Physics 782 – Computer Simulation of Plasma

CLASS DETAILS:
• Meeting Times: MW, 1:30-2:45pm Rm 103 White Hall
• Course Web Site: http://ulysses.phys.wvu.edu/~pcassak/phys782.html
• Instructor: Dr. Paul Cassak Rm 333 White Hall
• Contact Info: pacassak@mix.wvu.edu (304) 293-5102

OFFICE HOURS:
• In Room 333 of White Hall unless announced otherwise.
• Set times - Monday 3:00-4:00pm + by appointment + whenever the door is open
• Please come by for help with concepts, homework, or other advice!

PREREQUISITES:
• Catalog says – PHYS 481 or PHYS 781 - Principles of Plasma Physics and PHYS 633 (Electromagnetism I); programming proficiency in C, FORTRAN, or BASIC.

COURSE OBJECTIVES:
From catalog - “Projects teach mathematical and physical foundations of computer simulation algorithms and develop and refine physical understanding and intuition of phenomena encountered in plasma research.”

Two main objectives of this course is to develop an ability to understand and choose algorithms for solving plasma physics problems with computers using various models and to evaluate whether results from numerical simulations are believable. Another objective is to develop a comfort level applying numerical techniques to various plasma systems. There is no way to cover everything in computational plasma physics in a single semester, and it is not the goal of this course to do so. The goal is to build a foundation and expose you to its uses, which will allow you to apply numerical techniques to whatever application interests you.

EXPECTED LEARNING OUTCOMES:

Upon successful completion of this course, you will have:
1) developed an understanding of numerical algorithms and their implementation.
2) developed an ability to evaluate the validity of numerical simulations.
3) created a suite of codes for various plasma physics applications.
4) an ability to develop an understanding of plasma physics using simulations as a tool.

TEXTBOOK:
Plasma Physics Via Computer Simulation by C. K. Birdsall and A. B. Langdon (Optional)
Additional resources may be provided

SCHEDULING:
There will be no class on September 8 and 10 because I will be at a conference. Make-up classes will be scheduled according to availability, likely Fridays in November. I may also have to be away sometime in early November. I’ll keep you posted.
CLASS EXPECTATIONS:

• Your focus should be on genuine understanding.
• It is expected that you will put forth an active effort into learning.
• Do not expect that attendance is sufficient or lectures are complete. Important topics will be left out!
• It is expected that you will be considerate of your fellow classmates and myself.

HOMEWORK:

• Homework is assigned approximately every two weeks. Problems will be of many varieties - calculations, using codes, writing codes, etc. Each of these are useful to develop a comfort level with computational plasma physics. Problems often cover applications!
• For problems including a coding portion, you will have to turn in your code electronically via email by the time it is due.
• For problems that require code writing, it is imperative to comment the code appropriately. No credit will be given for codes that are not properly commented!
• For problems that require the generation of plots, standard scientific practices of labeling plots should be followed. No credit will be given for plots that are not labeled!
• If you’re stuck on homework, talk to your classmates or come see me for help!

PROJECTS:

There will be two projects which will like regular homework but be more coding intensive. The first is due October 22 and the second is due December 11. Ideas for projects will be given out, but you will also have the option to choose your own project (in consultation with me).

COMPUTATIONAL RESOURCE LOGISTICS:

The computers in White 103 are set up with dual boot of Windows and Ubuntu Linux. Both our lives will be easier if you use Linux. The Linux side has a compiler (gfortran) and the graphics package Interactive Data Language (IDL). Both are standard tools, and it is expected that you will use these for the course activities. Needless to say, what we learn is platform independent, but it will be helpful for the course to run smoothly if we all use the same languages.

You should have been given ID card access to White 103 at any time. (Please test this and see Viola if there are any issues.) You log into the computers using your WVU MasterID. Anything you put on the computer will remain there, but it is not backed up. You should back up anything you put on the White 103 computers!

COLLABORATION POLICY:

Science is fundamentally a collaborative endeavor. It is very rare in the modern world for someone to sit alone in a room and make important contributions to science. As such, working together is encouraged! However, copying is not allowed in any form. This is especially important in this class which contains coding. For example, you can work together to develop an algorithm, but you must code it up individually. An important balance must be reached! Copying someone else’s solution is not allowed in science, nor will it be allowed in this class. An appropriate technique is to try the homework on your own first, then discuss it with your classmates, then try again on your own.
GRADING BREAKDOWN AND SCHEME:

Your grade will be based on homework (50%), project 1 (15%), project 2 (20%) and class participation (15%). There will be approximately 5 assignments, as shown on the schedule. Grades will be awarded roughly as:

- A 100-90%
- B 90-80%
- C 80-70%
- D 70-60%

Some regard will be paid to natural breaks in the grade distribution. I reserve the right to adjust grade scales (i.e., curve) in the interest of fairness and propriety if warranted.

GRADING POLICIES:

- Homework is due at the beginning of class. Homework turned in up to a week late will be graded by the same standards as on-time homework, but with a 50% lateness penalty.
  - Accidentally deleting an important file is not an excuse for lateness!
  - If you don’t finish on time, submit what you have and turn the rest in late!
- Partial credit is awarded, so develop your ideas logically. Show your work (credit is for the process, not the solution!) and draw sketches where appropriate.
- Take pride in your work. If your solution is illegible, I can’t give credit.
- Grading appeals must be made within one week of when the submission is returned.

SOCIAL JUSTICE STATEMENT:

WVU policy – “West Virginia University is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and nondiscrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

“The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see http://diversity.wvu.edu.” Please let me know if I can be of any assistance, and do so with sufficient notice.

ACADEMIC INTEGRITY STATEMENT:

WVU policy – “The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at http://www.arc.wvu.edu/admissions/integrity.html. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.”