
- The Cold War, and its components, not all which are directly nuclear.
- MAD

General Education Program, its Goals and Relationship to Physics

This cluster satisfies General Education Areas F1, F2, and G. Students must pass both courses to gain this GE credit (GE credit does NOT accrue to either single course).

The Cluster reinforces Goal 1 & 2 Outcomes listed in bold below, and contributes to meeting Goal 3 through all four Outcomes, also listed in bold. Course activities help students demonstrate these Outcomes.

Goal 1: Develop the intellectual skills and competencies necessary to participate effectively in society and the world

1. Demonstrate effective oral communication
- 2. Demonstrate effective written communication**
- 3. Demonstrate the ability to think critically and creatively**
- 4. Apply quantitative reasoning concepts and skills to solve problems**
- 5. Find, understand, examine critically and use information from various sources**
6. Comprehend and use appropriate technological resources effectively

Goal 2: Develop broad knowledge of biological and physical sciences, humanities and creative arts, and social sciences

- 1. Explain and apply basic scientific methods**
- 2. Demonstrate an understanding of the living and non-living physical world**
3. Recognize the structures and institutions that frame human interactions
- 4. Express appreciation of cultural, intellectual, and artistic ideas and works**
5. Demonstrate effective creative expression and understanding through artistic means
6. Identify life-skills and behaviors needed to flourish as a mature person

Goal 3: Develop abilities to integrate knowledge, make informed ethical decisions, and accept civic responsibility

- 1. Integrate and combine knowledge and abilities developed in several fields to analyze and critically evaluate specific problems, issues, or topics**
- 2. Illustrate the ability to self-reflect and assess relevant ethical values**
- 3. Identify and analyze problems within local, regional, national, and/or global**

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contexts

4. Demonstrate enhanced awareness of multicultural, community, and/or technological perspectives

To learn more about the GE Program at CSU Stanislaus, visit www.csustan.edu/GE.

Quantitative Reasoning

Quantitative Literacy (QL) – also known as Quantitative Reasoning (QR) – is a “quantitative habit of mind”, proficiency, and comfort in dealing with and rationally processing numerical data. Individuals with strong QL skills possess the ability to analyze quantitative problems in everyday life situations using logical reasoning steps. They are able to read and understand numerical data. They can create valid arguments based on quantitative evidence and know how to interpret their conclusions. They are capable of clearly communicating their analyses and arguments in a variety of formats (including words, tables, graphs, mathematical equations and models, as appropriate).

The formal definition of Quantitative Literacy implies competency in different fields of basic mathematics, and their application to diverse problems in the sciences, business and administration, politics, economics, and in everyday life. Most importantly, QL requires an understanding of the mathematics that is deeper than mere memorization of, and facility with, calculation procedures. Possession of strong QL skills requires competency in critical areas:

1. **Approximation / estimation** – The ability to do effective approximation and estimation.
2. **Mathematical models** – The ability to understand the assumptions behind mathematical models, and the implications that those assumptions have for the validity and scope of conclusions that are drawn.
3. **Tables and graphs** – The ability to represent and understand data in graphical forms and other visual representations.
4. **Algebra** – The ability to understand and manipulate algebraic equations, including the ability to draw conclusions from functional dependencies. Competency in this area thus goes beyond the ability to substitute for known variables and to perform the requisite arithmetic.
5. **Geometry** – The ability to think and visualize in higher dimensions, including an understanding of the dependencies of geometric properties, such as volume, on the dimensions of the shapes. The ability to express properties in terms of angles.
6. **Statistics** – The ability to draw appropriate conclusions from statistical data, including an understanding of statistical distributions and properties such as average, median, and standard deviation. The ability to incorporate uncertainties in the data when drawing conclusions.

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War and Peace and Quantitative Reasoning

These are some examples of applying the skill areas above to the physics part of this cluster:

- Areas 1 & 6 – an analysis of an article from the Modesto Bee about the radiation dangers from space travel.
- Areas 6 – implications of radiation exposure on mortality and life expectancy.
- Areas 4 – radioactive decay and dating
- Areas 1 & 2 – radioactivity as a power source
- Areas 1, 2, & 6 – the poisoning of Alexander Litvinenko
- Areas 3 (graphs) - radioactivity decay curves, double radioactive decay activity

Grading

Although Scott Davis will be the instructor of record for this class, he and I will be grading our sections separately. The final grade that you receive will be composite of the two. However, it is required that you pass both sections of the class in order to pass the class overall.

Organization of the material

The physics content of the physics content in this cluster can be conveniently divided into three parts;

Basic Physics of the Nucleus

- Atomic structure, and the properties of elementary particles
- Atomic number and atomic mass
- Isotopes
- Radioactivity
- Nuclear series
- Half life and radio dating

Health and Safety Issues

- Health hazards of ionizing radiation, including uv and X rays, and non-radiation hazards
- Radiation dosage, including background and cosmic radiation
- Biological processes affected by radiation
- Treatment
- Catastrophic incidents, Hiroshima, Nagasaki, Chernobyl, Three Mile Island

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Nuclear Devices

- Nuclear Reactions
- Chain reactions
- Reaction cross sections
- Nuclear reactors
- Fission and Fusion
- Thermal Neutrons and moderators
- Nuclear weapons
- Atomic bomb
- Hydrogen bomb

The plan is to cover the the section on basic physics and health and safety aspects in the Fall, then nuclear reactors and nuclear weapons during the Spring.