Advanced Physics
MEduc 6670, 3 Cr. Hr.
Weber State University
Summer 2009
Adam Johnston, Weber State University

COURSE PHILOSOPHY:

"Advanced physics" can bring to mind at least two images. One could be the latest innovations and advancements and cutting edges to reveal the fibers of string theory or the multiple dimensions of general relativity. Another – this course's approach to "advanced physics" – is to develop a more genuine and in-depth understanding of the physics principles that are fundamental: concepts regarding motion, forces, and energy. Although this doesn't at first sound like the most exciting and truly "advanced" physics, what we often find is that this is exactly what we need to understand every other aspect of the physical universe. In addition, it turns out to be fun.

This course is intended to provide the content knowledge for practicing teachers to become experts in the field of physics teaching. To truly serve such a purpose, this course probably should be about 18 months long, but we'll settle for a one-week workshop! As professional teachers, experts in the field of learning, you realize that this could be problematic. This course will leave much of the responsibility for developing a thorough understanding to you, but will model the process of learning physics by modeling authentic science and inquiry-based learning. The hope is that this will not only enable you to become better prepared in physics, but also to have examples of activities that you can take to your classroom.

The greatest assets of this classroom are one another. You are surrounded by teaching and science experts, and we will rely heavily on each other's experiences and perspectives, both the freshest and the most well aged. You are expected to participate, listen, suggest, volunteer, laugh, deliberate, build, design, interact, etc. – all of the things that you should expect from your own ideal classroom. Knowledge, after all, is not produced in a vacuum, but is a creative and social endeavor that begs your constructive contributions. *The one contribution which is not welcome is the one which only serves to bemoan the "system," government, administrators, mothers-in-law, students, etc.* Our discussions and foci will be upon those things that we can control. These things, ultimately, are the ones that will make a difference in our classrooms.

COURSE OBJECTIVES:

This course should enable the student to:

- Evaluate his/her own understanding of fundamental physics content.
- Begin to develop a deeper understanding of motion, force, and energy, including the historical development of these concepts.
- Design course curricula for the physics and physical science classroom.

THE DETAILS:

Instructor:
Adam Johnston, Weber State University
(Phone: 801.626.7711; Email: ajohnston@weber.edu; Office: SL 207)

Meeting times: 13-17 July 2009; 8:30 AM – 4:00 PM

Meeting place: SL 222, Department of Physics, Weber State University

Course Web Page: http://physics.weber.edu/johnston/phsxteach

Text: Holton & Brush (2001). *Physics, the Human Adventure: From Copernicus to Einstein and Beyond*. Rutgers Press.

SCHEDULE:

Everything below is subject to revision, but at least you can see that there was some semblance of planning that went into this course. If you aren't told otherwise, expect the following itinerary to hold true.

	Monday	Tuesday	Wednesday	Thursday	Friday
8:30 – 9:00	Introductions	Problem of the day	Problem of the day	Problem of the day	Problem of the day
9:00 – 10:00	Bubbles: Observations of the natural world	Discuss Holton & Brush: Ch. 6-8	Discuss Holton & Brush: Ch. 9-11	Discuss Holton & Brush: Ch. 15-18	Conservation of energy: Simple cases
10:00 – 11:00	The biggest: Measuring the sun	Moving right along: Motion graphs	Sticky tape and balloons	Electromagnetism: How to light a light bulb	Conservation of energy: Collisions
11:00 – 12:00	The smallest: Measuring a molecule	Debrief FCI		The problem with everything you know: wave-particle duality	Conservation of energy: Heat and mechanical energy
12:00 – 1:00	**LUNCH**	**LUNCH**	**LUNCH**	**LUNCH**	**LUNCH**
1:00 – 2:00	What do we know and how do we know what we don't know? The *Force Concept Inventory* (FCI)	Fun with motion: The case of freefall	Making waves: The case of sound and resonance	Wave-particle duality: the SEM and Photoelectric effect	Closing Demonstrations and final debriefing
2:00 – 3:00		Elevator physics			
3:00 – 4:00	*Break and brainstorm*	*Break and brainstorm*	*Break and brainstorm*		

ASSIGNMENTS:

You knew that there had to be something in the way of assessment, didn't you? In addition to your active participation in the course and completion of lab activities, there are two major sets of assignments that you will complete:

- During the week of the course, you will complete multiple labs, contribute to discussions, participate in activities, etc. These will be assessed for completeness daily, and you will be responsible for being prepared for class each day (e.g., reading assignments).
- After the course is completed, you will complete a final "take home" exam. This exam will be open book, open note, etc., but will require your reflection upon the week's activities and readings. This assessment is meant to measure your understanding of the physics concepts covered during the course. It will be due four weeks after the week of the class (though it isn't expected that you will need this much time).