The University Of Sheffield.

Department Of Physics & Astronomy.

Second Year Information 2018-2019

THE SECOND YEAR PROGRAMMES

The second year programme forms the central part of your degree. It consists mainly of core modules, which build on the material introduced in the first year, so that on completion you will have at your disposal the knowledge needed to tackle the more specialised content of the final years. As usual, the academic year is divided into two semesters, each with a formal examination period and the work done in each semester will usually be examined at the end of that semester. For some topics, such as quantum mechanics, that are spread over two semesters as parts of PHY250 and PHY251, the examination in 2nd semester may also include the material taught in the 1st semester. The combination of laboratory work, homework assignments and the need to prepare for the examination means you will have to organise your work schedule very carefully right from the outset to make sure you keep up with the progress of the course and meet all the relevant deadlines.

Unlike the first year, your second year performance does contribute directly to your final degree class. The BSc classification is determined from the weighted average of the second and third year marks in the ratio 1:2, and the MPhys classification from years 2, 3, and 4 in the ratio 1:2:2 (1:1:2 for Year Abroad students). Furthermore, if you are registered for the MPhys degree, you must achieve an average mark of at least 59.5% in your second year. The threshold for continuation on Year Abroad MPhys programmes is an average mark of 59.5% in Autumn semester. If you do not achieve the threshold for an MPhys programme, you will be required to change to BSc. If you achieve an average mark just above the threshold you will be encouraged to switch to BSc, although formally you can continue on the MPhys programme. The thresholds are introduced to make sure that students can achieve the highest possible classification that reflects their performance. The 3rd and 4th year modules are very challenging and are based on your knowledge of the 1st and 2nd year courses. There are a number of mathematically challenging modules in the 3rd year that are core (compulsory) for MPhys students but are optional for BSc students. Achieving 60% in the 2nd year may cause problems with MPhys students passing these mathematically challenging modules in the 3rd year, requiring them to graduate prematurely with a BSc award. It is very important then to achieve your full potential in the second year modules. The marks for modules after **resit exams are capped at 40%**, however well you perform in the resit exam – so it is very much in your interests to pass everything from the first attempt.

Students will be able to resit each failed module only once. If you fail modules in the resit exams in August you will NOT be able to retake the failed modules next year. In order to automatically progress to 3rd year, students must achieve 120 credits, while consideration is given to progression for students achieving a minimum of 100 credits after August resits.

More information about the University of Sheffield regulations can be found on: https://www.sheffield.ac.uk/calendar.

THE SECOND YEAR PHYSICS PROGRAMME

The second year programme is made up of two 25-credit core modules and several 10-credit core and optional modules.

PHY221	Classical Physics (core) [1]	(Autumn)
PHY227	Optics (core) [1]	(Spring)
PHY230	Experimental Physics 1 (core) [2]	(Autumn)
PHY231	Experimental Physics 2 (core) [2]	(Spring)
PHY235	Programming in Python (core/optional) [3]	(Autumn)
PHY236	Computational Physics for Theoretical Physicists (optional) [4]	(Acad. Year)
PHY245	Physics of Materials (optional)	(Autumn)
PHY248	Physics with Labview (optional) [5]	(Spring)
PHY250	From Electromagnetism to Quantum Mechanics (core)	(Autumn)
PHY251	From Thermodynamics to Atomic and Nuclear Physics (core)	(Spring)

Notes

1. Optional for Dual Honours students on some programmes.

2. Dual Honours students take only PHY230. Theoretical Physics students can take PHY230 as an option.

3. PHY235 is core for MPhys students except those on Dual Honour degree programmes: Physics and Astrophysics, Physics and Philosophy, Chemical Physics and Physics with Medical Physics. It is also core for students taking BSc in Theoretical Physics and Physics with Computer Science.

4. PHY236 is an option for Theoretical Physics students only.

5. PHY248 is core for Medical Physics students.

Single Honours Physics students must select 20 (MPhys) or 30 (BSc) further credits from the list of approved options, including physics, computer programming, astrophysics and medical physics. Dual Honours students on most programmes have no choice of modules within physics, since it is essential that the core physics curriculum is fully covered at this level. BSc Physics and Astrophysics students will take further 10 credits from the list of approved options. Theorists have four optional (40 credits in total) modules in this year that they can choose from several courses in Astronomy, Medical Physics, Physics and Mathematics. They must, however, take either PHY230 or PHY236 as part of these optional modules. For more information, see the current programme regulations for your particular programme at:
https://www.sheffield.ac.uk/programmeregulationsfinder/faculty?code=FCP&year=2018

OUTLINE STRUCTURE OF SECOND YEAR PHYSICS MODULES

It is essential that you attend the introductory meeting. The introductory meeting will take place on Monday, 24 September 2018, at 5 p.m. in LT1 (Hicks building).

Important information will be given to you at this meeting concerning the Year structure, coursework, timetable etc.

Classes in the 2nd year start on Monday, 24 September 2018, at 9 a.m.

The majority of modules are lecture-based, with 25 credit modules having 6 lectures per week and each 10 credit module having two lectures per week. The core lecture courses are supported by **tutorials, homeworks and problem classes.** Attendance at the tutorials and problem classes is compulsory but they are not assessed. Homeworks contribute 20% towards the final mark for the modules. It is essential that you complete all this coursework. This is required from you under the University of Sheffield Students' Charter. If you fail to complete the assessed coursework for a module in which the coursework comprises 20% of the module mark, you will need to get a **minimum grade of 50%** in the end-of-semester examination in order to obtain the module **pass mark of 40%.** Past experience has shown that there is a strong correlation between failing to hand in coursework and failing the module completely. If you find yourself failing to hand in work, you should discuss this with the 2nd Year tutor and the module leader as a matter of urgency. You will not be able to resit the coursework in the August resit period for most modules although the coursework still counts towards resit marks. So if you achieve a low coursework mark because you failed to submit items of coursework this low mark will carry over to the resit mark.
If you are re-taking a module with attendance, you need to complete all coursework for this module, regardless of whether you have previously completed it. The marks for any module are not transferred from previous years.

Experimental work

The experimental work in second year is organised as two separate modules (PHY230 and PHY231). Experimental modules (PHY230 and PHY231) are assessed entirely by coursework, differing from other taught modules that typically carry significant (80%) weighting for the end-of-semester examination. The deadlines for all coursework are rigorously enforced and attendances at lectures and other classes are recorded. Late submissions of the coursework including lab work will be penalised.
There is also an optional module (PHY248: Physics with Labview) that is partially lab based.

Programming

Programming in Python (PHY235) is compulsory for students on MPhys Physics, Theoretical Physics and Physics with Computer Science programmes, and optional for other programmes except for students on Physics and Astrophysics programme who will learn Python as part of their astrophysics curriculum (especially PHY241, PHY242). Theoretical Physics students also have the opportunity to undertake computational physics projects using Python and solve problems via computer algebra software in PHY236. Non-theorists cannot select PHY236 since the skills components of this module are in common with PHY230.

Tutorials

You will be assigned an academic tutor at the beginning of each semester. Tutorial sessions are at weekly intervals throughout both semesters, starting in week 2 of each semester. These academic tutorials will either involve you in solving problems, preparing material on specific topics or discussing chosen aspects linked to your coursework. You will be expected to contribute fully in these sessions and to have put in sufficient preparatory work. You will

be expected to talk to your group and use the board. The tutorials are aimed at helping you with the course and in developing your communication and presentation skills. You will get much more out of these tutorials if you prepare for them.

Tutorials are compulsory. If you cannot attend a tutorial for any reason, you must inform your tutor immediately.

Personal and Senior Tutors

In addition to academic tutorials, you will be invited to meet with your personal tutor – usually the same tutor as in the first year - at the beginning of each semester to reflect on previous examination results, discuss any queries relating to your programme, your choice of optional modules, careers or any non-academic issues. You can also arrange to meet your personal tutor at any time if you have issues you wish to discuss.

In the case of specific problems that may impact upon your academic studies, or any concerns relating to your engagement, you may request or be requested to meet with the Senior Tutor.

Problem Classes

In addition to academic tutorials, there will be 10 problem classes per semester. The aim of these is to develop problem solving skills and understanding, by tackling the problem sheets associated with the courses. There will be 7 problem classes in each of the core modules PHY250 and PHY251 and 3 more in PHY221 and PHY227. Problem classes are not assessed but students are expected to attend them and the attendance will be monitored. The problems attempted in these classes are very good practice for the questions you will meet on your end of semester exams. Full participation in these classes is in your best interests.

Homework Exercises

The purpose of the homeworks is to provide practice in applying the ideas and concepts met in the lectures. This will enhance your problem-solving skills, which are a critical part of your training as a physicist. It is also useful practice for the numerical parts of the end-of-semester examination questions.

A timetable of all the homework exercises will be given out in week 1. Homeworks are assessed and their marks will contribute 20% to the final mark for the module. Problems for homeworks will be posted on the module web-page and answers should be handed-in to the drop box on F-floor (with attached cover sheets). The deadline for most homeworks will be on Monday at 4 pm with the exception of week 12 when the deadlines will be on Monday and Friday at 4 pm. Late submission will be penalised.

Examinations

Most modules have end-of-semester written examinations. Two core modules PHY250 and PHY251, worth 25 credits, each have two formal exams. The duration of each of the two exams for each module is 3 hours, so in total each module is examined for 6 hours. Each exam contributes 40% towards the final module mark.

For PHY250, one exam includes mathematics and solids (A), whereas the other exam includes topics on electromagnetism and quantum mechanics (B). Four lectures on relativity are also included in the PHY250 syllabus but this part will not be examined at the formal end-of-semester examination.

For PHY251, one exam includes thermal physics (including statistical physics) and solids (A), and the second exam includes quantum mechanics, atomic and nuclear physics (B).

All questions in the core module examinations (PHY250/251/221/227) are compulsory and no options will be provided.

Assessment of Modules

For core taught modules (PHY250, PHY251, PHY221, PHY227) the assessment is on the following basis:

End of Semester Examinations 80% + Homeworks 20%.

To pass a module a student will need to pass the combination of all formal examinations (2 exams for PHY250/251, 1 exam for PHY221 and PHY227) AND the combination of the examinations and the homeworks.

This means that to pass PHY250, for instance, a student will need to get at least 39.5% for the sum mark for the two examinations AND at least 39.5% for the combination of the two examinations (80% contribution to the final mark) and all homeworks (20% contribution of all homeworks to the final mark).

For other physics modules (PHY235, PHY236, PHY230, PHY231, PHY245, PHY248) other arrangements apply (see the table on the last page).

Resit Examinations

If you fail a module (your total mark is less than 39.5% or the exam mark is less than 39.5%), you will need to resit the exam(s) for this module in August. For PHY250 and PHY251, which include two formal examinations each, failing a module means that you have to resit **BOTH** exams in August.

It is generally not possible to resit coursework (the few exceptions are listed at the end of this guide). Hence if you fail to complete any of the coursework for a module in which the coursework comprises 20% of the module mark, you will need to achieve a **minimum grade of 50%** in the resit examination in order to obtain the module **pass mark of 40%!**
It is therefore very much in your interest to attempt all homeworks and attend all classes.

Students will be able to resit the failed modules only once. If you fail modules on the resits in August you will not be able to retake the failed modules next year.

Graphical Prize

In order to promote good practice, we have introduced a graphical prize for second year students (three prizes are awarded annually). This must be associated with a physics, medical physics, astrophysics or mathematics module. Details of submission and assessment of figures will be announced near to the end of the academic year.

THE SECOND YEAR ASTROPHYSICS PROGRAMME

It is essential that ALL students on Dual Honours Astrophysics courses attend the introductory meeting. The Introductory meeting will take place on Wednesday, 26th September at 12:00 pm in Hicks D17.

ALL second-year students on the Dual Honours Astrophysics courses must take all five second-year astrophysics modules (10 credits each):

PHY213	Stellar Structure and Evolution	(Autumn)
PHY216	Galaxies	(Spring)
PHY229	Extra-solar Planets and Astrobiology	(Spring)
PHY241	Observational Astronomy	(Autumn)
PHY242	Astronomical Spectroscopy	(Spring)

OUTLINE STRUCTURE OF SECOND YEAR ASTROPHYSICS MODULES (PHY213/216/229/241 & 242)

The second year astrophysics modules are all lecture-based. They are assessed primarily by end-of-semester examinations, worth between 60--80% of the total module mark, with the remaining 20-40% made up by coursework component. The coursework takes a variety of forms:

Python programming (PHY241, 242)

Astrophysics dual students will be introduced to the Python programming language as part of their core astrophysics modules. PHY241 will involve seven practical sessions in which Python is introduced and applied to astronomical imaging data. This will be assessed through a Python programming homework (20%). PHY242 will involve spectral line fitting in Python, which will be assessed via a written report (15%).

Astrophysics dual students will be introduced to the Python programing language at a pair of Python 'bootcamps'. These bootcamps will run on Monday, 24 September, (Arts Tower 1012), and Wednesday, 26 September (Hicks D17), at 2-5 pm. Attendance at these bootcamps is compulsory. If attendees have their own laptops they should bring them to the bootcamp to have Python installed.

Essay (PHY216, 229)

Essay assignments are intended to develop your ability to retrieve information from a variety of sources and distil your findings into a concise, accurate and well-written report. These are essential skills that you will use repeatedly in your later career, whether in astronomical or physical research, industry, commerce or the public sector.

Detailed instructions regarding the essay titles, style, word limits, deadlines and so on will be provided by the lecturers concerned, but here are a few general guidelines:

- Read the brief. Adjust your writing style and the level of technical detail according to the audience you are asked to address: a magazine article for the educated layman is different from an essay aimed at your fellow second-year students, and different again from a professional review article for specialists in the field.
- **Do not plagiarise**. If we find that your essay has been copied, either word for word or with minor rephrasing, from another source, you will be given a zero grade and a formal note will be placed on your student record. Intellectual theft

of this kind is illegal, dishonest, unethical and simply wrong. Details about what exactly constitutes plagiarism, and how to avoid it, can be found on the Department's website at http://www.shef.ac.uk/physics/teaching.html (click on "Plagiarism and Collusion").

- Do not simply list facts. Your essay needs to have a coherent structure and a good flow: the more lively and interesting it is, the better. Marks will be given for originality of treatment (within the limits of the brief) and for evidence of critical thought and judgment.
- Proof-read! You will be assessed on your mastery and clear exposition of the subject material, but also on your writing and presentation skills. Bad grammar and spelling will be penalised: so will presentational flaws such as poor or uncaptioned illustrations, misplaced page breaks, and inept typesetting. If you use Word, learn how to use the equation editor.
- Meet the deadline. Late submissions will be penalised.

Laboratory work (PHY213 & PHY242)

Two of the astrophysics modules have an associated lab-based practical – PHY213 and PHY242. In the first semester, you will be expected to attend the PHY213 lab for approximately 3 afternoon sessions. The exercise for PHY213 can be carried out in Python or another software package.

In the second semester, you will be expected to undertake the PHY242 online spectroscopy lab, which will require the equivalent of 2 afternoon sessions. This will not be timetabled, since you will be provided with on-line instructions to complement the lab script.

The topics of the lab exercises are linked to the material of the taught course, but as with the first year course and the second year physics laboratory, the aims of the lab are more geared towards the development of specific skills in problem solving, data analysis, errors and presentation of results than simply to illuminating the taught material. The course lecturer will be on hand in the lab to assist you with any problems you encounter.

The lab exercises will be assessed largely on the basis of your written reports (20% for PHY213 and 25% for PHY242). It is important to emphasise that we require a full formal report, not just a lab diary or a collection of notes. Guidelines on report writing and error calculations are available in the lab; here are a few basic principles:

- The report should be properly structured, with a brief introduction describing the general background and motivation, followed by sections on theory (if applicable), method, analysis, results and conclusions.
- All numerical results must include full consideration of errors, which must be properly carried through any calculations. You should explain the source(s) of error and justify the numerical estimates you have made. A number of good books on this subject exist, e.g. Les Kirkup's Experimental Methods (John Wiley, 1994) and Louis Lyons' Data Analysis for Physical Science Students (Cambridge Univ. Press, 1991).
- You should think carefully about how to present your data in the most effective way. Graphical presentation is usually best where possible, although you may wish to include the source table of measurements as an appendix for reference. Graphs should be properly labelled (axis labels, scale, units, title, legend or key);

data points should have error bars; fits to data should be explained and errors on fit parameters calculated.

- There will be bonus marks for developing the practicals beyond the instructions in the lab sheets. The more initiative you can show, the better.

Observational work (PHY241)

As part of PHY241 you will be expected to complete a simple observational project using the telescopes on the roof of the Hicks building. These projects are designed to give basic hands-on experience of astronomical observing and can be completed in only a few hours of telescope time.

There are 3 aspects to the observing practical, which counts 20% towards your overall grade for this module:

1. **Data acquisition**: To ensure the availability of staff and equipment, you will be required to attempt your observations in a specified period, which will be announced during lectures. Sign-up sheets covering this period will be posted on the Astronomy noticeboard outside the astronomy teaching laboratory. **Note that in principle all of Mondays through Fridays are available!** Although you should be able to complete all your observations in a single session, to allow for the vagaries of the British weather we expect that all students should sign up for **at least** two evenings per week until they have successfully completed their observing. If you cannot do this, you **must** discuss the problem with the lecturer **before** the start of the designated observing period, or as soon as the problem (e.g. illness) becomes apparent. We advise completing the observations as soon as possible: if the weather seems to be clear and settled at any time in the first week, make a special effort to sign up. Attendance at the observing is compulsory – you will not receive any marks for the practical if you fail to show up or, if the weather is bad for part of the specified observing period, you have not shown much initiative to sign up for other time slots. Make arrangements with Paul Kerry for the night(s) you want to observe. Only if the entire period is unusable, or if you have genuinely serious reasons as to why you could not do the observations (up to the discretion of the teaching staff), will this component not count towards the final mark. In all other cases, you must also include a narrative on the observations (conditions, time/date, settings used, etc.).

2. **Analysis**: After you have obtained your observations, analysis of the data will be carried out after reading week, in the timetabled computer labs for PHY241.

3. **Report**: Please follow the same style as for a formal laboratory report. **Submission deadline: Friday 14th December,** to the departmental office.

Problem classes

There will be one astrophysics problem class each week. Each class will be devoted to one of the astrophysics modules being taught in that semester, following a timetable set by the year tutor at the start of the semester. The aim of the problem classes is to develop problem solving skills and understanding by tackling problem sheets associated with the courses. Three members of staff will be on-hand to provide assistance during the classes. **Attendance at the classes is compulsory for dual astrophysics students**. Single Honours students taking one or more astrophysics modules as options are not required to attend problem classes, but are strongly encouraged to do so.

SUMMARY OF SECOND YEAR MODULES AND RESIT REGULATIONS

The following table summarises the Second Year Physics and Astrophysics modules. It lists the course work components and identifies which of these components it is possible to resit.

Module	Credits	Exam(s)	Coursework	Resit of coursework
PHY250 From Electromagnetism to Quantum Mechanics	25	80% (pass required to pass module)	Homeworks 20%	No resit of coursework
PHY251 From Thermodynamics to Atomic and Nuclear Physics	25	80% (pass required to pass module)	Homeworks 20%	No resit of coursework
PHY236 Computational Physics for Theoretical Physicists	10	0%	Python numerical projects 2x33%, SageMath analytical project 33%	No resit of projects
PHY213 Stellar Structure and Evolution	10	80%	Lab 20%	No resit of coursework
PHY216 Galaxies	10	80%	Essay 20%	Resit of essay possible
PHY241 Observational Astronomy	10	60%	Python homework 20%, Observing practical 20%	No resit of observing practical
PHY221 Classical Physics	10	80% (pass required to pass module)	Homeworks 20%	No resit of coursework
PHY235 Programming in Python	10	35%	Labs 15%, formal assessments 2x25%	Resit of assessments possible
PHY227 Optics	10	80% (pass required to pass module)	Homeworks 20%	No resit of coursework
PHY229 Extra-solar planets and Astrobiology	10	80%	Homework 20%	Resit of coursework possible
PHY230 Experimental Physics I	10	0%	100% lab work	No resit possible
PHY231 Experimental Physics II	10	0%	100% lab work	No resit possible
PHY242 Astronomical Spectroscopy	10	60%	Python exercise 15%; Spectroscopy lab 25%	No resit of lab possible
PHY245 Physics of Materials	10	80%	Homeworks 20%	No resit of coursework
PHY248 Physics with Labview	10	0%	100% lab work	No resit possible