

## HONORS PS1500 - PHYSICS IN THE PLAYS OF TOM STOPPARD

### Course Outline - Spring Semester 2014

**INSTRUCTOR:** Dr. Bradley W. Carroll  
**OFFICE:** SL 202  
**TELEPHONE:** 626-7921  
**E-MAIL:** bcarroll@weber.edu  
**COURSE HOMEPAGE:** <http://physics.weber.edu/carroll/honors/>  
**TEXTS:** *Hamlet*, William Shakespeare;  
*Rosencrantz & Guildenstern are Dead*, Tom Stoppard;  
*Tom Stoppard: Plays Five*, Tom Stoppard;  
*Seven Ideas that Shook the Universe*, Nathan Spielberg and Bryon D. Anderson  
(ISBN: 0471848166)

**Science and math background assumed:** none!

### OUTLINE

In several of his plays, Tom Stoppard examines the paradox of free will in a deterministic Newtonian world. To what extent can individuals control their lives in a clockwork universe? We will examine the rise and fall of the Newtonian worldview in this course, and see how this provides the philosophical themes of three of Tom Stoppard's plays, *Rosencrantz & Guildenstern are Dead*, *Arcadia*, and *Hapgood*. Classroom activities will include

- discussions of the ideas of the plays
- performing selected readings from the plays
- investigations that explore the physics content of the plays

There will be a two-part midterm for each of Stoppard's plays (covering the storyline of each play and the physics in it), and an optional course project of your choice (with the instructor's approval).

### OFFICE HOURS

1:30 - 2:30 MTTh  
4:00 - 5:00 WF  
and  
any other time I am in my office

The topics for the small-group discussions will be distributed during the previous class. **Come prepared** to discuss any of the topics. A Quick Quiz will be given each day the plays are discussed. Each Quick Quiz can add 1 point to your physics exam scores. The midterms on the physics content of the plays will consist of multiple-choice questions, and will be given on ChiTester over a two-day period; remember to bring a picture ID. The other will be a short essay paper (3 - 5 pages) on an assigned topic from the plays. Each person is responsible for his or her own work. Academic dishonesty on any exam will result in a grade of zero being given for that examination. A second violation will constitute failure of the course.

Physics provides the fundamental description of physical reality, an exciting and sometimes startling view of the world that most people never get to see. Above all, **Ask Questions at Any Time!** If you have questions that can't be cleared up in class, drop by my office to discuss the meaning and implications of the material. Relax and enjoy this exploration of how nature really works, and remember the words of British scientist J. B. S. Haldane: "Not only is the universe stranger than we imagine, it is stranger than we can imagine!"

### **GRADING**

"A": An overall quiz and midterm average of at least 80% *and* an acceptable approved project for a total of at least 90% (midterms + project) *and* a satisfactory effort in group discussion

"B": An overall quiz and midterm average of at least 80% *and* a satisfactory effort in group discussion

"C": An overall quiz and midterm average of at least 70% *and* a satisfactory effort in group discussion

"D": An overall quiz and midterm average below 70% *or* an unsatisfactory effort in group discussion

"E": An overall quiz and midterm average below 70% *and* an unsatisfactory effort in group discussion

The course project is worth up to 10%. It should be something original and creative, and must be at least peripherally related to the subject matter of the course. With your project you must hand in a short written paper that describes what you did and how it is connected to the course. No last-minute projects will be approved. Your project should be something we can both be proud to share with the rest of the class!

## SCHEDULE AND READING ASSIGNMENTS

### Week 1

- Jan 7 Introduction  
*Seven Ideas*, p. 1 - 13  
9 *Seven Ideas*, p. 14 - 35

### Week 2

- Jan 14 *Seven Ideas*, p. 35 - 49  
16 *Hamlet*, p. xxv - xxxiv (Shakespeare's Life) and  
Act 1, Scene 1 through Act 2, Scene 1

### Week 3

- Jan 21 *Hamlet*, Act 2, Scene 2 through Act 3, Scene 4  
23 *Hamlet*, Acts 4 and 5

### Week 4

- Jan 28 *Seven Ideas*, p. 50 - 65  
30 *Seven Ideas*, p. 65 - 73

### Week 5

- Feb 4 *Seven Ideas*, p. 73 - 83  
6 *Rosencrantz & Guildenstern*, Act 1  
**\*\*\* Exam #1 (Physics) - ChiTester (Feb 6 - 8)**

### Week 6

- Feb 11 *Rosencrantz & Guildenstern*, Act 2  
13 *Rosencrantz & Guildenstern*, Act 3  
14 Movie night: *Rosencrantz & Guildenstern are Dead*

### Week 7

- Feb 18 *Seven Ideas*, p. 84 - 105  
20 *Seven Ideas*, p. 106 - 124

### Week 8

- Feb 25 *Seven Ideas*, p. 125 - 138  
**\*\*\* Exam #2 essay paper due at beginning of class**  
27 *Exploring Chaos* (readings to be handed out in class)

### Week 9

- March 4 *Arcadia*, Act 1, Scenes 1 and 2, p. 7 - 52  
6 *Arcadia*, Act 1, Scenes 3 and 4, p. 52 - 75  
**\*\*\* Exam #3 (Physics) - ChiTester (March 6 - 8)**

### Week 10

- March 11 **Spring**  
13 **Break**

**Week 11**

- March 18 *Arcadia*, Act 2, Scenes 5 and 6, p. 76 - 102  
20 *Arcadia*, Act 2, Scene 7, p. 102 - 137

**Week 12**

- March 25 *Seven Ideas*, p. 139 - 183  
27 *Seven Ideas*, p. 184 - 198

**Week 13**

- April 1 *Seven Ideas*, p. 199 - 220  
**\*\*\* Exam #4 essay paper due at beginning of class**  
3 *Seven Ideas*, p. 220 - 224

**Week 14**

- April 8 *Hapgood*, Act 1, Scenes 1 - 3, p. 489 - 516  
10 *Hapgood*, Act 1, Scenes 4 and 5, p. 516 - 547  
**\*\*\* Exam #5 (Physics) - ChiTester (April 10 - 12)**

**Week 15**

- April 15 *Hapgood*, Act 2, Scenes 1 - 3, p. 548 - 575  
17 *Hapgood*, Act 2, Scenes 4 - 7, p. 575 - 593

**Exam #6 essay paper due Tuesday, April 22,  
at the presentation of course projects**

**FINAL EXAM**

Tuesday, April 22, 9:00 - 10:50 pm

Presentation of course projects

## **WSU Natural Sciences General Education Program**

### **Mission Statement**

The mission of the natural sciences general education program is to provide students with an understanding and appreciation of the natural world from a scientific perspective.

Science is a way of knowing. Its purpose is to describe and explain the natural world, to investigate the mechanisms that govern nature, and to identify ways in which all natural phenomena are interrelated. Science produces knowledge that is based on evidence and that knowledge is repeatedly tested against observations of nature. The strength of science is that ideas and explanations that are inconsistent with evidence are refined or discarded and replaced by those that are more consistent.

Science provides personal fulfillment that comes from understanding the natural world. In addition, experience with the process of science develops skills that are increasingly important in the modern world. These include creativity, critical thinking, problem solving, and communication of ideas. A person who is scientifically literate is able to evaluate and propose explanations appropriately. The scientifically literate individual can assess whether or not a claim is scientific, and distinguish scientific explanations from those that are not scientific.

### **Foundations of the Natural Sciences Learning Outcomes**

After completing the natural sciences general education requirements, students will demonstrate their understanding of general principles of science:

1. Nature of science. Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.
2. Integration of science. All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.
3. Science and society. The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.
4. Problem solving and data analysis. Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.

### **The Physical Sciences Learning Outcomes**

Students will demonstrate their understanding of the following feature of the physical world:

1. Organization of systems: The universe is scientifically understandable in terms of interconnected systems. The systems evolve over time according to basic physical laws.
2. Matter: Matter comprises an important component of the universe, and has physical properties that can be described over a range of scales.
3. Energy: Interactions within the universe can be described in terms of energy exchange and conservation.
4. Forces: Equilibrium and change are determined by forces acting at all organizational levels.