Final Project: Overview and Instructions

The final project counts for 30% of your grade in the course

Please read these instructions carefully.

Key Dates

Friday, Dec 7 by 11:00 PM:

Project submission deadline

- Electronic: all project-related files, including Python code(s), input data and output data uploaded through the link on the course website
- Electronic: project report to be uploaded through the link on the course website by the deadline. This should be typed and in PDF format. No hand written reports will be accepted.

Breakdown of tasks

To successfully complete your project you will need to organize your work into 4 main tasks.

- **Background research** — Gather the knowledge you will need to define the problem and write your project report. You will at least need to get a grasp of the underlying physics and the wider context. Include any equations you need — showing derivations if appropriate. You could include a little history too. The project briefing will provide a brief synopsis and some links or references that you can use as starting points for your background research. Make use in particular of textbooks and web resources. You can do much of this in parallel with the other tasks.
- **Program development** — This can itself be broken up into several tasks. Define the problem, design your program, write the code, and test and refine it.
- **Investigation** — Use your program to investigate the problem by using it to generate results for various scenarios. The project briefing will include some examples of problems to explore. These are intended to illustrate the scope and depth of the investigations required for a high grade. However, you need not follow these suggestions exactly, nor should you be limited by them.
- **Write the report** — See below for what is expected. Start as soon as possible. Do not leave all the writing until you have finished developing and running the program. You should aim to write-up "as you go".

Working together

You are encouraged to discuss your work with other students. However, while exchanging ideas and comparing results is fine, **your final program design must be your own and you must write all code yourself.** (You may, however, use any code posted on the course website.) Similarly, **any results you present must be obtained with your own program**. Each individual is responsible for submitting their own versions of both the electronic files

and hardcopy report. If you have worked extensively with someone else, then you **MUST acknowledge** this in your project report. Examples: "The program algorithm was designed after discussions with Albert Einstein and Niels Bohr"; "Marie Curie suggested the idea for sub-function `radium.m`".

PYTHON built-in functions

You may use the standard set of elementary math functions in the math or numpy libraries (e.g., `sqrt(x)`, `cos(x)`) and any graphics or programming functions. You **may not** use the built-in numerical methods functions (e.g., ODE solvers, integration routines etc.). In general, you should implement numerical techniques such as the ones we have covered in the course yourself. If in doubt as to whether a particular function is allowed, ask your instructor.

Scheduled classes

There will be no formal class meetings on subsequent Fridays. **It is recommended that you use the scheduled class time to work independently on your project**, either in the open Computer Labs, or elsewhere.

You are expected to attend the scheduled labs as normal. These sessions should be used for program development and testing and for running the simulations. The instructor will provide guidance on programming issues and will advise on debugging techniques. This is your chance to get help designing, debugging, and testing your program. Try to do as much code development as possible before the session, so that we can reserve class time for dealing with specific problems.

Project Programs

You must submit all PHYTHON files that you write for the project, including the main function, any sub-functions called by the main function and any stand-alone ancillary functions or scripts (e.g., for plotting graphs, initializing input data files etc.). In general, **you should upload anything that would be needed in order to run your program(s) and reproduce your results**.

Each separate py-file should start with a header comment, which should

- Give your name and the project title;
- Describe briefly the purpose of the function;
- List any input parameters and/or files;
- List the output values and/or files.
- Provide an example of use (what does a user have to type to run the program?)

The Project Report

The report should be written using a word processor (or LaTex) and submitted in PDF format. The report must have a **cover page** giving your name and the project title.

The report must include the following sections

1 A succinct introduction to the topic giving the background, the aims of the project and describing the essential physics (approximately 1 page). This should be based on your own research into the topic. Do not just regurgitate the opening paragraphs of the briefing sheet.

2 A program "manual" explaining briefly the design and purpose of the program(s) you have written. This should include a clear description of how to run the program. It should also include a complete print-out of the source code and perhaps a flowchart. (Approx 2 pages + diagrams & program listing.)

3 A brief description of your investigations using the program, which should include your results presented as graphs and/or tables. (Approx. 2 pages + graphs/tables as necessary.)

4 A brief discussion of your results and a summary of your conclusions. What do your computer experiments tell you about the physical system you have modeled? (Approx. 1 page.)

5 A list of all references you used for your background research. This may include books, articles, and web pages.

The page numbers in parentheses are guidelines. They are not intended to be strictly adhered to, but you should not greatly exceed them. Don't include long lists of numbers in tables; use a graph instead.

Assessment

As a guide only, projects will be graded roughly as follows:

(a)	Background research (context, physics, aims):	15%
(b)	Program quality (does it work, produce accurate results?) and documentation:	30%
(c)	Results and discussion (suggested problems or similar):	30%
(d)	Initiative & innovation (exploring beyond the project briefing):	15%
(e)	Report (presentation quality):	10%

Note: Extra credit may be awarded under (d) for exceptionally interesting or challenging further investigations.