**PHY 231 - PHYSICS FOR FUTURE PRESIDENTS**

**FALL 2022**

INSTRUCTOR: PROFESSOR ABHAY L. DESHPANDE

**Class When:** Tuesday & Thursday 1:15-2:35 PM

**Where: Social and Behavioral Science Building Room: S228**

Co-Instructors\*\*: Dr. Wenliang Li & Dr. Charles-Joseph Naim

**Course Description:** The aim of this course is for you to learn how science addresses the most important societal issues facing our planet.

**Scientific Objective:**

* To understand the fundamental science of energy, energy usage in the world, and the human impact on the global climate
* To learn, through process of discovery, how science formulates questions, and addresses them with evidence based reasoning
* To address specific questions which must be asked and answered in order to understand the important societal questions of energy usage and environmental impact
* To learn about other issues with strong physics content such as satellites, space, quantum devices, nuclear energy in the context of weapons, global threats due to terrorism, etc.
* We will take on all issues that a potential conscientious leader of a world, country, government agency, public or private company, a citizen's representative may have to take on to make good decisions. We will learn how to address issues even when one is not the world expert in all issues.

At the completion of this course you should have improved ability to:

* Look at complex issues and identify (break them down in to) basic science questions and correlate them to the impact on and is impacted by the political, social, economic, and ethical dimensions
* Understand the limits of scientific knowledge
* Critically evaluate scientific arguments in the context of societal impact
* Ask good questions
* Find information using various resources, and evaluate their veracity
* Communicate scientific ideas clearly
* Relate to science in various personal situations

**TEXT: *Physics and Technology for Future Presidents by Richard Muller***

**Clickers: Turning Point Technologies (or equivalent suggested by the University) for in-person meetings.**

**Attendance Policy:** Attendance is **required**. This will be an interactive class, with in-class group activities and responses. Your attendance is critical to your success and of this class'. Participation in the class is part of your grade. Everyone participating in this class, must follow the University guideline at the time for COVID related issues. Any student not in compliance with this will be asked to leave the class.

**Reading:** There will be reading assignments to be completed before the class, and some times short assignment (short answer to a single question) related to the reading. There will be discussions related to to the reading in the class, so be sure to read! You may be asked about it.

**Homework:** Two components to the homework. 1) Approximately, every alternate week you will find a link relevant and submit a link related to the media coverage of topic of discussion that you find interesting/compelling and related to our class: you should be ready to discuss this in the class. **H**[**ere is a link**](http://www.google.com/url?q=http%3A%2F%2Fwww.andrew.cmu.edu%2Fcourse%2F33-115%2Fresources.html&sa=D&sntz=1&usg=AOvVaw3fE646lUMRRlO6yP5k-52c) to a large number of interesting sources compiled by a professor at Carnegie Mellon University. 2) Other homework will be assigned as we go through the course, at approximate frequency of once-every-two weeks. Late homework will not be accepted.

**Project/Presentations:** There will be one group project (by a group of ~5 students) due early October, and one term project to be performed by the same group in a topic that interests you most, due early December.

**Extra Help and Office Hours:** I will be available to discuss things at the end of each lecture for additional half an hour. If you need more, we will make appointments as needed.

\*\* Co-instructors are research physicists at Stony Brook, who will step in place of Prof. Deshpande, should he have to travel during the semester.

**Grading:**

Midterm exams (2) : 15% of the grade each

Attendance: 10%

Final Exam 40%

Group Presentations (2): 10% each

**Other Important Info:**

Everyone participating in this class, must wear a mask/face covering at all times. Any student not in compliance with this will be asked to leave the class.

**Disabilities:** If you have a documented disability and wish to discuss accommodations, please come see me.

DISABILITY SUPPORT SERVICES (DSS) STATEMENT:

If you have a physical, psychological, medical or learning disability, that may impact your course work, please contact DSS, Educational Communications Center (ECC) Building, Room 128 or call (631) 632-6748. They will determine with you what accommodations if any, are necessary and appropriate. All information and documentation is confidential.

ACADEMIC INTEGRITY STATEMENT:

Each student must pursue his or her academic goals honestly and be personally responsible and accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to Academic Judiciary. For more comprehensive information on academic integrity, including categories of dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/acdemicjudiciary/

CRITICAL INCIDENT MANAGEMENT:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromise the safety of the learning environment, or inhibit student's ability to learn.

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| Physics for Future Presidents Stony Brook University Physics 231 | | | | |
| Fall 2022 | | | | |
| Chief Instructor: Prof. Abhay Deshpande with co-instructors Dr. Wenliang Li and Charles-Joseph Naim | | | | |
| **Approximate Schedule: This will evolve as we go through various topics** | | | | |
| **Date** | Meeting Number | **Topic of discussion** | **Lecture Number and Link** | **Comments or Homework** |
| 8/23/22 | 1 | Introduction | Lecture01.pdf | Overview of this class and its contents |
| 8/25/22 | 2 | Energy vs. Power & Physics of Explosions | Lecture02.pdf | You should have learnt the difference between energy and power. Explosivity depends on how fast stored energy can be converted in to heat. Today we did Slide 1-22 of Lecture02.pdf. We will continue tomorrow and then move on to Lecture 3 |
| 8/30/22 | 3 | Energy and Power (II) | Lecture03.pdf | Coal, Solar, Electric, Hydrogen fuel: Pros, cons, limitations; Think of use in automobile in each of these cases, Comparison of energy requires uniform units: learn to convert. **Read and Research WIND power.** |
| 9/1/22 | 4 | Energy and Power (III) | Lecture04.pdf | Review and lots of questions and discussions. Test of Turning Point. All worked. Next week we will use **Turning Point for attendance.** |
|  |  |  |  | Homework 1 |
| 9/6/22 | 5 | Atoms and Heat | Lecture05.pdf | Introduction to Subatomic Structure. Connection to observed propoerties of matter: heat, brightness, darkness/dullness |
| 9/8/22 | 6 | Atoms and Heat (II) | Lecture6.pdf | Temperature, effects of heat, space shuttle, thank god for water, heat engines and their efficiencies |
|  |  |  |  | Home work 2 |
| 9/13/22 | 7\*\* | Review of Atoms & Heat | Lecture7.pdf | Multiple choice review of Atoms and Heat. Introduction to Radioactivity |
| 9/15/22 | 8\*\* | Radiation and Radioactivity | Lecture8.pdf | Radiation types: alpha, beta and gamma, definition of "REM", medical issues with radiation, nuclear assassinations |
|  |  |  |  | **Homework 3** |
| 9/20/22 | 9 | Radiation and Radioactivity | Lecture9.pdf | Meaning of increamental effect of radiation on population, statistical samples and one standard deviation, real impact of Chernobyl.... |
| 9/22/22 | 10 | Half-life, nuclear fission and nuclear fusion | Lecture10.pdf |  |
|  |  |  |  | **Homework 4** |
| 9/27/22 | 11 | Group Presentation (I) |  | Group1, 2, 3 and 4 |
| 9/29/22 | 12 | Group Presentation (II) If needed |  | Groups 5, 6, 7 and 8 |
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| 10/4/22 | 13 | Chain Reaction and Nuclear Weapons | Lecture11.pdf | Noble and evil uses of knowledge: It depends on how you decide to use it: Nobel Prizes in Physics 2021 vs. Atomic weapons. How is a bomb made? |
| 10/6/22 | 14 | **MidTerm Exam 1** |  |  |
| 10/11/22 |  | No Class:Midterm break |  |  |
| 10/13/22 | 15 | Controlled Chain Reactions, Nuclear Power Stations and Radioactive Waste | Lecture12.pdf | Good use of nuclear technology: nuclear power plants and energy production. |
| 10/18/22 | 16 | Integral Nonproliferation Introductory Teaching and learning Module | Lecture13-Module.pdf | Non-proliferation effort in the real world. A review of activities around the world and their successes/failures |
| 10/20/22 | 17 | Introduction to electricity & magnetism | Lecture14.pdf | Introduction to Electricity and Magnetism |
| 10/25/22 | 18 | What is light? | Lecture15.pdf | Introductoin to Electromagnetic radiation, wavelenth, frequency, speed |
| 10/27/22 | 19 | What is invisible light? | Lecture16..pdf | invisible light: UV or IR, relations between wavelengh, frequency, speed, power and temperature |
| 11/01/22 | 20 | Climate Change (I) | Lecture17.pdf | Global Warming (1) : True or fals, deabtes about human influence |
| 11/03/22 | 21 | **Midterm Exam 2** |  |  |
| 11/08/22 | 22 | Climate Change (2) | Lecture18.pdf | Global Warming (2) : Exagerations and realities but message the same |
| 11/10/22 | 23 | Climate Change (3) | Lecture19.pdf | Global Warming (3) : Climate vs. Weather, origin and impact of CO2, can it be reversed |
|  |  | Climate Change (4) | Selft Study Lecture 20A | Review of solutions for global warming: Review of renewable energy options |
| 11/15/22 | 24 | Gravity, Force and Satellites | Lecture21.pdf | Introduction to Newton's laws, and concepts useful to understand gravity, satellites, GPS etc. |
| 11/17/22 | 25 | Gravity (II) | Lecture22.pdf | Gravity (II) Rockets, Black Holes, Angular momentum etc. |
| 11/22/22 | 26 | The last lecture: Relativity | Lecture 23.pdf | Relativity, contraction, dilation of length and time. etc. etc |
| **11/24/22** |  | **No Lecture** | **Thanks Giving** | **No Lecture** |
| 11/29/22 | 27 | Group presentation 1 | During Class time | Presentations from Groups 1, 2, 3, 4 |
| **12/01/22** | 28 | **Group Presentation 2** | **During Class time** | **Presentations from Groups 5, 6, 7, 8** |
| 12/06/22 |  | Reading day |  | No lecture, no presentation, no exam |
| 12/08/22 | 29 | Final Exam | During Class time | Will cover Chapters 1-10 and 11 |
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