SC527 - Concepts in Physics III: Fluids, Rotation, and Thermodynamics
November 2004 - January 2005

Description: For teachers, mastery of concepts including fluids, rotational motion, and thermodynamics. Connections between microscopic and macroscopic behavior in thermodynamics as an example of the role of models in the physical sciences. These concepts will also be discussed in a historical and philosophical context to build pedagogical content knowledge, and there will be additional discussion of pedagogy rooted in science education research.

Proposed times: Tuesday 4:30 – 7:30 p.m., Friday 4:30 – 7:30 p.m.

Dates: November 5 - January 11th.

Location: Tuesdays: School of Education, room 309
Fridays: Metcalf Center for Science, 590 Comm. Ave., room 134 or 136

Instructors:

<table>
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<tr>
<th>Name</th>
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Grading Scheme:
Homework 10%
Quizzes 7.5%
Midterm test 20%
Final Exam 22.5%
Portfolio 40%
- Lab Book (10%)
- Presentation (15%)
- History/Philosophy/Physics Education Research Literature analysis (15%)

Lab Book: This should contain class notes, results and analyses of the hands-on activities done in class, and notes you take on the presentations from the other members of the class. Including work you do on homework problems is fine but not necessary.

Presentation: This is a group oral presentation, followed by a poster presentation, of a lesson plan or curriculum module for use in your class that connects to the material from this course, along with student worksheets. You will also be graded on your individual evaluation of three of the other presentations.

Literature Analysis: During the course everyone will be assigned to read the same set of readings and journal articles covering various aspects of history, philosophy, and physics education research. Your individual paper is expected to refer to one or more of these readings, and should also include an analysis of how the readings connect both to this course as well as to activities that you do in your own classroom.
Books and Materials:
2. Readings in science education research literature.
3. Readings in history of science.

Course web site: [http://physics.bu.edu/~duffy/SC527_Notes.html](http://physics.bu.edu/~duffy/SC527_Notes.html)

Objectives and Goals

The goal of this course is to support the development of a mastery of fundamental physics with deep pedagogical content knowledge by teachers of physics. The immediate objectives are:

1. Provide a review and instruction in static and dynamic fluids, rotational motion, heat, and thermodynamics.

2. Assist teachers in developing their creativity in the development of laboratory activities to support inquiry-based learning in physics as described in the National Science Education Standards.

3. Offer teachers a historical and philosophical context for the topics covered so as to help them develop the analogies, metaphors, and direct examples that, in part, constitute the basis for a teacher’s pedagogical content knowledge.

4. Prepare the teachers for the next course in this sequence.

5. Continue preparing the teachers to take the Massachusetts Teachers Educational Licensure examination in physics.

Curriculum

There will thirteen or fourteen class sessions, each 3 hours in length. The typical session will be a mix of laboratory experiments, discussion centered around concepts of fluids, rotation, or thermodynamics; a problem-solving session; and either a discussion of the history and philosophy of science, or a discussion of the science education research literature and its bearing on the teaching of physics.

Code for Mastering Physics On-Line Homework System

When you register for the Mastering Physics homework system, at [http://www.masteringphysics.com](http://www.masteringphysics.com), you will be asked for a course code. Please enter the following code:

MPDUFFY0004
SC527 Course Schedule

Session 1: Friday November 5th
Sections from Knight: Sections 15.1 – 15.4

Assignments for next session
Mastering Physics: Assignment 1

Session 2: Tuesday November 9th
Topics: Bernoulli’s Principle and Fluid Dynamics. Viscous Fluids.
Sections from Knight: Section 15.5

Assignments for next session
Mastering Physics: Assignment 2

Session 3: Tuesday November 16th
Topics: Torque and Rotational Inertia.
Sections from Knight: Sections 13.3 – 13.4

Assignments for next session
Mastering Physics: Assignment 3

Session 4: Friday November 19th
Sections from Knight: Sections 13.1 – 13.2; 13.4 – 13.6

QUIZ #1

Assignments for next session
Mastering Physics: Assignment 4

Session 5: Tuesday November 23rd
Topic: Applying Newton’s Second Law for Rotation.
Sections from Knight: Sections 13.4 – 13.5

Assignments for next session
Mastering Physics: Assignment 5
Session 6: Tuesday November 30\textsuperscript{th}
Topic: Angular momentum. Rotational kinetic energy.
Sections from Knight: Section 13.7 and 13.9

QUIZ #2

Assignments for next session
Mastering Physics: Assignment 6

There will be no class on Friday November 26\textsuperscript{th} because of the Thanksgiving holiday.

Session 7: Friday December 3\textsuperscript{rd}
Topic: Rolling motion.
Sections from Knight: Section 13.8

Assignments for next session
Mastering Physics: Assignment 7

Session 8: Tuesday December 7\textsuperscript{th}
Topic: Temperature and Thermal Expansion.
Sections from Knight: Sections 16.1 – 16.3

MIDTERM TEST (90 minutes)

Assignments for next session
Mastering Physics: Assignment 8

Session 9: Tuesday December 14\textsuperscript{th}
Sections from Knight: Sections 17.5 – 17.6

PROJECT PRESENTATIONS

Assignments for next session
Mastering Physics: Assignment 9

Session 10: Friday December 17\textsuperscript{th}
Topic: The ideal gas law. Kinetic theory.
Sections from Knight: Sections 16.5; 18.1 – 18.4

PROJECT PRESENTATIONS and POSTER SESSION

Assignments for next session
Mastering Physics: Assignment 10
Session 11:  Tuesday December 21\textsuperscript{st}
\textbf{Sections from Knight:} Section 17.1 – 17.4; section 16.6

PAPERS DUE

QUIZ #3

\textit{Assignments for next session}
Mastering Physics: Assignment 11

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Session 12:  Tuesday January 4\textsuperscript{th}
\textbf{Topic:} More Thermodynamic Processes.  
\textbf{Sections from Knight:} Section 17.7

\textit{Assignments for next session}
Mastering Physics: Assignment 12

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Session 13:  Friday January 7\textsuperscript{th}
\textbf{Sections from Knight:} Section 18.5-18.6; chapter 19

\textit{Assignments for next session}
Mastering Physics: Assignment 13

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Session 14:  Tuesday January 11\textsuperscript{th}

FINAL EXAM + COURSE EVALUATIONS

HAND IN LAB BOOKS