PHYSICS 3250
Applied Nuclear Physics
Syllabus
Spring 2015
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The focus of PHYS3250 will be on applications of nuclear physics and nuclear energy. Lectures will be held every Tuesday and Thursday from 12:30-1:45pm, in Physics building room 205. Please see class website for the detailed calendar:
people.virginia.edu/~xz5y/PHYS3250_Spring2015/

Textbook and Material

There will be articles related to the course topics posted every week. You are required to read these articles. At least one problem in each homework assignment will be based on these journal articles.

Grading
The grading will be based on homework, a midterm exam, and the final exam. There will be participation points from in-class clicker questions and a term-paper. Details of the term paper will be available around or after the midterm exam.

The final grade will be determined as follows:

- Homework: 20%
- Midterm: 30%
- Final Exam: 40%
- In-class participation and term paper: 10%

Class Outline
1. Introduction: particles and forces, quantum mechanics applied to the nucleus;
2. Nuclear structure: shell model, semi-empirical mass formula, nuclear binding energy;
3. Radioactivity;

4. Passage of radiation through matter;

5. Radiation creation and detection: particle detectors, particle accelerators, X-ray generators;

6. Biological effects of radiation;

7. Industrial applications of radiation;

8. Nuclear medicine: imaging, radio-therapy, NMR;

9. Nuclear energy – introduction;

10. Nuclear fission: neutron cycle, moderators, reactor basics, thermal reactors, fast-breeder reactors, nuclear waste management, advanced fuel cycle, reactor safety;

11. Nuclear fusion: fission vs. fusion, thermo-nuclear fusion, magnetic confinement, progress towards fusion power, ITER, inertial confinement fusion;

12. Fusion in stars: fusion in the early universe, stellar burning, super-novae, nucleosynthesis;

13. Nuclear proliferation.
The following undergraduate projects are currently available at the division of applied nuclear physics. Contact the person associated with each project for more information. Model calibration using deterministic sampling. Contact Henrik Sjöstrand. Simulations of detector response in nuclear fission experiments. Contact Ali Al-Adili. Analysis of nuclear experiments for detector characterization. Contact Ali Al-Adili. Nuclear Physics books at E-Books Directory: files with free access on the Internet. These books are made freely available by their respective authors and publishers. E-books in Nuclear Physics category. Introduction to the Physics of Gyrotrons by Gregory S. Nusinovich - Johns Hopkins University Press, 2004 Gregory S. Nusinovich explains the fundamental physical principles upon which gyrotrons and related devices operate.