

## **Complexity and the Universe 1**

### **Important message about the material in this course**

#### **No Textbook!**

This course is exploratory and the material is new. Because of this newness, a textbook does not exist. *Therefore you should be aware that this is not a standard textbook course. This course is meant for those are willing to explore work without a textbook exploring new ideas.*

#### **Lectures:**

Most of the material will be delivered in lecture. There will also be reading links and notes on the web.

If you miss a session: If you miss a session, it's important to have someone "cover for you" by taking notes, collecting any handouts, and filling you in on the material.

#### **Math Level (see the write-up for more detail):**

The "traditional" math level will not be much more than algebra. But the course requires a level of logical sophistication because we will be examining the foundations of different mathematical and logical structures.

#### **Website:**

The web page with course notes: <http://www.physics.pdx.edu/~semuraj/complex1.html>

Course home page <http://www.physics.pdx.edu/~semuraj/complex1.html> (Note: In "complex1," 1 is a number)

#### **Grading:**

Approximate weighting for grades:

I. Attendance and participation: 25%

II. Two Exams: (The lowest score will be dropped and the highest two re-weighted.)

Exam I: 20%

Exam II: 20%

Exam III: 20%

III. Assignments: 15%.

Past grade levels were: A and A- (between 75 to 100), B (between 60-75), C (< 60). These scores are approximate.

#### **Tentative Outline of Topics (1/6/2010)**

We will use lectures and notes to discuss many new ideas. We examine foundational questions about. This outline of dates and topics, including the quiz/exam dates will be modified as we progress. We may need to abbreviate this list during a short 10-week term.

1. Introduction: Cosmological Complexity. (Synthesis versus reductionism)
2. A Universe for Free: How can the Universe be here?
3. Our Place Between Atoms and Stars: Evolution in the Universe, large scales of behavior
- 4A Life in the Universe.  
B Civilizations(?)
5. Assembling the Universe: Classes of behavior. Chaos, fractals, interactions. How can we get different things from identical building blocks?
6. A Universe Partly Beyond Reason? Logic, computation, irreducibility and the limits of laws
7. Cognition and agency in the Universe: Adaptivity, cognition, neural nets, memory as basins of attraction, methods of AI