A Guide to the Teaching of Physics at Liverpool University

Introduction

The aim of this document is to provide an introduction to the teaching of physics at Liverpool University and to describe the programme that is being set up to help lecturers new to the Physics Department to contribute to teaching in as efficient (and hopefully enjoyable) a way as is possible. To that end it contains three sections:

- A brief description of the main teaching methods used in the Physics Department.
- An outline of the management and quality control structures that are in place.
- Some information on our induction programme for new lecturers.

More, and more detailed, information on the first and to some extent the second of the above can be found in the Department of Physics Handbook.

Some of the people crucial to the teaching activities in the Department will be mentioned in the following. A compilation of names, office numbers, telephone numbers and a brief (and unofficial!) "job description" is given in an appendix to this document.

Teaching Methods

The teaching of physics is done mainly through lectures, tutorials and practicals. A first year student will typically have about twelve lectures, one tutorial and two afternoons of practical a week. The experiments done in the practical labs take between one and three afternoons to complete and write up. The situation in the second year is similar, while in the third and fourth years part of the practical is given over to more extended project work, often done within one of the Department's research groups.

Lectures start at 9am and are timetabled in "slots" of one hour length. To allow students time to get between lectures, which may in some cases be in different buildings, each lecture should take 45mins; students will get restive if you exceed this limit on a regular basis! Students are required to "sign in" to lectures, a register being provided by Carole Brown for this purpose. Lecturers are free to organise their lectures as they choose. Demonstrations and the use of both blackboards and overheads are often found to help the students to concentrate for the full length of a lecture; something different around 20mins into a lecture is a good way of combating the well-known "low" which occurs around then.

Tutorials are held in groups of typically five students, with one academic staff member or postdoctoral fellow (or occasionally a research student) to lead the proceedings. Tutorial problems are circulated a couple of weeks before the tutorial. The students return their answers to these problems, which are marked, and the tutorials are used to discuss the solutions to the problems and, ideally, any interesting issues arising from the problems. Again, a register of attendance is kept and first year students receive a mark for attendance, to encourage them to turn up. Tutorial problems are produced by the lecturer responsible for the module. The relevant Tutorial Organiser (Robert Page for year 1, Neil Jackson for year 2 and Steve Barrett for years 3 and 4) will explain the procedure for distributing the tutorial problems to the students. The lecturer is also responsible

for producing answers to the tutorial problems. Again, the relevant Tutorial Organiser will explain how these are distributed to the staff and post-grad.s leading the tutorial groups. We view tutorials as an important way of getting students to talk about physics. Getting a lively discussion going is a challenge!

Practicals are held in the Chadwick Laboratory. The experiments the students do are described in a practical handbook. The students are supervised by members of staff and post-graduates. Again, students must sign in and, in this case, also out, giving the time at which they came and went. Post-graduates supervising practicals are to receive training from 1999/2000, following some cases in which they were confused about aspects of the experiments they were supervising. If you are worried about the competence of "your" post-grads, talk to the relevant Lab Organiser. The practical write-ups are marked as the experiment is finished. Make sure you know where the marks should be written down; currently on the write-up itself, on the front of the practical book and on a card to allow Carole to collate the marks more easily. Some students will treat practicals like cookery sessions; they will follow the recipe and not think about what is happening. If possible, talk to these people and get them interested in the physics behind the experiment. Other students will be interested in the practicals and will ask you things about what is going on, which may well entail some preparatory work on your part; can you remember the difference between Fraunhofer and Fresnel diffraction?

Paul Rossiter is the Teaching Laboratory Supervisor; he and his staff are of great help when critical part X breaks down in the middle of a complex measurement.

In addition to the above, teaching is done through problems classes and group projects.

Managing Teaching

The Physics Department is run by Bill Stirling (Head of Department) and the Physics Management Group, i.e. Phil Allport (Director of Research Courses), Paul Booth (Director of Research), Dominic Dickson (Director of Taught Courses) and Paul Nolan (Deputy Head of Department). Dominic Dickson and the Board of Studies in Physics (BOSIP) have overall responsibility for the structure and content of the various physics courses and the physics components of joint courses involving physics. The Chairman and Secretary of BOSIP are Leo Carroll and Mike Thomas, respectively. Under BOSIP are the three Year Committees, the First and Second Year Committees and the Third/Fourth Year Committee. These committees are chaired by Dominic Dickson, Paul Nolan and Mike Houlden, respectively. All the people responsible for modules taught to each of these year groups are on the respective Year Committee. (Courses at Liverpool are taught as a series of modules - see the Handbook for more detail). BOSIP determines the syllabus that should form the basis of a module and assures that the courses give students a balanced physics education. The Year Committees look after the nitty-gritty aspects of modules, considering things like: What can be done to improve the attendance at tutorials? Would it be more appropriate to teach "Waves" in the context of electromagnetism or mechanics, or should both courses cover the material? Proposals for changes to modules, for example to tackle the poor attendance at tutorials, are either approved there or forwarded for consideration by BOSIP if they represent a serious change to the module. The Module Organiser, usually the lecturer if the module is delivered as lectures, is responsible for presenting the material to the students, setting tutorial problems and setting and marking the exam papers etc. used in the assessment of those students.

Written examinations are the primary means of assessment used by the Department. As such, considerable care is taken to ensure that examination questions are of a high standard. The Module

Organiser must make sure that exam questions are checked by another member of staff, before they go to the Examinations Co-ordinator for the relevant year group (currently Peter Hayman for year 1, Neil Jackson for year 2 and Themis Bowcock for years 3 and 4). From there they go to an External Examiner, who further checks the questions and assesses whether they are of a suitable level of difficulty. Final corrections are made and the Examinations Co-ordinator, Ray Gamet, then sends the papers off to the Examinations Department of the University. Note, this has to be done three to six months before the date of the exam!

There is one further job for which a specific person within each year committee is responsible; the organisation of practicals. Currently the people responsible for organising practicals are Peter Hayman in year 1, Ronan McGrath in year 2 and Mike Houlden in years 3 and 4. These are the people responsible for producing the Lab. Handbooks and for ensuring that post-graduate supervisors are adequately trained.

There are two main lines of feedback from students to Module Organisers. The first is the module questionnaire, completed once each semester by the students taking the module. The Module Organiser adds up the marks, notes significant comments, gives a summary of the statistics and comments to Carole and presents these in a report to the Year Committee. The Committee discusses any necessary action. The second is through the Student-Staff Committee. This meets twice a semester under the chairmanship of the Director of Taught Courses (Dominic Dickson). Representatives of each year group comment on modules, exams, etc. and Dominic is responsible for ensuring that module organisers respond to criticisms and suggestions raised in the meeting.

There is a further "quality control" system for lecture based modules. Lecture monitors are assigned to each module. The monitor attends a lecture, agreed by the lecturer and the monitor, and discusses the experience with the lecturer afterwards. This can be very useful in two respects. Firstly, for example, the person who monitors your lectures will be able to tell you that the reason everyone is going to sleep in your lectures is that your voice is boring; it pays to consciously introduce somewhat exaggerated inflection when lecturing. Secondly, you will monitor someone else's lectures and notice how important it is that sub- and super-scripts are legible on overheads, and how effective even the simplest of demonstrations can be in getting a point over. The lecturer and monitor together produce a written report which can include ideas on how the lectures can be improved.

The Induction Programme for New Lecturers

The aim of the induction course is to give you a chance to try each of the above teaching activities and learn a little about how best to tackle them, before you are given your first module to teach. The programme is described briefly in the following.

Tour of the Department

On Monday 20th September at 9:30am, there will be a quick tour of the Department. For those of you not familiar with the teaching facilities at Liverpool, this will give you the chance to see where things are, e.g. the lecture theatres, practical lab.s, PCs for students, the libraries etc. You will also meet the organiser of the module in which you are to give your first lectures (see below).

The University Induction Scheme

Participating in the University's Induction Course, which this year takes place on Monday the 20th September from 12:30 (lunch provided) and Tuesday the 21st September from 9:00, is obligatory.

Some elements of the course are useful, for example you will have the chance to deliver a short lecture, which will be video taped. Watching the tape afterwards makes you aware how distracting mannerisms like walking up and down all the time, excessive hand waving, terminating each sentence with "uhum" and the like, can be.

Lecturing

You will be asked to give two lectures in your first semester in a module being taught by one of your colleagues. This gives you the chance to prepare the lectures with the help of the module organiser and to get their feedback on the lecture afterwards; the Module Organiser will sit in on the lectures you give. You will also be asked to devise some tutorial and exam problems for the module. Past exam papers and previous tutorial problems are readily available as guidelines to what is required. Please think about structuring the problems, for example, "Write down Newton's Law of Gravitation and use it to show that the period of the moon's orbit about the earth..." is bad, in that if the student, a brilliant physicist with a lousy memory, cannot remember the Law of Gravitation, they are precluded from answering the second part of the question. Result, brilliant physicist gets terrible marks; we have done a bad job!

You will meet the organiser of the module you are to lecture in as part of the "Tour of the Department" mentioned above.

Practical Work

In your first semester, you will be expected to supervise first or second year practicals and you will be asked to devise and supervise a third or fourth year project.

The third year projects should involve investigations in which reasonable progress can be made by a student working three afternoons a week for ten weeks. The time available for the fourth year projects is three afternoons a week for twenty weeks. There is a (limited) amount of money available for buying equipment and project students often use the resources of the research groups. Some projects have made a genuine contribution to the research efforts of the department, as well as being great experience for the students. Others have allowed members of staff to follow up ideas outside their mainstream research; can you think of projects that would fit into either of these categories? Please discuss you ideas with Mike Houlden, he will be able to advise you on their feasibility.

Having done some supervision in our lab.s, you may feel that some of our current practicals could profitably be replaced, perhaps with experiments you recall having done as an undergraduate that you found interesting. A meeting will be organised towards the end of the first semester in which we will discuss ideas you have for new practicals. Pleases note these down as they occur to you and feel free to discuss them with the Lab. Organisers at or before the abovementioned meeting.

Teaching Computer Programming

Currently, in their first year Liverpool physics students receive a module on using various standard PC packages, such as spreadsheets, word processors, etc. They do not get a formal introduction to computer programming, though those doing an M.Phys. will write a Monte-Carlo program in their third year. The Department has been considering the re-introduction of a course on computing and the suggestion is that you as a group think about what a module on computing should look like. Should it be based around object oriented techniques? Should it concentrate more on the skills of developing algorithms to solve problems? Should an "old fashioned" language be used, Fortran,

Pascal or c, or should we concentrate on something more modern, such as Java? You are advised strongly to talk to the people in the Department who have taught computing in various guises, in particular Mike Houlden, Leo Carroll and Robert Page. Your task is to present a proposal for a module on computing to BOSIP during the second semester.

Tutorials

You will be given a tutorial group to lead. This will give you the opportunity to meet a small group of our students "face-to-face". You will rapidly discover the problems people have understanding even the simplest (for you!) concepts in physics. Don't forget, you are one of the best physicists in your generation and have been doing physics for years!

Summary

There follows a summary of the activities organised as part of the induction programme:

Time and place	Activity
Monday 20th September 1999, 9:30, room 332, Oliver Lodge Laboratory.	Tour of teaching facilities. Meet module organiser of module in which lectures to be given.
20th September 1999, 12:30, Staff House, main dining room.	University Induction Course Part I
21st September 1999, 9:00, Senate Room.	University Induction Course Part II
First semester.	Two lectures in a chosen module.
First semester.	Supervise 1st/2nd year practicals.
First semester.	Take tutorial group.
First semester.	Supervise 3rd/4th year project.
For middle of second semester.	Proposal for Computing module.

Final Comments

This is the first time that we have tried a (fairly) formal induction scheme for new staff within the Physics Department. Your comments would be welcome. We certainly hope that it helps you in starting your teaching career.