Welcome to CAS CC212 - Core Natural Sciences 2: Reality, Science, and the Modern World. CC212 is the second semester Core natural sciences course, with an emphasis on computational and mathematical reasoning. The goal of the course is to open our students to the world of 20th/21st century scientific questions. Studies include the paradigm-shifting scientific theories which forced the 20th century into a new understanding of our relation to the physical world, beginning with relativity and quantum theory, and exploring emergence, neuroscience and artificial intelligence.
Course staff

This course is a collaborative, team-taught course given by:

- Dr. Binyomin Abrams (CAS Chemistry, SCI 270B, abramsb@bu.edu)
- Dr. Emily Allen (CAS Core, CAS 119, eallen2@bu.edu)
- Dr. Emanuel Katz (CAS Physics, PRB 571 amikatz@bu.edu)
- Dr. Paul Lipton (CAS Neuroscience, BSC 114, palipton@bu.edu)
- Dr. Robin Stevens (CAS Core, CAS 119, rjs01@bu.edu)
- Dr. Wayne Snyder (CAS Computer Science, MCS 147, snyder@bu.edu)

Additionally, Core peer tutors will assist with lectures, discussions, and tutorial sessions:

- Isabella Amorim iamorim@bu.edu
- Madison Crosby mmcrosby@bu.edu
- Angelee Handa arcangel@bu.edu
- Jessica Miller jmiller4@bu.edu

All members of the course staff are available for consultation during their office hours and by appointment. All students are welcome and encouraged to attend any of the office hours listed to discuss coursework and ask questions about the course.

Emergency questions that you have about the course can be sent to cc212-questions@bu.edu. E-mails sent to this address will reach all of the course staff simultaneously. Please use a valid BU email address for email communication regarding CC212 issues. Please do not use hotmail, yahoo or any other email account, as the spam filters of your teaching staff may ignore messages originating from these accounts.

Texts and equipment

Required materials

In addition to the PDF documents (course textbook and other handouts available on the Lectures and Handouts tab), the following materials are required for each student in the course. All required materials are available in the BU Bookstore, or may be purchased from other vendors (use the ISBN numbers below to make sure you get the correct edition).


3. Scientific (non-graphing, non-programmable) calculator (recommended: [http://goo.gl/uRZQ8K](http://goo.gl/uRZQ8K)).

4. Top Hat account ([see below](http://goo.gl/uRZQ8K))

**Classroom response system and other electronic devices in lecture/discussion**

We will be using Top Hat for preparation for lectures, in-class quizzes, lecture work, and other assessment. All students need an active Top Hat account.

You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets. You can visit the Top Hat Overview within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as provides a brief overview to get you up and running on the system. The course join code for CC212 in Spring 2017 is 189118, and your account for Top Hat must use your BU email address (ending in @bu.edu) in order for you to get credit for your work on Top Hat.

We will use Top Hat for lecture preparation, classroom engagement, periodic attendance, and some quizzes; that said, recent studies ([click here](http://goo.gl/uRZQ8K)) have shown that taking notes with electronic devices (computers, tablets, etc.) leads to lower performance by students on exams. For this reason, we require that you take notes using the traditional pen and paper mode. Similarly, while you will use your cellphones or tablets for answering Top Hat questions, make sure to keep them down when they are not in use so that you might best benefit from the lectures.

**Learning objectives**

**Content-specific objectives**

- Understand current thinking regarding the concepts of matter, energy, their interactions, and their conservation
- Understand relativity (Newtonian, special) and how it is a practical necessity in 21st century life
- Develop a conceptual understanding of the structure and behavior of the atom, including the quantum mechanical nature of the electron cloud
- Understand the driving force behind spontaneous processes and how they are governed by the second law of thermodynamics.
- Learn and apply the basic definitions and relationships of the concepts "mind," "brain," "consciousness," and "intelligence."
- Study the basic structure and biology of the brain, focusing on the role of networks of neurons.
- Understand the concept of "emergent property" and its relationship to the notion of intelligence.
- Understand the nature and limitations of computation by an algorithmic process. Understand the claims pro and con regarding the thesis of "Strong AI."

**Broader educational objectives**

- Learn how to assimilate data from representative examples and truly understanding how the behavior in these cases derives from the fundamental principles at work.
- Learn to evaluate hypotheses based on application of the underlying principles.
- Study the application and limitations of abstract models of complex phenomena.
- Utilize basic experimental techniques to probe and understand physical phenomena through in-class inquiry experiences and at-home activities.
- Learn to think and write clearly about technical and scientific ideas.
- Learn to think critically about the future (e.g., of machine intelligence) using thought experiments and hypothetical reasoning.
- Develop comfort and facility with quantitative reasoning skills and application to real-world problems.

**Important Information**

**Communication**

Periodic e-mails will be sent to the entire class using the BU-link (registrar’s online information system). Make sure that you check your BU e-mail address regularly so that you do not miss any important messages.

**Course format**

CC212 consists of two components:

- Lectures (Tuesdays and Thursdays 3:30pm-4:45pm in CAS 326)
- Discussion:
  - B1 (Katz and Lipton): Mondays 11:15am-12:05pm in SED 307
  - B2 (Stevens): Mondays 12:20pm-1:10pm in PRB 146
 Attendance is mandatory at all lectures and discussion sections, and students must attend their registered discussion. Your grade will be based on your performance and contributions in all aspects of the course. Students missing more than two course meetings will receive a grade penalty. Important announcements will be made in lecture, discussion, or on the course Blackboard site; these include reading assignments, problems, and/or worksheets. The detailed schedule of lectures and discussions can be found here.

**Important note about lecture preparation:** it is imperative that you *read (and work through problems on) the relevant readings and review the notes from the previous classes before coming to class*. In lecture we will spend the majority of the time selectively explaining the most challenging parts of the material, working through activities to understand the concepts, and going beyond the level of the readings, rather than just reiterating the readings. Please feel encouraged to ask questions during the classes.

**Electronic devices**

Laptops and tablets are not permitted in class. You will find that a laptop is not a good vehicle for note taking in this course, as it is impossible to recreate the diagrams and figures we will be discussing in class. Also, recent studies have shown that taking notes with electronic devices (computers, tablets, etc.) leads to lower performance by students on exams. For this reason, we require that you take notes using the traditional pen and paper mode. All you will need to take notes in class is a pen or pencil and a notebook or some paper.

Cell phones will be used in class only for Top Hat work. Make sure to keep cell phones down when they are not in use (for Top Hat) so that you might best benefit from the lectures.

**Absences**

Attendance is mandatory at all lecture and discussion sections. Students missing more than two course meetings will receive a grade penalty. A missed exam will count as zero. Additionally, a component of your grade will be assigned to participation in both lecture and discussion.

**Academic Conduct**

All work and conduct regarding this class are governed by the Rules and Regulations as described in the Boston University Academic Conduct Code. All students are responsible for reading, understanding, and following this Code. Specifically, all work that you submit in this class must be your own work. While you are encouraged to work in groups on homework assignments and to discuss strategies and concepts, each student must submit papers that represent their own work and is written in their own words. Students suspected of committing academic misconduct will be reported to the Dean’s office.
Copyright laws and protection

"The syllabus, course descriptions, packets, and handouts created for this course, and all class lectures, are copyrighted by the professors of CC212. Except with respect to enrolled students as set forth below, the materials and lectures may not be reproduced in any form or otherwise copied, displayed or distributed, nor should works derived from them be reproduced, copied, displayed or distributed without the written permission of the course instructor. Infringement of the copyright in these materials, including any sale or commercial use of notes, summaries, outlines or other reproductions of lectures, constitutes a violation of the copyright laws and is prohibited. Students enrolled in the course are allowed to share with other enrolled students course materials, notes, and other writings based on the course materials and lectures, but may not do so on a commercial basis or otherwise for payment of any kind. Please note in particular that selling or buying class notes, lecture notes or summaries, or similar materials both violates copyright and interferes with the academic mission of the College, and is therefore prohibited in this class and will be considered a violation of the student code of responsibility that is subject to academic sanctions."

Grading and Assessment

Assessment in CC212

Your work in CC212 will be assessed from a combination of quizzes, exams, activities, papers, homework, and in-class participation. There will be three midterm exam: two will be given in class during the semester and the third will be given during the final exam period. If the need arises, the dates of the exams may be changed without notice. In case of a serious medical or other emergency that prevents you from attending an exam, e-mail cc212-questions@bu.edu before the exam so we can discuss the situation and decide how to remedy it. Examination absences that are not arranged with us in advance, or for which a satisfactory serious cause that cannot be adequately documented, will result in a zero grade for that exam. No exceptions. Note: make-up exams are not allowed due to travel.

Students will be asked to two papers during the course of the semester. Details about each assignment will be given in class.

Course grading

Your course grade in CC212 will be determined as follows:
<table>
<thead>
<tr>
<th>Component</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Exams (3 exams x 15% each)</td>
<td>45%</td>
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<tr>
<td>Papers (2 papers x 10% each)</td>
<td>20%</td>
</tr>
<tr>
<td>Quizzes, activities, and homework</td>
<td>25%</td>
</tr>
<tr>
<td>Participation</td>
<td>10%</td>
</tr>
</tbody>
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During the term, you will receive numerical grades for individual exams, quizzes, papers, and activities; we do not assign letter grades to these individual assessments. Your overall course letter grade will be determined, in part, on your total score for the course. There are no fixed or pre-designated percentages of each grade; course letter grades will be assigned based on our assessment of how an individual performed relative to our absolute standards. This means that your grade is uncoupled from the grades of your classmates. Please note that we do not offer or accept extra credit assignments to augment your scores.

**Success in CC212**

CC212 is a 4-credit course, which means that each week you will meet with instructors for 4 contact hours, as well as 2-3 hours of independent work each week for each credit (8 – 12 hours of independent work per week). Depending on the week, we suggest that you break down these out-of-class hours in the following way:

- Assigned readings (textbook, papers, books) and related problems: 3-5 hours
- Reviewing your notes and *group discussions* about material from class: 2-3 hours
- Homework assignments and paper writing: 3-4 hours

**Note:** "discussing" material from class means working in study groups and going over problems, exercises, and reading material. Success in learning science requires students to see the material from many directions and to be able to articulate it in their own words. Students trying to work alone in this course will be at a tremendous disadvantage. We **highly recommend** that all work (except taking assessments and the actual writing of individual papers) for this class be done **in groups**. Please do not hesitate to ask for assistance in setting up a regular study group.

**Tutorial sessions (a.k.a. office hours)**
You are strongly encouraged to attend office hours frequently. They are a great opportunity to work through problems in groups, get support from course instructors, and ask questions. Note: you do not need to have a question or an appointment to attend these open hours. Rather, come frequently and maximize your effort by getting support. These tutorial sessions are helpful for all students.

An important note about getting answers to your questions: e-mail is not a replacement for office hours. While instructors will certainly respond to personal, private, and urgent matters by email, they will not be regularly answering content-related questions by email. To get answers from instructors, please attend any of the office hours.

This is a tentative syllabus and is subject to change at any time. Students are expected to conform to these instructions and any other instructions given throughout the semester.