

UNIVERSITY OF STRATHCLYDE

DEPARTMENT OF PHYSICS

2011/2012 HANDBOOK

for

4th AND 5th YEAR STUDENTS

MSci in Physics

MSci in Applied Physics

MSci in Photonics

MSci in Physics and Mathematical Finance

MSci in Biophysics

MSci in Physics with Visual Simulation

Honours BSc Physics

Honours BSc Applied Physics

Honours BSc Laser Physics and Optoelectronics

Honours BSc in Mathematics and Physics

Honours BSc in Physics with Teaching

BSc in Physics and Applied Physics



This handbook should help guide you through your studies, but if you have any questions please do not hesitate to ask. Our friendly and experienced staff will be glad to help. We are one of the most successful physics departments in the UK and our teaching was awarded the top grade of “excellent” in the Government assessment of Scottish Universities. Our courses are accredited by the Institute of Physics. They are designed to be exciting, stimulating and rewarding. We think you will enjoy them.

With best wishes

*Prof Rob Martin
Head of Department*

This Handbook should be read in conjunction with the University's STUDENT HANDBOOK that can be accessed at <http://www.strath.ac.uk/student/>

MSci in Physics, MSci in Applied Physics, MSci in Photonics

These enhanced degrees aim to teach Physics to a greater depth and breadth than the BSc degrees and provides an excellent qualification for those wishing to go on to work in industry as well as providing a superb preparation for research leading to a PhD degree. With the Applied Physics and Photonics degrees there is also an Industrial Placement that is undertaken during the long vacation between third and fourth year.

MSci in Physics with Visual Simulation

This degree course has been designed to provide a broad-based knowledge of physics and mathematics combined with studies of computer systems, programming and software development.

MSci in Physics and Mathematical Finance

There is growing demand by financial institutions for physicists. This degree is ideal for mathematically minded physicists interested in a career in the financial sector.

MSci in Biophysics

This unique degree course combines a strong foundation in physics with specialisation in biophysical applications.

BSc Honours Physics

This is a broad based physics course which aims to give the student coverage of a wide range of topics in physics with emphasis on modern physical principles. As the student proceeds towards his or her Honours Degree a larger fraction of the time is spent on physics with considerable flexibility in the choice of subjects available.

BSc Honours Applied Physics

The main objective of this course is to develop the skills necessary to solve practical problems in industry. It is designed around a core of fundamental physics and mathematics, linked to a programme of interdisciplinary applied physics and a wide choice of elective subjects.

BSc Honours Laser Physics and Optoelectronics

The course admitted its first students in 1985 and was the first undergraduate course of its kind in Europe. It aims to combine a strong grounding in mainstream physics with specialisation in laser physics, optoelectronics and the associated technologies.

BSc Honours Physics with Teaching

This course aims to provide for students interested in following careers in education a training in which physics is integrated with teaching methods and practice. The degree offers a joint qualification which prepares graduates to be teachers of physics in secondary schools. Students cover the syllabus of the Honours Physics degree plus the curriculum and classroom experience required for General Teaching Council recognition.

BSc Honours Mathematics and Physics

The aim of this degree is to provide students with a joint qualification in Mathematics and Physics by providing the opportunity to pursue Mathematics and Physics to a high level. It contains the physics necessary for future fundamental and applied work, along with computational and theoretical physics.

BSc Physics and Applied Physics

This BSc degree is gained by a 3-year course involving a flexible selection of modules from physics, mathematics and other subjects. It provides a physics based education for the non-specialist, and aims to equip students for the wide range of careers in which numeracy and a grasp of physical principles are seen to be an advantage.

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We look forward to welcoming you into the final years of your study. We aim to work with you to achieve a valuable year's study this year, whether it is to graduate with a Pass Degree or progress on for a BSc Honours or MSci degree. Whatever your plans, we hope your study is successful. We know it will be challenging, and involve much hard work, but we believe that you will find the effort well worthwhile, an investment to prepare you for your chosen career.

THE ACADEMIC YEAR 2011/2012

REGISTRATION : Monday 19th September 2011 – Friday 23rd September 2011

SEMESTER I :

University closed	Monday 26 th September 2011
Teaching Weeks 1 – 12	Tuesday 27 th September 2011 – Friday 16 th December 2011
Christmas Vacation	Saturday 17 th December 2011 – Sunday 1 st January 2012
University closed	Monday 26 th December 2011 – Wednesday 4 th January 2012
Revision Period	Thursday 5 th January 2012 – Friday 6 th January 2012
Examination Weeks	Monday 9 th January 2012 – Friday 20 th January 2012

SEMESTER II :

Teaching Weeks 1-12	Monday 23 rd January 2012 – Friday 27 th April 2012
Spring Vacation	Monday 2 nd April 2012 – Friday 13 th April 2012
University closed	Friday 6 th April 2012
University closed	Monday 9 th April 2012
Revision Week	Monday 30 th April 2012 – Friday 4 th May 2012
Examination Weeks	Tuesday 8 th May 2012 – Friday 1 st June 2012
University closed	Monday 7 th May 2012
University closed	4 th & 5 th June 2012

These dates are correct at the time of publishing but you are advised to check <http://www.strath.ac.uk/studying/currentstudent/keydates/> regularly for any changes

GENERAL INFORMATION

The Further and Higher Education Charter for Scotland was published in 1994. A leaflet outlining its main points is available from the University's Administrative centre, in the McCance Building. The University's academic provision was inspected by the Enhancement Lead Institutional Review (2010) and was given the highest rating possible.

The Faculty of Science includes the Departments of Physics, Mathematics and Statistics, Computer & Information Science, Pure & Applied Chemistry as well as the Strathclyde Institute of Pharmacy and Biomedical Sciences which comprises the bioscience departments. The Faculty, one of four in the University, has administrative and financial powers devolved to it by the University.

The current office-holders in the Faculty are:

Dean: Professor Iain Hunter

Vice-Deans: Dr A Mulholland (Knowledge Exchange)
Professor Alan Harvey (Research)
Dr Chris Prior (Academic)

Permanent administrative staff of the Faculty are:

Faculty Manager: Ms Bronagh Dallat
Assistant Faculty Manager: Mrs Jill Kyle

Enquiries to Faculty staff can be presented at the Student Business enquiry desks in the McCance Building. [They also deal with changes of address, changes of registration for classes or courses, medical certificates and the administration of the Examination Boards that consider your end-of-year examination results.]

The Department is housed mainly in the **John Anderson (JA) building**, but some staff have offices and laboratories in the adjacent Colville (Col.) Building, linked at levels 3, 4 and 5. The John Anderson Building is open Monday to Friday from 8.00 am to 10.00 pm. After 6.00 pm access is only via the main door (level 5) or via the Colville Building as the subsidiary entrances are locked to maintain security.

The Department makes available JA8.18 (The Bob Illingworth Room) as a **Student Reading Room**. You are asked to cooperate by not using 8.18 for conversing, eating or drinking. This room is for students of all years, and of all courses. (Please treat it with care, or else the facilities will be withdrawn.) There is a student common room and a computer room on JA level 5.

The Department has over **30 academic staff**. The Head of Department (2010/2013) is Professor Rob Martin (JA 8.02).

Information on the Department and its staff can also be obtained from the Department Website <http://phys.strath.ac.uk>

Should you need to contact a member of staff, contact details can also be found on the Department Website <http://phys.strath.ac.uk/information/people/people.php>. Alternatively, messages for staff may be left in their pigeonhole on the 8th floor of the John Anderson Building, outside JA 8.31. (Please note, names are above pigeonholes, not under.) Besides its academic staff, the Department also includes research fellows, research assistants and research students who, besides their research activities, participate in the teaching of the Department. In addition there are also technical and secretarial staff. **Photographs** of all the staff are displayed on the **8th. Floor of the John Anderson Building** outside JA 8.03.

The Department uses the internet to communicate with students and so it is essential that you check both your university email account and any class announcements made through the University VLE MyPlace.

On timetables and notices, each building on the Campus is identified by a prefix. Originally these were mostly single letters, and the John Anderson Building was denoted by K.

This is still used by the University in its timetables for classes and examinations, but the more user-friendly notices issued by the Department use two letter building prefixes, like JA for the John Anderson Building, LT for the Livingstone Tower, etc.

YOUR DEGREE COURSE

Course Requirements

Each degree course is made up of a number of classes. A full year's curriculum normally totals a minimum of 120 credits. Your list of classes to be studied must be agreed with your Adviser (see next page) and then you will be able to complete your registration with the University. The syllabus and book list for the main classes given by this Department can be found at <http://phys.strath.ac.uk/undergrad/classes.php>

Each degree course is governed by a set of Regulations that specify the compulsory classes you must follow for that degree course as well as the progress requirements to move from one year to the next year of a given degree course. These Regulations can be downloaded from <http://phys.strath.ac.uk/undergrad/handbook>

In addition to the Regulations that are specific to your chosen course you are bound by a set of general regulations and these can be read at

<http://www.strath.ac.uk/corporateservices/gmpt/academicaffairs/publications/> (for pre 2009/10 years 4, 5 select Part 2B)

ERASMUS SCHEME

Student Exchange Abroad

The Department has exchange agreements with a number of Universities in Europe, in Austria, Germany, France, Poland, and Switzerland that allow students to spend up to a year studying abroad during their 4th year. There are many benefits to studying abroad, from help with foreign language skills to enhancing your CV. You can find more information on the scheme at the Erasmus website <http://www.britishcouncil.org/erasmus-benefits.htm>.

If you are interested and would like to know more, see Dr F. Papoff (Room JA 8.09) before November. The number of such places is limited and preference is given to those whose academic progress suggests they will benefit from the extra challenge of study abroad.

At the Start of the Year

All students are invited to meet their Adviser of Study during "Week 0", 20th – 24th September 2011 the week before the start of the 1st semester to discuss their progress and confirm their electives. Your **Adviser** will want to discuss with you which classes are to be included in your curriculum. If your pre-registered choices are no longer available your Adviser will approve and amend your curriculum then may then register.

It is important that your **class registration** be correct as (amongst other things) it is used to check the feasibility of draft exam timetables. You may change your list of classes through PEGASUS, the University's VLE, but there are restrictions on changing your classes more than 2 weeks into the semester. Any change needs the approval of your Adviser.

Should you want to change course e.g. to BSc Natural Sciences or BSc Physics and Applied Physics, consult your Adviser of Study. The Natural Sciences course is administered by Dr. Alan McCrudden (SIBS 4.59) on behalf of the Faculty of Science. The BSc Degree in Physics and Applied Physics is coordinated by Dr. T. Han (JA 8.05). It offers an alternative, and wider, course of study for those who find themselves uncomfortable with the Honours curricula.

The University has recently approved the award of the BSc Degree with Commendation for students who score an average of at least 60 % in their first attempt at the level 2 and 3 classes taken in the third year of study. As the year proceeds, your adviser remains available to help you with academic advice.

Timetables

The timetables for each degree course will be available on the Departmental website at the start of each semester:

<http://phys.strath.ac.uk/undergrad/timetable/semester1.php>

<http://phys.strath.ac.uk/undergrad/timetable/semester2.php>

Advisers of Study

The Course Advisers 4th and 5th year:-

Physics MSci and BSc Honours	Prof. E. Riis JA 8.08, ext. 3371	e.riis@strath.ac.uk
Applied Physics MSci and BSc Honours	Dr. B. Hourahine, JA 8.23, ext. 2325	benjamin.hourahine@strath.ac.uk
Laser Physics & Optoelectronics BSc Honours	Dr. B. Hourahine, JA 8.23, ext. 2325	benjamin.hourahine@strath.ac.uk
Photonics MSci	Dr. B. Hourahine, JA 8.23, ext. 2325	benjamin.hourahine@strath.ac.uk
Physics with Teaching BSc Honours	Dr F. Papoff, JA 8.09, ext. 3178	papoff@phys.strath.ac.uk
Mathematics and Physics BSc Honours	Dr F. Papoff, JA 8.09, ext. 3178	papoff@phys.strath.ac.uk
Mathematics and Physics BSc Honours	Dr. D. Greenhalgh, LT 8.10, ext. 3653	david.greenhalgh@strath.ac.uk
Physics with Mathematical Finance MSci	Dr F. Papoff, JA 8.09, ext. 3178	papoff@phys.strath.ac.uk
Biophysics MSci	Dr. C. Trager-Cowan, JA 2.08 ext. 3465	c.trager-cowan@strath.ac.uk
Physics with Visual Simulation MSci	Prof. E. Riis JA 8.08, ext. 3371	e.riis@strath.ac.uk
Natural Sciences BSc	Dr. A. B. McCruden, SIBS 4.59 ext. 3749	a.b.mccruden@strath.ac.uk
<i>Non-Graduating Students</i>	Dr F. Papoff, JA 8.09 ext. 3178	papoff@phys.strath.ac.uk

Counsellors and Personal Development Advisers (PDA's)

As well as an Adviser of Study, you will have been allocated to a Counsellor who is a member of the academic staff. This year your Counsellor will remain the same but the title of this role will change to Personal Development Adviser (PDA). The PDA's role is to make your progress through your university studies as free of problems and difficulties as possible. You should receive a copy of a booklet about being a student which explains the PDA scheme more fully. You should meet your PDA as soon as possible after the start of term. Should problems arise with the PDA arrangements see Dr. N. Langford (JA 8.17) who organises the PDA scheme for the Department.

As your course progresses, students often find that their problems are more academic than personal, so your Adviser may be of greater help in these cases. But try to keep in touch with your PDA so that there is always at least one member of the academic staff who is aware of your special needs and circumstances.

The Department has a **Student-Staff Committee** (Convener Dr O. Rolinski) that is made up of student representatives from each year and a number of academic staff. Students are invited to choose their own representative in the first two weeks of the first term. The Committee has an important role, resolving difficulties that may arise. The Students Association offer training on how to be an effective representative. The Committee considers anything that affects the teaching of the courses or Student-Staff relations.

Problems that are personal to you should be raised with your Counsellor or Adviser. Matters affecting a group of students should be raised in the first instance with any staff member directly involved, but if this fails to resolve the matter, or if it raises wider issues, then ask your Student-Staff Committee Representative to raise it at their next meeting.

Text Books

Obtain your essential **textbooks** at the first opportunity.

REPORT WRITING

A key skill for any physicist is to communicate the outcomes of an investigation to a wider audience. During your course you will be expected to write formal reports on the practical work that you undertake in years 1 to 3 and the final year projects that you take in your 4th and 5th year of study. During the first three years of your study at Strathclyde the Department will give you the necessary training on how to write a report and this will include advice on the structure and content of the report, how to reference and how to avoid plagiarism. The Department will use the anti plagiarism software Turnitin (<https://turnitin.com/static/index.php>) to check for plagiarism.

SAFETY REGULATIONS

These apply to all parts of the University. Your attention will be drawn to these when they affect you. Particular care needs to be exercised in laboratories, and in general, you are not allowed to work in a laboratory unsupervised. For this reason, it is not usually possible to make up time lost for any reason during a laboratory session by putting in extra time later. The Department's safety rules are listed at the back of this handbook.

ADVICE FOR STUDENTS WITH SPECIAL NEEDS

The University is committed to supporting students with special educational needs, which may range from dyslexia to mental health problems. To this end the University has a dedicated unit, the Disability Service. Please refer to your University Handbook for further details and see <http://www.strath.ac.uk/disabilityservice/>

To ensure the Department meets your needs as defined by the Disability Service, Ms K. Munro (kirsten.munro@strath.ac.uk) and Dr T. Han (t.han@strath.ac.uk) are the Departmental Disability Contacts. Should you have any questions then please do not hesitate to contact either of them.

INFORMATION TECHNOLOGY, PEGASUS AND MYPLACE, AND PERSONAL TRANSFERABLE SKILLS

Expertise in *information technology* (IT) and well developed *personal transferable skills* are essential if you are to maximise your performance in the academic work of your chosen course. Essays, laboratory and project reports, for example, must normally be word processed while the ability to analyse and plot experimental data using available software packages is essential for progress in scientific research. Familiarity with IT also allows you to search the internet and electronic databases for reference material to assist in the writing of assignments and dissertations. In the later years of the course, the emphasis on project work trains you in the planning and performance of research, while the preparation and delivery of presentations, gives you the confidence to communicate your results and their relevance to both specialists and non-specialists as is required of professional scientists.

Years 4 & 5: Research project and its written and oral presentation, problem solving, research training and communicating physics.

PEGASUS and MYPLACE

The University has developed its own information server known as PEGASUS that is used to provide services to both staff and students. Please refer to your University Handbook for further information.

In addition to PEGASUS the Faculty of Science has its own information server, MYPLACE, and this is used to provide copies of lecture notes, assignments, tutorial questions etc., as well as providing discussion forums for students. As with PEGASUS you will receive training on the use of MYPLACE in the first weeks of your course and information relating to MYPLACE can be downloaded from <http://MyPlace.science.strath.ac.uk>

ASSESSMENT AND PROGRESS

There are a variety of methods by which classes are examined and the lecturer at the start of a class should give the relevant details. You should note that **the pass mark for classes of levels 1 - 4 is 40% and for level 5 classes it is 50%**. Note that the credits associated with a class are indivisible. You cannot be awarded a fraction of its credits for meeting part of its requirements.

The most common assessment method is by examination. The conduct of examinations is covered by University regulations including:

1. You need to produce your student identify card at exams.
2. You are forbidden to have with you in the exam room notes of any sort unless the exam instructions explicitly permit them. [Possession of such notes in the exam room is an offence, irrespective of whether use is made of them.]

In *Physics* examinations note that for the same reason you must not take into the exam graphic calculators with memory bank facilities, and in particular, no calculator with alphabetic input. (In *Physics* and *Mathematics* exams, *programmable* calculators are forbidden. Other Departments may have other special restrictions for their examinations.

4th and 5th YEAR PROJECTS

The timetable for key events associated with the projects is given in Appendix 5, together with the marking schemes used for the various components of the projects. For the Level 4 Project 12 421 the assessment is based on your performance in four elements: The Formal Report, 50 %, the conduct of the experiment, 20 %, the performance in a viva voce examination, 20 % and student talk 10 %. For the Level 5 Projects 12 5210 and 12 521 the assessment is based on your performance in four elements: The Formal Report, 30 %, the conduct of the experiment, 30 %, the performance in a viva voce examination, 30 % and student talk 10 %.

PLAGIARISM

Please see the University Handbook and follow this link <http://www.strath.ac.uk/media/ps/cs/gmap/academicaffairs/policiesandprocedures/student-guide-to-academic-practice-and-plagiarism.pdf> for guidelines on plagiarism. If you are unsure of any aspect of this, please contact the department. The Department will use the anti plagiarism software Turnitin (<https://turnitin.com/static/index.php>) to check for plagiarism.

EXAMINATION ATTEMPTS

All students will be entitled to TWO attempts only to gain the credits for any class. These attempts will normally comprise the First Attempt taken in either the January or the May Diet of Examinations and the Second Attempt taken in the August re-sit Diet of Examinations (level 3 classes only; for level 4 and level 5 classes, there are no resits in August and the next attempt will be in the main January/May diet of examinations). For some classes, such as Practical classes or classes with significant elements of continuous assessment, both attempts may take place during the 1st and 2nd semesters. It is the lecturer's responsibility to outline the assessment procedure for the class at the start of the course.

PLEASE NOTE: THE MARK YOU ACHIEVE AT YOUR 1ST ATTEMPT AT AN EXAMINATION WILL DETERMINE THE LEVEL OF DEGREE AWARD. RE-SITTING A FAILED EXAMINATION WILL ONLY IMPROVE YOUR TRANSCRIPT AND NOT YOUR DEGREE AWARD.

TARGETS

You should aim to obtain the credits for all your classes because progress to later years of the course and the award of the degree depend on your cumulative total. The various degrees have different progress requirements and summarised in the table below. Details are also available at <http://phys.strath.ac.uk/undergrad/handbook>

Progression Requirements

FOR ALL DEGREES YOU MUST ACHIEVE AN APPROVED STANDARD OF PERFORMANCE WITH REGARDS TO LEVEL OF STUDY AND ACADEMIC ACHIEVEMENT.

FOR EACH YEAR OF STUDY THE DEPARTMENT DEFINES THIS LEVEL AS A CREDIT-MARK AVERAGE OF BETTER THAN 50% FOR MSci DEGREES.

	4 th Year to 5 th Year
Degree	Credit Requirements
All MSci degree	In order to progress to the fifth year of the course, a student must normally have accumulated at least 460 credits from the course curriculum. In addition, at all stages of the course, a student must have achieved an approved standard of performance with regard to level of study and academic attainment.

Award Requirements

To be awarded a degree you must satisfy certain credit requirements and these are listed below.

Degree Type	Credit Requirements
BSc Physics and Applied Physics	To be awarded a BSc Physics and Applied Physics degree you must have accumulated 360 credits of which 60 credits must be at Level 3.
BSc (Hons) degree	To be awarded a BSc degree with Honours you must have accumulated 480 credits of which at least 180 credits must be at Level 3 or above and of these 90 must be at Level 4 or above.
MSci degree	To be awarded a MSci degree with Honours you must have accumulated 600 credits of which at least 210 credits must be at Level 4 or above and of these 120 must be at Level 5.

The Honours degrees are classified into four grades, Class I (a "First"), Class II(i) (an "Upper Second"), Class II(ii) (a "Lower Second") and a Class III ("Third"). The algorithm for calculating the average mark is given later in the handbook.

MSci degrees require an extra year of study and are currently classified as for BSc Honours degrees, except there is no Class III.

Students who fail to qualify for a degree may be eligible for the award of the Diploma or Certificate of Higher Education.

The level of your award is determined by the algorithms in Appendix 3. Details of the average mark that you must achieve for each level of award are given in the General Regulations that govern your study whilst at Strathclyde. These can be viewed at

<http://www.strath.ac.uk/corporateservices/gmpt/academicaffairs/publications/> (select Calendar Part 2b and then look at Regulation 15.1.34)

EXAMINATION BOARD DECISIONS FOR FOURTH YEAR MSci STUDENTS

Whichever method of assessment is used an Examination Board will consider the results of your examinations. The Board meets first in June and also, to consider the results of August resit examinations, in September. The Boards of Examiners will take one of the following decisions which will then be notified to you through PEGASUS. (Make sure the University has your current address.) Whether you progress from one year to the next is determined by your performance in the examination diets.

PLEASE NOTE THAT MARK YOU ACHIEVE FOR YOUR 1ST ATTEMPT AT AN EXAMINATION WILL DETERMINE THE LEVEL OF DEGREE AWARD. RE-SITTING A FAILED EXAMINATION WILL ONLY IMPROVE YOUR TRANSCRIPT AND NOT YOUR DEGREE AWARD.

Note that the Board **only** gives decisions relating to your *present* course, so "Withdraw", "Resit" etc. need to be understood in this context. But if you *change* course (for example, to a Pass Degree course) these decisions do not necessarily still apply. Ask for advice from your counsellor or adviser if in doubt.

PASS

This means that you have passed in all the examinations in your curriculum, and that you are free to progress to the next year of your degree course without any resit examinations.

MAY PROCEED FoSAMS

This means that although you have not passed in all of your examinations, but have performed at a satisfactory level for you to be awarded the minimum number of credits, excluding carried classes, for the current year of study. You are free to progress to the next year of your degree course without taking any resit examinations but those classes that you have failed will be shown on your transcript. It is therefore in your best interest to attempt the resit classes.

MAY PROCEED

This means that although you have not passed in all of your examinations, you have obtained enough passes to go on to the next year of your course. This will apply only after the resit diet of examinations.

RESIT

This decision indicates that you have to resit and pass the examination(s) in the class or classes specified before you can be permitted to proceed to the next year of your course. Only the first attempt is normally permitted in the Final Honours examinations. If you have had an attempt discounted then FoSAMS progression will be considered at the September Examination Board.

DO NOT PROCEED (SUSPEND)

If by the September Examination Board you have not satisfied the progress regulations, your registration will be suspended and you will not be permitted to attend classes for the following session. Instead, you must first resit and pass in enough classes in order to be allowed to continue on your course of study.

TRANSFER

A student who does not obtain sufficient passes to meet the requirements for progress on an Honours degree course may be required to transfer to the corresponding Pass Degree in the subject

WITHDRAW

A student whose performance is considered to be so bad that none of the above alternative decisions would be appropriate will be required by the Examination Board to withdraw from his or her present degree course.

Students who are suspended or required to withdraw from Honours courses will receive details of the BSc degree course in Natural Sciences. Many students have transferred to this degree after failing to meet the progress requirements of the course of their first choice, and have then succeeded in completing a course more appropriate to their needs.

Alternatively, it may be feasible to transfer to an alternative course in a subject that is more closely aligned to your present career intentions.

You may also have the following comments next to individual class marks.

ATTEMPT DISCOUNTED

The Examination Board recognises that factors, such as ill health or adverse weather may have affected your performance in the class. The mark you achieve for the class is discarded and the next attempt at the class is regarded as the first* attempt. (*If the mark discounted is a re-sit the attempt will be regarded as the same number as the re-sit attempt e.g. 2nd, 3rd or 4th attempt.)

GRADUATION

What is Graduation?

The University holds Degree Congregations each year at which students graduate with degrees of the University. Until you have graduated, in person or "in absentia", you are not entitled to call yourself a graduate. For consideration for many types of employment, it is necessary to be able to show your degree certificate, presented to you at Graduation.

When are the Degree Congregations?

July and November in the Barony Hall. The dates and times for your degree ceremony will be announced in March.

Registration for Graduation

Who should register to Graduate?

All students hoping to graduate should register using the form available from Student Business. Registration is essential even if you want to graduate "in absentia" (i.e. the degree is conferred in your absence).

You cannot graduate twice with any degree. If you expect to qualify for a BSc Degree this year, but hope to go on to Honours, you should consider deferring graduation until your Honours Year. Students who graduate with a BSc Degree and then qualify for an Honours degree may apply for a Post-Graduation Honours parchment setting out the subject and class of Honours awarded. No registration fee is required for Post-Graduation Honours.

When do I need to register?

As soon as the forms become available in March. Do not wait until you have sat your examinations or until your award is approved - that will be too late. The deadlines for registration this year are late April for July graduations and late August for November graduations.

What are the fees?

The fees change each year, but for example in 2010 the Graduation fee was £30 or £15 for those graduating "in Absentia": The fee includes your subscription to the Graduates Association and a small charge for administration. The hire charges for the appropriate hood and gown are about £30.

How do I graduate "in absentia"?

Your degree will be conferred "in absentia" if you wish (tick the appropriate box on the form). Your degree parchment will be sent to the address given on your graduation form 2-3 weeks after the ceremony.

What happens if I do not qualify in time for graduation?

If you have registered to graduate in July but you do not qualify for the degree in time, Student Business will assume that you will graduate "in absentia" at the November ceremony; similarly if you register for November but do not qualify in time your registration would be deferred to July.

Debtors

If you owe the University money for any reason (fees, rent, library fines) you will not be permitted to graduate. You should clear any debts with Finance Office or the Library immediately.

Graduation Day

If you have registered to graduate by the appropriate date and have qualified for the award of the degree, Registry will send you information in the week before Graduation. This will include tickets for two guests to attend the ceremony.

What do I wear?

The correct academic dress (i.e. the gown and hood appropriate to your degree), otherwise you will not be permitted to graduate. The University does not provide gowns, but they can be hired.

Male graduands are expected to wear a dark suit, with a white shirt and dark tie. Female graduands are expected to wear a dark skirt and white blouse or a white or dark dress. If you wish, a recognised national dress (including the kilt) may be worn.

PRIZES

A number of prizes are given at the end of each year of each course. The value of the prizes is usually quite modest: they are intended only as an incentive and encouragement as you work towards your degree. Details of the prizes can be found at <http://phys.strath.ac.uk/undergrad/handbook>

MOVING HOME

It is important to keep **both** Student Business and the Department informed of **any change in your address**; else important information (like examination and graduation information) might go astray. Change of Address forms are available from the Student Office, JA 8.31. Please always advise the Department of any change of address, that way you can ensure that we keep our records up to date.

DIFFICULTIES:

If you find yourself with a problem or in difficulty the University has people and procedures in place to help (please refer to the University Handbook for contact details of all the main University services) but within the department help is also available. You can go and see your counsellor or adviser in the first instance. Do not delay getting help as often the problems are much reduced if tackled early enough. If they cannot give help themselves, they will often know of others who can help.

HAVE YOU THOUGHT ABOUT YOUR FUTURE?

The **Careers Advisory Service** (Livingstone Tower, Level 5) has a Student Employment Service specifically designed to help not only with your career when you are ready to leave the University (whether or not your University career has been successful), but can also help with finding temporary jobs during vacations. They also advise on finding jobs abroad. You can find out more about it at the Student Jobs section of the Careers Service web site at www.careers.strath.ac.uk/ses/index.shtml and from the University Handbook.

Have you considered the Erasmus Scheme? See page 6 for further details.

How much good experience can you gain from now on? How will you keep a record of your development for future reference?

If you want to find out more about the career options for subject graduates, call in the Careers Service and ask for the Signpost Sheet 'Your Degree in subject'

What Next? You can view this on the web at www.prospects.ac.uk and enter 'signposts - subject' in the key word search on the front page.

At least a year before leaving the University, you should register with the service. Not only do they provide much information on possible careers, they will also arrange a programme of job interviews for you (known as the "Milk Round") with companies looking for employees.

Besides arranging job interviews for students who are (or think they may be) in their final year at University, the Careers Advisory Service also can help find temporary/vacation employment. They also advise on study opportunities abroad.

Surveys have shown that Strathclyde University's graduates are more likely than most graduates from elsewhere to find a job quickly. Nevertheless the job situation remains difficult nationwide and it is important to think through what career you might follow well before you graduate. Apart from the benefits of being early in the race for the better jobs, the realism produced by knowing the job market usually helps motivate your study.

Fourth and Fifth Year: Career Planning and Development: Successful Applications

For BSc Honours students your final year is the time to follow through from the planning and research elements of the career choice process outlined in the 1st, 2nd and 3rd year handbooks. This should have helped you to progress your career thinking to a point where you are ready to take some action. However, if you have not yet started to consider the future beyond your degree the whole process will need to be incorporated into this year.

During your honours year you will need to balance the academic demands of your course with the final stages of career planning and job search. Decisions will need to be made at various stages of your final year and the timing of these will vary depending on your career focus. Some opportunities have closing dates very early in the academic year, even before Christmas.

You can continue to refine your career focus and embark on the job/postgraduate search process using the resources of the Careers Service. These include:

- The opportunity to continue to work with a careers adviser to clarify your career aspirations and develop an appropriate action plan.
- Exploration of the occupational, postgraduate and employer information available from the Careers Service resource centre, at www.careers.strath.ac.uk/inforoom.shtml and at www.prospects.ac.uk. The prospects site contains some of the most comprehensive occupational and postgraduate information in the world. From the front page follow 'career planning' to 'think about opportunities' to 'occupations' or 'postgraduate study'.
- Attend relevant seminars from the Career Essentials programme. Copies of this are distributed early in first semester and are also available from the Careers Service or at www.careers.strath.ac.uk/guidance/seminars.shtml. Topics such as applications, CVs, interview skills, assessment centres and how to look for a job are all included.
- Develop your CV with help from the Careers Service. Identify sources of vacancies for your areas of interest including national and local vacancy bulletins searchable on the Careers Service web site at www.careers.strath.ac.uk/vacancies/index.shtml or available fortnightly from the Information Point.

Careers Service staff are happy to help you at whatever stage of the career planning job search process you have reached. Your counsellor or adviser will provide references for you, if you ask.

Careers Advisory Service is on level 5 of the Livingstone Tower. Besides arranging job interviews for students who are (or think they may be) in their final year at University, they also can help find temporary/vacation employment. They also advise on study opportunities abroad.

Even if, as 4th year student, you are optimistic of continuing into a 5th year, you may well find it advantageous to join the scheme. Your fourth year may not work out so well as you hope, and securing a job offer before finishing your course may make all the difference to your prospects (as well as to your morale).

Project Timetables

Project 12 421

Taken in 4th year by MSci Physics, MSci Applied Physics, MSci Photonics, MSci Physics with Visual Simulation, BSc Physics, BSc Applied Physics, BSc Laser Physics and Optoelectronics and BSc Mathematics and Physics students.

20th September 2011 Project booklet to students

Students will receive project booklet and project request slips. The project booklet will contain details of projects offered, notes on safety training and a warning on the detection of plagiarism.

20th September 2011 – 30th September 2011 Students choose projects

Students should visit supervisors and draw up a shortlist of 3 potential projects in order of preference from 1 to 3. Each project request must be signed and dated by both the student and the supervisor and submitted to the student office, JA8.30 (Marionanne McLaren).

12 Noon 30th September 2011 Last date for submission of Project choice form to JA8.30 (Marionanne McLaren)

5th October 2011 Project allocations announced at 12 noon. Official start of Projects

17th October 2011 Literature review complete

Students submit literature survey for project (which will usually take the form of the Final Report's introductory chapter.)

30th January 2012 – 3rd February 2012 Mock viva voce examinations

The mock viva voce examination will give students a formative experience of a viva voce examination. The performance in the mock viva voce examination will not count towards the final assessment of the project.

28th March 2012 Project Talks 1-5 pm in parallel Sessions

Each student will be given a 15-minute slot. The expectation is that students will talk about their project for 10 minutes and then be questioned by the audience for 5 minutes.

16th April 2012 Project reports submitted

Project reports to be submitted as PDF format through MyPlace and then passed through Turnitin for plagiarism detection.

To be arranged Viva week

Students will be given the choice of when the Project viva will be scheduled.

Project 12 521

Taken by 4th year students on either the MSci Biophysics or MSci Physics and Mathematical Finance degrees. This project runs over both 4th and 5th year of the degree.

20th September 2011 Project booklet to students

Students will receive project booklet and project request slips. The project booklet will contain details of projects offered, notes on safety training and a warning on the detection of plagiarism.

20th September 2011 – 30th September 2011 Students choose projects

Students should visit supervisors and draw up a shortlist of 3 potential projects in order of preference from 1 to 3. Each project request must be signed and dated by both the student and the supervisor and submitted to the student office, JA8.30 (Marionanne McLaren).

12 Noon 30th September 2011 Last date for submission of Project choice form to JA8.30 (Marionanne McLaren)

5th October 2011 Project allocations announced at 12 noon.

17th October 2011 Literature review complete

Students submit literature survey for project (which will usually take the form of the Final Report's introductory chapter.)

30th January 2012 Official start of Projects

30th January 2013* Project reports submitted

Project reports to be submitted as PDF format through MyPlace and then passed through Turnitin for plagiarism detection.

30th March 2013* Project Talks 1-5 pm in parallel Sessions

Each student will be given a 15-minute slot. The expectation is that students will talk about their project for 10 minutes and then be questioned by the audience for 5 minutes.

To be arranged Viva week

Students will be given the choice of when the Project viva will be scheduled.

***Date is provisional and will be confirmed in next year's Student Handbook.**

Project Information for Continuing 5th Year Students**Project 12 520**

Taken in 5th year by MSci Physics, MSci Applied Physics, MSci Photonics, MSci Physics with Visual Simulation students. The expectation is that students will continue with the project started in 4th year.

30th January 2012 – 3rd February 2012 Mock viva voce examinations

The mock viva voce examination will give students a formative experience of a viva voce examination. The performance in the mock viva voce examination will not count towards the final assessment of the project.

28th March 2012 Project Talks 1-5 pm in parallel Sessions

Each student will be given a 15-minute slot. The expectation is that students will talk about their project for 10 minutes and then be questioned by the audience for 5 minutes.

16th April 2012 Project reports submitted

Project reports to be submitted as PDF format through MyPlace and then passed through Turnitin for plagiarism detection.

To be arranged Viva week

Students will be given the choice of when the Project viva will be scheduled.

Project 12 521

Taken by students on either the MSci Biophysics or MSci Physics and Mathematical Finance degrees

30th January 2012 – 3rd February 2012 Mock viva voce examinations

The mock viva voce examination will give students a formative experience of a viva voce examination. The performance in the mock viva voce examination will not count towards the final assessment of the project.

17th February 2012 Project reports submitted

Project reports to be submitted as PDF format through MyPlace and then passed through Turnitin for plagiarism detection.

1st March 2012 Project Viva

28th March 2012 Project Talks 1-5 pm in parallel Sessions

Each student will be given a 15-minute slot. The expectation is that students will talk about their project for 10 minutes and then be questioned by the audience for 5 minutes.

SAFETY

Safety is YOUR business and responsibility at all times. These notes supplement the Department's Safety Regulations and should be read carefully.

Potential hazards in physics laboratories include fire, electrical, materials and chemicals, machinery, gas cylinders, "common" accidents, ionizing radiation, laser UV, and microwave radiation. Special precautions are necessary for work on the roof of the John Anderson Building.

Fire

Unlikely but potentially fatal to many people if it should happen. No smoking in labs. Do not let waste paper accumulate. Do not leave gas burners on unattended. Electrical equipment, especially older power supplies can go on fire if short circuited and wrongly fused. Rotary pump motors can seize (i.e. jam) and go on fire if not properly protected. In general switch off unattended equipment unless there is a good reason for leaving it on. Know where the fire exits are.

Electrical

Current through heart stops operation of heart. Use safety equipment (see below). When adjusting equipment keep one hand away from equipment and away from any earthed conductor. This reduces current through heart from two-handed contact from 'live' to 'earth'. Know about resuscitation procedures - see notices displayed in every lab.

- Mains operated equipment including 5V power supplies, desk lamps etc.: Safety depends on correct wiring of plug, good quality cable, right fuse, proper earthing. "Tingly feeling" in finger when touching equipment indicates that it is not earthed properly. Report defects to demonstrator or lab technician - do not leave it for someone else.
- High voltage capacitor banks are very dangerous. Lethal charge is stored long after power supply switched off if fault occurs in protection circuits. Safety depends on good insulation and safety checks before alteration or maintenance (forbidden to students).
- Any high voltage equipment. "Tracking" occurs across surface of insulator. High voltage can then appear at unexpected places. Switch off power supply when altering circuit.
- Darkroom equipment - e.g. safety lights, driers etc. Dangerous because the darkroom is usually small, badly lit and wet (you are well earthed and hence at risk).

Materials and chemicals

- Many common chemicals and solvents are toxic - cancer an important risk, e.g. Benzene, Carbon Tetrachloride, Chloroform. Good ventilation important. Tap water is not necessarily drinking water.
- Many solvents inflammable - especially Benzene.
- Do not tip solvents down sink unless it is certain they will do no harm.
- Unless you have good knowledge of chemistry, do not mix chemicals without first getting expert advice.
- Alkali metals (e.g. sodium, potassium) react explosively with water.
- Mercury fumes are poisonous. If mercury gets spilled, inform demonstrator.
- Liquid nitrogen is cold but causes burns. Make sure it cannot splash into your eyes or onto your clothing.
- Asbestos fibres can lodge in lungs - cancer years later. Be cautious with asbestos and seek advice (there shouldn't be any asbestos in the lab).

- Many chemicals can cause dermatitis or other skin ailments (some people more susceptible than others). Keep your hands away from chemicals (gloves available if needed). Wash your hands if they should come into contact with chemicals of any sort.
- In general - do not eat in labs. Wash hands after leaving lab and before eating. Label all containers of chemicals and never use lemonade or similar bottles to store chemicals in.

Machinery

- In lab, rotary pumps have powerful electric motor with drive belt. Belt guard is not infallible protection against long hair or tie being caught up in belt. Fans on diffusion pumps are also a hazard.
- In machine shop - get expert advice. You should not use machines without supervision.

Gas cylinders

Contain gas at high pressure (~ 200 atmospheres). If a cylinder topples over, the danger results from its large weight and from the possibility that the cylinder neck may fracture (ejecting the valve). Gas cylinders should be secured to wall. Two valves to operate - get advice from demonstrator the first time you use one.

"Common" accidents e.g. falling down stairs, tripping over obstacles etc. Keep passageways clear of obstacles (e.g. bench stools, books, unused equipment) - especially in darkened labs. No horseplay in labs.

Radioactive or X-ray sources are covered by special rules. They must not be used without an approved scheme of work signed by the Department Radiation Protection Advisor.

Lasers are divided into classes

1	Harmless
2 or 3A	Low power but precautions needed
3B	Medium power - severe eye damage possible
4	Severe eye and skin damage possible


Before using any laser other than a class 1 you must have permission from your Supervisor who will arrange for an approved scheme of work signed by the Departmental Radiation Supervisor.

Roof of the John Anderson Building – You are forbidden to go onto the roof unless you have permission in writing from your Project Supervisor. He will tell you the current procedures.

Finally your first accident may be one we have not thought of yet. So be careful.

We believe the information provided in this handbook is correct at the date of publishing but may be subject to revision.

N.B. THIS HANDBOOK CAN BE SUPPLIED IN A VARIETY OF FORMATS TO SUIT YOUR NEEDS. PLEASE CONTACT THE DEPARTMENT FOR MORE INFORMATION

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 417		Class Name: Introduction to Scientific Programming, Design and Development	
Type: Compulsory	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr Carol Trager-Cowan		Tel: 3465 Email: c.trager-cowan@strath.ac.uk	
Teaching Staff: Dr Carol Trager-Cowan			
Pre-requisites: 12 336 Experimental Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		12	52	100

CLASS ASSESSMENT

Continuous
 1st Attempt 100 % report based
 re-submission of report

GENERAL AIMS

This class is designed to provide students with experience of sensors/transducers, amplifiers and computer data acquisition cards and software.

LEARNING OUTCOMES

On completion of this module, students should have:
 an appreciation of the processes required to design, prototype and test a simple instrument interfaced to a PC.

SYLLABUS

Students investigate the principles, operating properties and practical uses of one type of sensor or transducer. They specify an appropriate amplifier to be used with the transducer to produce a signal which may be monitored using a PC. They interface the transducer with its amplifier to a PC using an appropriate data acquisition card and create a data acquisition computer programme using an appropriate software package. Finally they calibrate and make biological measurements with their completed instrument.


RECOMMENDED TEXT / READING

National Instruments Developer Zone: Complete Data Acquisition Tutorial.
<http://zone.ni.com/devzone/cda/tut/p/id/3116>

All About Circuits: Operational Amplifiers
http://www.allaboutcircuits.com/vol_3/chpt_8/1.html

All About Circuits: Light Emitting Diodes
http://www.allaboutcircuits.com/vol_3/chpt_3/12.html

EDUCYPEDIA: Analog Electronics
<http://www.educyclopedia.be/electronics/analog.html>

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 418		Class Name: Physical Concepts	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr N. Langford		Tel: 3077	Email: n.langford@strath.ac.uk
Teaching Staff: Dr N. Langford			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
12	0		36	52	100

CLASS ASSESSMENT

Continuous Assessment

1st Attempt 100 % continuous assessment based on 3 assignments and oral presentations

Re-sit Re-submission of coursework

GENERAL AIMS

The aim of the class is to track the development of the key concepts in physics and review how this shapes the current understanding of the subject.


LEARNING OUTCOMES

On completion of this module, students should have:

- Appreciate the historical development of key concepts and relationships in physics.
- Be able to set these concepts and relationships in their proper context within the development of physics.
- Gain an insight into the approaches which prove appropriate in introducing these concepts at school level.
- Appreciate the need explain and illustrate physical principles in a way which makes them accessible.
- Acquire experience in presenting information.

SYLLABUS

The contributions of individuals will be identified and set in context both from a historical and scientific perspective. From the secondary school curriculum in physics, a number of concepts which students find difficult will be identified and these, together with appropriate teaching strategies, will be considered in more detail. At the end of the class students should have a better appreciation of physics as an evolving subject rooted in practical usefulness but with a coherent and self contained structure of concept and theory.

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 419		Class Name: Physical Sciences 2	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 2
Class Coordinator: Dr H. Fraser		Tel: 3420	Email: h.fraser@phys.strath.ac.uk
Teaching Staff: Dr H J Fraser Prof S Kuhr, Dr S Virmani			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
0	12		0	88	100

CLASS ASSESSMENT

Examination
 1st Attempt 100 % Examination
 Re-sit 100 % Examination

GENERAL AIMS

The aim of the class is to extend the development of a student's problem solving skills

LEARNING OUTCOMES

On completion of this module, students should have:


- *confident to identify* a previously unseen problem on any Physics topic covered in your education to date,
- *have improved* your scientific analysis skills and problem solving skills,
- *improved your skills* in critical analysis and evaluation of information,
- *able to identify* potential solutions to such unseen problems and know how to approach and tackle such problems,
- *know how to write-up the problem, often starting with a diagram* in a manner which makes it easy for you, your peers and the examiners to see how you have tackled the problem.

SYLLABUS

Problems will be taken from first two years physics courses

RECOMMENDED TEXT / READING

Benson University Physics

		FACULTY OF SCIENCE CLASS DESCRIPTOR Project	
Class Code: 12 421		Class Name: Project	
Type: Compulsory	Level: 4	Credits: 40	Semester: 1 and 2
Class Coordinator: Prof. K. P. O'Donnell		Tel:	Email: k.p.odonnell@strath.ac.uk
Teaching Staff: To be appointed			
Pre-requisites:			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
0	0	0	0	400	400

CLASS ASSESSMENT**Format:** Continuous**1st Attempt:** 100 % Continuous Assessment comprising written report 50 %, oral presentation 10 %, viva 20 % and supervisor mark 20 %**Re-sit:** As above**CLASS FEEDBACK**

Students will receive continual feedback on how they are performing on the project through regular weekly meeting with project supervisor(s). Students will also undertake a training-oral at beginning of 2nd semester with feedback on performance being provided after the oral.

GENERAL AIMS

This is the BSc project and is undertaken in 4th year and will allow students to develop as independent learners

LEARNING OUTCOMES

By the end of the course a student shall;

- Be able to undertake a research project with minimal guidance
- Be able to present and defend their work in a variety of ways

SYLLABUS

Students gain experience of research techniques by performing an open-ended research project. The topic may be practical, theoretical, or computation physics or a mixture of all three. The work is normally carried out in the research laboratories under the individual supervision of an experienced researcher.

RECOMMENDED TEXT / READING

Reading related to project area

FACULTY OF SCIENCE CLASS DESCRIPTOR			
Class Code: 12 423		Class Name: Semiconductor Physics and Devices	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 1/2
Class Coordinator: Prof. R. W. Martin		Tel: 3132 Email: r.w.martin@strath.ac.uk	
Teaching Staff: Prof. R. W. Martin			
Pre-requisites: 12 321 Quantum Physics, 12 330 Solid State Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		24	40	100

CLASS ASSESSMENT

Examination

1st Attempt 100 % based on examination**GENERAL AIMS**

The aim of the class is to track the development of key concepts in solid state physics and to show how these concepts can be exploited to produce functional devices.

LEARNING OUTCOMES


On completion of this module: Students will be able to demonstrate knowledge of topics listed in the syllabus and be able to apply that knowledge to related numerical problems.

SYLLABUS

1. Chemistry and physics of semiconductor materials.
2. Semiconductor statistics - electron and hole populations.
3. Electrical conduction - drift and diffusion of charge carriers.
4. The p-n junction and related devices.
5. Photonics - the interaction of semiconductors with light.
6. Electronics - transistors, bipolar and unipolar. Power devices. Integration.
7. Quantum wells and microstructures.
8. Advanced topics.

RECOMMENDED TEXT / READING

D.A. Neamen, Semiconductor Physics and Devices 3d Edition (McGraw-Hill, 2003)

	FACULTY OF SCIENCE CLASS DESCRIPTOR Ethics for Science and Engineering		
	Class Code: 12 425	Class Name: Ethics for Science and Engineering	
Type: Compulsory / Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr Carol Trager-Cowan		Tel: 3465	Email: c.trager-cowan@strath.ac.uk
Teaching Staff: Dr Carol Trager-Cowan			
Pre-requisites:			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIE S	ASSIGNMENT S	SELF STUDY	TOTAL
6	10		34	50	100

CLASS ASSESSMENT

Continuous

1st Attempt: 100 % essay based on a topic covering an ethical issue in either research or medicine.

Re-sit: Re-submission of essay

GENERAL AIMS

This class is designed to provide students with an understanding of how ethical issues affect and inform scientific research

LEARNING OUTCOMES

On completion of this module, students should have:

- To present the ethical issues and codes of practice associated with scientific research.
- To present the ethical issues and codes of practice associated with research on humans and animals and the associated laws.
- To show how advances in the biomedical sciences can be lead to ethical dilemmas within society and to present methods for developing an ethical viewpoint on controversial ethical topics and also understand how others might develop contrary views.

SYLLABUS

- a) Use a web-based exercise to investigate how the Ethical Matrix technique can be used to help clarify the interested parties and ethical issues associated with controversial topics.
- b) Read supplied web-based source material on scientific and biomedical ethics and associated codes of practice.
- c) Produce a 15 minute seminar on a selected case study covering a topical ethical issue in research or medicine.
- d) Write up to a 4,000 word essay on the same topic.

RECOMMENDED TEXT / READING

On Being A Scientist: Responsible Conduct In Research. http://www.nap.edu/catalog.php?record_id=12192

Harvard Medical School Policies on Research Integrity. <http://www.hms.harvard.edu/integrity/>

The Role and Activities of Scientific

Societies in Promoting Research Integrity www.aaas.org/spp/sfrr/projects/report.pdf

Medical Research Council – Good Research Practice.

<http://www.mrc.ac.uk/PolicyGuidance/EthicsAndGovernance/GoodResearchPractice/index.htm>

Medical Research Council – Policy and Procedure for Inquiring into Allegations of Scientific Misconduct.

<http://www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d=MRC002454>

Physics World: The social conscience of scientists <http://physicsweb.org/articles/world/12/12/1>

Learning lessons about ethics

<http://physicsweb.org/articles/world/12/3/2/1>

Ethics and the Welfare of the Physics Profession

http://scitation.aip.org/journals/doc/PHTOAD-ft/vol_57/iss_11/42_1.shtml

Ethics enters the 21st century

<http://physicsweb.org/articles/world/12/11/2>

Ethics of Medical Research on Humans

Medical Research Council – Ethics and Research Governance

<http://www.mrc.ac.uk/PolicyGuidance/EthicsAndGovernance/index.htm>

World Medical Association: Declaration of Helsinki. Ethical Principles for Medical Research Involving Human Subjects. <http://www.wma.net/en/30publications/10policies/b3/index.html>

The Nuremberg Code http://www.ushmm.org/research/doctors/Nuremberg_Code.htm

Research using Animals

UK Home Office <http://homeoffice.gov.uk/science-research/animal-research/>

British Union for the Abolition of Vivisection. <http://www.buav.org/>

Fund for the Replacement of Animals in Medical Experimentation
<http://www.frame.org.uk>

The Boyd Group – A discussion forum on animal use. <http://www.boyd-group.demon.co.uk>

Medical Ethics


The Hippocratic Oath http://www.pbs.org/wgbh/nova/doctors/oath_classical.html

American Medical Association code of ethics. <http://www.ama-assn.org/ama/pub/physician-resources/medical-ethics/code-medical-ethics.shtml>

Nuffield Council on Bioethics <http://www.nuffieldbioethics.org/>

BioethicsWeb <http://bioethicsweb.ac.uk/>

AAPM Medical Physicist Code of Practice. http://www.aapm.org/medical_physicist/default.asp

	FACULTY OF SCIENCE CLASS DESCRIPTOR Instrumentation Systems		
	Class Code: 12 439	Class Name: Instrumentation Systems	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr T. Han		Tel: 3267	Email: t.han@strath.ac.uk
Teaching Staff: Dr T. Han			
Pre-requisites:			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIE S	ASSIGNMENT S	SELF STUDY	TOTAL
24	6		20	50	100

CLASS ASSESSMENT

Examination and continuous

1st Attempt 80 % based on examination 20 % Assignment

Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to track the development of the key concepts in solid state physics and how these concepts can be exploited to form functional devices

LEARNING OUTCOMES

On completion of this module, students should have:

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS1) Steady State techniques

Optical configurations: Absorption and emission spectroscopy, correction for instrumental response using transfer functions, the diffraction grating, resolving power, monochromator design, convolution at a slit, the differential spectrophotometer, derivation techniques, CCD detection, OMA and parallel processing, noise filters and phase sensitive detection.

Charged particle configurations: Double and single focussing mass spectrometry, ion sources, electron multiplier, application to isotope abundance and large molecules, scan laws, array detection techniques, electron spectrometers.

2) Transient techniques

Impulse methods: sources, photodiode detection, the photomultiplier, MCP-PM, oscilloscope detection, the boxcar, digital averaging, the streak camera, parallel processing, image intensifiers, convolution, applications to excited state lifetimes.


Phase/modulation methods: relationships between time and frequency domain data, Fourier analysis, source modulation, phase measurements.

RECOMMENDED TEXT / READING

J.P. Bentley "Principles of measurement Systems", Longman, 1983

B.E. Jones "Instrumentation, measurement and Feedback", McGraw-Hill, 1977

E.O. Doebelin "Measurement systems, Application and Analyses", McGraw-Hill, 1966

plus : system applications in analytical spectroscopic techniques – various sources – consult library.			
		FACULTY OF SCIENCE	
		CLASS DESCRIPTOR	
Management of Technological Information			
Class Code: 12 478		Class Name: Management of Technological Information	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Prof. A. Cunningham		Tel: 3474 Email: a.cunningham@strath.ac.uk	
Teaching Staff: Dr A. G. Slight			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
10	10		30	50	100

CLASS ASSESSMENT

Continuous Assessment and Examination

1st Attempt 50 % continuous assessment in the form of group project submission and 50 % Examination

Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to the various pathways taken when trying to protect and exploit technological ideas

LEARNING OUTCOMES

On completion of this module, students should have:

- Understanding of innovation, entrepreneurship and commercialisation and the skills required for success in these areas
- Exposure to management principles and techniques relevant to technological industries
- Development of understanding of cash flows and break even calculations
- Experience of team working
- Improved appreciation of career opportunities and roles for technology based students

SYLLABUS


Training in the Management of all aspects of innovation, including patenting and other forms of IP protection, R&D Planning, product life cycle management, market research, production and selling. The class introduces the students to various management tools, including work breakdown structures, network diagrams, and cash flow tables.

Project work concentrates on the production by a team of students of a business plan for the development of an innovative product (chosen by the team themselves), including the development of a formal cash flow plan and break even analysis for the project.

RECOMMENDED TEXT / READING

References are extracted from various books on Innovation and related subjects;

Students are also directed towards numerous recently published Government papers on Innovation (e.g. The Lambert Review, The Cox Report and several published by the NESTA organisation.)

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 481		Class Name: Atomic and Molecular Physics	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 2
Class Coordinator: N. Langford		Tel: 3077	Email: n.langford@strath.ac.uk
Teaching Staff: Dr Y. Chen, tbc			
Pre-requisites: 12 321 Quantum Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		0	64	100

CLASS ASSESSMENT

Examination

1st Attempt 100 % Examination

Re-sit 100 % Examination

GENERAL AIMS

This class aims to give a general overview and understanding of atomic and molecular physics and relate these to practical applications and related fields of study.

LEARNING OUTCOMES

On completion of this module, students should have:

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS**Atoms**

Structure and classification of energy levels, interaction with fields, radiative transitions and spectra. Some quantum mechanical ideas related to atomic physics, isolated complex atoms, wavefunction and probabilities, angular momentum coupling, terms, states, configuration interaction. Atoms in interaction with external field. Atomic clusters.

Molecules

The quantum mechanics of bonding will be discussed in order to understand chemical bonds, their spatial arrangement, and strength. A quick overview of molecules will be given: important chemical groups and key molecules such as water, amino acids, and proteins. Relevant forces in molecules will be discussed starting out with the Born-Oppenheimer separation. Forces will lead to normal modes of vibrations and potential energy surfaces. The importance of weak forces such as in the hydrogen bond will be discussed. Reaction kinetics will be discussed using potentials, Fermi's golden rule, and more general curve crossings. This will be illustrated by the Marcus theory for electron transfer. Aspects of dynamics such as phase and population relaxation will be covered as well as relaxation theories. Techniques will be summarised such as infrared absorption spectroscopy and Raman scattering. Finally, some practical applications will be discussed such as why grass is green.

Syllabus**Atoms**

Hydrogen atom: wavefunction; spherical harmonics; associated Legendre functions; probability and radial distribution functions.

Angular momentum: quantum operators; commutation relations; \hat{L}^2 and L_z ; shift operators; states; matrix

elements, spin, composite system, Clebsch-Gordan series.

Atomic spectra and atomic structure: transition; selection rule; addition of angular momenta; fine structure; Lamb shift.

The Helium atom: spin eigenstates; singlets and triplets; Pauli exclusion principle; symmetric and anti-symmetric wavefunctions; transitions.

The alkali atoms: shell structure; screening; quantum defect; fine structure.

LS Coupling: Russell-Saunders coupling; jj coupling; intermediate coupling; selection rules; periodicity; term symbols; configuration interaction.

Atoms in external fields: Zeeman effect; Stark effect.

Atomic clusters: free-electron model, metal clusters and the Jellium model, magic number, size dependent excitation and emission.

Molecules

The quantum mechanics of bonding: Orbitals, hybridisation, σ -bonds, π -bonds, secondary bonds; Electronic states, HOMO, LUMO. **The chemical zoo:** All and more you ever wanted to know of chemistry; The important elements: H, C, N, O, metals; Water, alcohols, Polymers, Amino acids, Peptides, the peptide bond, primary/secondary/tertiary structure, DNA, Salts. **Forces:** Born-Oppenheimer approximation: nuclear vs. electronic, other examples; Bonds, harmonic approximation, normal modes; Anharmonicity: 3rd and 4th order, Morse potential, dissociation; Intermolecular forces, hydrogen bonds, ionic, Lennard-Jones. **Kinetics:** Free energy; Potential energy surfaces; Curve crossing; Perturbation theory, Fermi's golden rule; Barriers, Boltzmann, Arrhenius; The simplest reaction: electron transfer, Marcus theory. **Dynamics:** Coherence vs. population; T1 and T2 times; Kubo theory; Landau-Teller theory. **Techniques and methods:** IR absorption and Raman scattering by vibrations; VIS absorption by electronic states, Franck-Condon principle; MD simulations. **Specific examples:** Why is grass green? Photosynthesis, antenna complexes, ET in reaction centres; Why does water ice float? The structure of water, structure makers and breakers, syrup, Atlantic cod.


RECOMMENDED TEXT / READING

Atkins P and Friedman R, "Molecular Quantum Mechanics", Oxford, 2005.

Foot C, "Atomic Physics", Oxford, 2004

Rodney Cotterill, "Biophysics: an introduction", Wiley, 2002

Atkins, "Physical Chemistry", Oxford.

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 483		Class Name: Quantum and Nonlinear Optics	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 2
Class Coordinator: Dr G. R. M. Robb		Tel: 3358	Email: g.r.m.robb@strath.ac.uk
Teaching Staff: Dr G. R. M. Robb and Dr D. K. L. Oi			
Pre-requisites: 12 321 Quantum Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		12	52	100

CLASS ASSESSMENT

Examination
 1st Attempt 100 % Examination
 Re-sit 100 % Examination

GENERAL AIMS

This class aims to give a general overview and understanding of the quantum nature of light

LEARNING OUTCOMES


On completion of this module, students should have:
 Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS

Classical electromagnetism, vector and scalar potential theory, linear and nonlinear media, nonlinear processes, optical coherence, quantum harmonic oscillator, quantisation of the electromagnetic field, states of single mode fields, nonclassical light.

RECOMMENDED TEXT / READING

The Quantum Theory of Light, by R.Loudon

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 485		Class Name: Special Topics in Optics	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 2
Class Coordinator: Dr A. Cunningham		Tel: 3474	Email: a.cunningham@strath.ac.uk
Teaching Staff: Prof A. Cunningham and Dr T. Han			
Pre-requisites: 12 322 Solid State Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		0	64	100

CLASS ASSESSMENT

Examination

1st Attempt 100 % Examination

Re-sit 100 % Examination

GENERAL AIMS

This class aims to give an indication of the role of optics in solid state systems and in environmental applications

LEARNING OUTCOMES

1. On completion of this module, students should have:
2. Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS**Part-A**

A number of phenomena in Solid State Physics is considered paying particular attention to Optically Activated Solids. Hence including the following topics:

Atomic Physics: e.g. solving Schrödinger's equation for hydrogenic and multi-electron atoms, LS coupling, Born-Oppenheimer principle, Hund's rules, etc.

Solid State Physics: e.g. structure of crystalline and amorphous materials, optical centres in solids (colour centres, impurities), phonons, etc.

Optics: e.g. absorption and emission of light by matter, etc.

Laser Physics: e.g. stimulated emission, population inversion, gain equations, etc

Part-B

Environmental Optics

1. Introduction to natural light fields. Applications: illumination and imaging, geophysics, remote sensing, photosynthesis and vision. Radiometric definitions: solid angle, polar coordinates, radiant energy, radiant power, exitance, irradiance, radiant intensity, radiance. Irradiance from a distant source. The radiance theorem.
2. Diffuse sources. Exitance/radiance relationship for a Lambertian source. Irradiance from Lambertian disks and spheres.

3. Sun/earth radiant energy transfer. Characteristics of solar irradiance in space and its modification by the atmosphere. Solar heating and the earth's equilibrium temperature. Radiation balance, albedo and greenhouse effect.
4. Characteristics of light fields. Coordinate system. Irradiances from radiance integrals over solid angles. Practical irradiance measurements. Mean cosines. Reflectances. Directional attenuation coefficients.
5. Inherent optical properties: coefficients of absorption, attenuation, scattering and the volume scattering function. Apparent and 'hybrid' optical properties. Optical depth.
6. Radiance transfer theory. Derivation of the equation of radiance transfer. Gershun's Law. Underwater visibility. Visibility contrast. Derivation of range of visibility from radiance transfer equation. Design and calibration of radiance meters.
7. Scattering from particles. Basic geometry. Optical cross sections and efficiency factors. Extinction measurements for particle counting. Classification of approximate scattering functions. Van de Hulst's diagram. Rayleigh scattering. Rayleigh-Gans scattering. Anomalous diffraction. The amplitude scattering matrix. Stokes parameters. The Mueller matrix.
8. Image radiometry. Irradiance of images formed by lenses. Optics of the human eye. Vision at low light levels. Light absorption by detector arrays in the image plane. Poisson statistics of object discrimination.

RECOMMENDED TEXT / READING

Optical Spectroscopy of Inorganic Solids by Henderson B. and G.F. Imbusch


Any text books on Quantum Mechanics

Boyd R W Radiometry and the detection of optical radiation. John Wiley and Sons, New York.

Bohren C F and Huffman D R 1988 Absorption and scattering of light by small particles. John Wiley and Sons, New York

Mobley, C. D. 1994 Light and water: radiative transfer in natural waters. Academic Press.

Kirk, J.T.O. 1994 Light and photosynthesis in aquatic ecosystems. Cambridge University Press.

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 486		Class Name: Special Topics in Physics Plasma Physics and Astrophysics	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 2
Class Coordinator: Dr A. W. Cross		Tel: 4614	Email: a.w.cross@strath.ac.uk
Teaching Staff: Prof R. Bingham and Dr A. W. Cross			
Pre-requisites: 12 321 Quantum Physics and 12 328 Electromagnetic Theory			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	24		0	52	100

CLASS ASSESSMENT

Examination

1st Attempt 100 % Examination**GENERAL AIMS**

This class aims to give an indication of the state of art in plasma physics and astrophysical plasmas

LEARNING OUTCOMES

On completion of this module, students should have:

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS

Plasma Physics: basic plasma physics theory (particle orbit theory, fluid equations, ideal and magnetohydrodynamics, wave equations and kinetic theory). Physical interpretation of plasma phenomena illustrated with examples drawn from fusion plasmas.

Astrophysics: The history and geography of our galactic environment: stellar evolution - nuclear reactions and synthesis: role of weak interactions. Red giants, white dwarfs. Supernovae, neutron stars, black holes. Cosmology - the Big Bang and its physics.

RECOMMENDED TEXT / READING

"The Physics of Plasmas", T.J.M. Boyd and J.J. Sanderson, Cambridge University Press, 2003


"Plasma Physics – An Introductory Course", Richard Dendy, Cambridge University Press, 1993

"Introduction to Plasma Physics and Controlled Fusion", Volume 1, Second edition. F.F. Chen, Plenum Press, 1984

"Plasma Physics", R.A. Cairns, Blackie, 1985

"A Plasma Formulary for Physics, Technology and Astrophysics", D. Diver, Wiley, 2001

" High Energy Astrophysics " by Malcolm Longair, Cambridge University Press

	FACULTY OF SCIENCE CLASS DESCRIPTOR Communicating Physics		
	Class Code: 12 490	Class Name: Communicating Physics	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr C. Trager Cowan		Tel: 3465	Email: c.trager-cowan@strath.ac.uk
Teaching Staff: Dr C. Trager-Cowan, Dr R. Martin, Prof. D. Jaroszynski			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIE S	ASSIGNMENT S	SELF STUDY	TOTAL
12	12		24	52	100

CLASS ASSESSMENT

Continuous Assessment
 1st Attempt 100 % Continuous Assessment
 Re-sit 100 % Continuous Assessment

GENERAL AIMS

The aim of this class is to introduce the techniques of communicating and popularising physics.


LEARNING OUTCOMES

On completion of this module, students should have:
 Individually and in groups, students will perform a number of exercises linked to some or all of the following topics: scientific journalism, physics in art and literature, physics webpage and discussion forum, science festivals and science centres.

SYLLABUS

Presentation of Science to the public (CTG)
 Art & Science (DJ)
 Presentation on the Web (KW)

RECOMMENDED TEXT / READING

		FACULTY OF SCIENCE CLASS DESCRIPTOR Special Topics in Applied Physics	
Class Code: 12 493		Class Name: Special Topics in Applied Physics	
Type: Compulsory/Optional	Level: 4	Credits: 10	Semester: 2
Class Coordinator: Prof. A. Cunningham		Tel: 3474 Email: a.cunningham@strath.ac.uk	
Teaching Staff: Prof. A. Cunningham, Dr Carol Trager-Cowan			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIE S	ASSIGNMENT S	SELF STUDY	TOTAL
24	12		0	64	100

CLASS ASSESSMENT

Continuous Assessment and Examination

1st Attempt 85 % Examination. 15 % continuous assessment in the form of group project submission of a technical specification for a microscope system

Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to the concepts behind acoustics and microscopy.

LEARNING OUTCOMES

Students will gain insights into the physical basis and applications of acoustics and ultrasonics, and also into the interdisciplinary field of microscopy.

SYLLABUS

Part A: Acoustics

1. Introduction scope and application of acoustics and ultrasonics. Terminology and units. The 1-dimensional wave equation. Physical examples of 1-d wave propagation: string, elastic bar, column of compressible fluid.
2. The travelling harmonic wave in geometric and complex notation. Principle of superposition. Particle velocity in a plane acoustic wave.
3. Derivation of the 3-d acoustic wave equation. Interpretation of the wave equation. Propagation speed and bulk modulus. Propagation speed and specific heat ratios. Frequency shift of speech in helium atmospheres. Acoustically induced changes in density, particle displacement and temperature. Potential and kinetic energy in waves.
4. Scales of measurement: SIL, SPL, reference levels in air and water. Attenuation of acoustic signal strength in plane, cylindrical and spherical wavefronts. Absorption.
5. Comparison of plane and spherical waves pressure, particle displacement and particle velocity. Acoustic intensity. Relative strength of velocity and pressure signals in spherical waves as a function of wavefront curvature.
6. Wave impedance. Characteristic impedance of the medium. Impedance of a standing wave in a pipe. Impedance of a travelling spherical wave. Real (resistive) and imaginary (reactive) components of wave impedance.
7. Simple acoustic sources: the monopole, baffled monopole and dipole. Impedance, volume flow rate, source strength and radiated power.
8. The baffled piston. Axial intensity and angular distribution of radiated sound. Radiation impedance of a

piston. Dependence of radiation efficiency on size of piston relative to wavelength.


9. Waves in pipes and horns. Travelling waves in pipes. Waveguides. Acoustic horns: shapes, detailed treatment of the exponential horn, cutoff frequency, phase speed in the horn, impedance. Comparison of the radiation resistance of a piston radiating into free space and driving a horn.

10. Waves in enclosures. Analogies between mechanical, electrical and acoustic resonators. Acoustic compliance. The Helmholtz resonator. Bass reflex loudspeaker cabinet design.

11. Bio-acoustics. The human ear: anatomy and function. Impedance matching via the middle ear lever system. Songs of small insects: the problem of the *Drosophila* mating call and its solution.

Part B: Microscopy

Standard optical microscopy, fluorescence microscopy, confocal microscopy and 2 photon microscopy. Scanning electron microscopy, transmission electron microscopy and scanning probe microscopy

	FACULTY OF SCIENCE CLASS DESCRIPTOR Advanced Computational Physics		
	Class Code: 12 496	Class Name: Advanced Computational Physics	
Type: Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr B. Hourahine		Tel: 2325 Email: Benjamin.hourahine@strath.ac.uk	
Teaching Staff: Dr B. Hourahine			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIE S	ASSIGNMENT S	SELF STUDY	TOTAL
12	24		0	64	100

CLASS ASSESSMENT

Continuous Assessment and Examination
 1st Attempt 40 % Examination, 60 % continuous
 Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to the use of computational methods to address given physics problems


LEARNING OUTCOMES

Students will be able to demonstrate an understanding of the appropriate choice of method from the syllabus to address selected computational physics problems.
 Be able to demonstrate an understanding of the algorithms described in the course.
 Ability to implement stable, efficient and numerically correct versions of these algorithms, with source code which is well documented.
 Demonstrate an ability to decide the reliability and usefulness of derived computational results.
 Appreciation of the physical significance of derived computational results.

SYLLABUS

Fitting of experimental data to numerical models, goodness of fit, error and covariance of fit parameters.
 Principle components of large data sets
 Random numbers, Monte-Carlo sampling, integration and importance sampling.
 Random walks, Metropolis sampling, sampling statistical mechanics ensembles and the Ising model
 Partial differential equations, the Laplace equation on a grid, relaxation and over-relaxation, Green's function solutions

RECOMMENDED TEXT / READING

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: 12 494		Class Name: Special Topics in Theoretical Physics-Gravitation and Cosmology	
Type: Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Prof N. R. Badnell		Tel: 4176 Email: badnell@phys.strath.ac.uk	
Teaching Staff: Prof N. R. Badnell			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		0	64	100

CLASS ASSESSMENT

Continuous Assessment and Examination
 1st Attempt 100 % Examination
 Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to the large scale structure of space-time

LEARNING OUTCOMES

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS

Firstly, we develop the necessary mathematical concepts: 4-vectors, the metric tensor, covariant derivatives, connection coefficients and the Riemann curvature tensor. Secondly, we use them to derive Einstein's gravitational field equation and look at idealized cosmological solutions for the large-scale structure of the universe, including the standard model.

We conclude with a study of gravitational collapse and the properties of black holes.


RECOMMENDED TEXT / READING

***-Essential Relativity: Special, General, and Cosmological, W. Rindler (OUP, 2001 Edition: ISBN 0198508360 paperback)

***-(Schaum's outline of) Tensor Calculus, D. C. Kay (McGraw-Hill)

* -Gravitation, C.W. Misner, K.S. Thorne and J.A. Wheeler (Freeman).

* -Principles of Physical Cosmology, P.J.E. Peebles (Princeton).

	FACULTY OF SCIENCE		
	CLASS DESCRIPTOR		
Advanced Computational Physics			
Class Code: 12 496	Class Name: Advanced Computational Physics		
Type: Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr B. Hourahine		Tel: 2325 Email: Benjamin.hourahine@strath.ac.uk	
Teaching Staff: Dr B. Hourahine			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIE S	ASSIGNMENT S	SELF STUDY	TOTAL
12	24		0	64	100

CLASS ASSESSMENT

Continuous Assessment and Examination
 1st Attempt 40 % Examination, 60 % continuous
 Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to the use of computational methods to address given physics problems


LEARNING OUTCOMES

Students will be able to demonstrate an understanding of the appropriate choice of method from the syllabus to address selected computational physics problems.
 Be able to demonstrate an understanding of the algorithms described in the course.
 Ability to implement stable, efficient and numerically correct versions of these algorithms, with source code which is well documented.
 Demonstrate an ability to decide the reliability and usefulness of derived computational results.
 Appreciation of the physical significance of derived computational results.

SYLLABUS

Fitting of experimental data to numerical models, goodness of fit, error and covariance of fit parameters.
 Principle components of large data sets
 Random numbers, Monte-Carlo sampling, integration and importance sampling.
 Random walks, Metropolis sampling, sampling statistical mechanics ensembles and the Ising model
 Partial differential equations, the Laplace equation on a grid, relaxation and over-relaxation, Green's function solutions

RECOMMENDED TEXT / READING

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
Class Code: PH 406		Class Name: Discharge and Free Electron Physics	
Type: Optional	Level: 4	Credits: 10	Semester: 1
Class Coordinator: Dr A. W. Cross		Tel: 4614 Email: a.w.cross@strath.ac.uk	
Teaching Staff: Dr A. W. Cross and Dr K. Ronald			
Pre-requisites: 12 328 Electromagnetic Theory, 12 321 Quantum Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIE S	ASSIGNMENT S	SELF STUDY	TOTAL
24	12		0	64	100

CLASS ASSESSMENT

Examination
 1st Attempt 100 % Examination
 Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to the basic physics behind discharges and free electron physics

LEARNING OUTCOMES

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS


Free Electron Physics:-electrons studied as free charged particles,
 Electron optics and electron microscopes,
 Free electron devices - electron accelerators and synchrotrons,
 Free electron radiation sources - Gyrotrons, Klystrons, Free-electron lasers,
 Intense electron beam physics.

Discharges:

Basic plasma physics, Debye lengths, plasma frequencies, physics of particle transport in gases, physics of ionisation/particle emission, analysis of the Townsend avalanche, Paschens law, excitation in discharges, the role of metastables, relaxation scales, RF discharges, applications of discharges

RECOMMENDED TEXT / READING

A.M. Howatson, "An introduction to gas discharges"
 C. A. Brau, "Free-electron lasers"
 P.S. Fargo, "Free-electron physics"
 P.J. Goodhew "Electron microscopy and analysis"
 S. Humphries, "Charged particle beams"

	FACULTY OF SCIENCE		
	CLASS DESCRIPTOR		
Topics in Photonics			
Class Code: PH 418	Class Name: Topics in Photonics		
Type: Compulsory	Level: 4	Credits: 20	Semester: 1
Class Coordinator: Dr T. Ackemann	Tel: 3079 Email: thorsten.ackemann@strath.ac.uk		
Teaching Staff: Dr T. Ackemann, Dr. N. Langford, Prof. E. Riis			
Pre-requisites: Suitable understanding of Electromagnetic theory, quantum mechanics and atomic physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
36	12	0	4	148	200

CLASS ASSESSMENT

Format: Continuous and Examination

1st Attempt

75 % Written Examination 3 hrs long Format 3 Questions from 6 – Exam paper will comprise 3 sections each containing two questions. One question must be answered from each section.

25 % 3 Homework assignments.

Re-sit: 100 % Examination

GENERAL AIMS

The course provides an introduction to laser physics, laser optics and nonlinear optics as required for the work in many photonic labs.

LEARNING OUTCOMES

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems.

SYLLABUS**Laser Physics:**

Properties of laser radiation; Spontaneous and stimulated emission; Einstein A, B coefficients; Spectral line broadening; Population inversion; Multiple Level systems; Small signal gain; Amplification and line narrowing; Threshold condition; Gain saturation; Oscillating frequency; Spatial hole burning; Output coupling; Q-switching and methods of Q-switching; Amplification and saturation under pulsed operation.

Beam Propagation:


Plane waves and paraxial rays; Ray transfer matrices; Multi-element and periodic optical systems; Cavity stability; Longitudinal modes; Gaussian beams; Complex beam parameter; Complex beam parameter and Ray transfer matrices; Optical resonators; Multiple mirror cavities; Dielectric mirrors; Polarisation; Wave-plates; Jones matrices; Optical fibres.

Nonlinear optics:

Linear wave equation; Classical electron oscillator; Dielectric susceptibility; Dispersion including group velocity; Nonlinear oscillator; Nonlinear polarization; Nonlinear wave equation; Coupled amplitude equations; Second order effects – second harmonic generation, phase matching, sum and difference frequency matching, parametric amplification and oscillation; Third order effects – optical Kerr effect, self-phase modulation, self-focusing, degenerate four wave mixing; Optical solitons; Mode-locking.

RECOMMENDED TEXT / READING

Recommended text(s): A. Yariv: Photonics: Optical Electronics in Modern Communications, Oxford University Press (2007) other text books as suggested by lecturers.

		FACULTY OF SCIENCE	
		CLASS DESCRIPTOR	
		Advanced Topics in Solid State Physics	
Class Code: 12 502		Class Name: Advanced Topics in Solid State Physics	
Type: Compulsory / Optional	Level: 5	Credits: 20	Semester: 1 st
Class Coordinator: Dr B Hourahine		Tel: 2325 Email: benjamin.hourahine@strath.ac.uk	
Teaching Staff: Dr B Hourahine			
Pre-requisites:			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
30	10	30	50	80	200

CLASS ASSESSMENT**Format:** Examination**1st Attempt:** 100 % Examination**Re-sit:** 100% Examination**GENERAL AIMS**

The aim of this course is to introduce advanced concepts associated with the physics of solid state systems.

LEARNING OUTCOMES

By the end of the course a student shall demonstrate an understanding of the material listed in the syllabus

SYLLABUS

The independent particle picture and Bloch states (band structure and density of states from 3 to 0 dimensions)

Where band theory breaks down (disordered and non-periodic solids, collective excitations and quasi-particles)

Interacting electrons (Jellium, Hartree and Hartree-Fock, screening and correlation, the Thomas-Fermi model and density functional theory)

Phases of matter (first and second order phase transitions, symmetry vs order parameters, excitations and topological defects)

Transport (normal metals and semiconductors, superconductors, the quantum hall effect, topological insulators)

RECOMMENDED TEXT / READING**Recommended text(s):**

Solid State Physics, C. Kittel, Wiley 1996


The electronic structure and chemistry of solids, P. A. Cox, Oxford University Press 1987

The Solid State, H. M. Rosenberg, Oxford University Press 1988

Nanophotonics, P. N. Prasad, Wiley-Interscience 2004

Optical properties of Solids, M. Fox, Oxford 2010

Computational Physics, J. M. Thissen Cambridge University Press 2007

	FACULTY OF SCIENCE		
	CLASS DESCRIPTOR Advanced Topics in Optics		
Class Code: 12 503	Class Name: Advanced Topics in Optics		
Type: Optional	Level: 5	Credits: 20	Semester: 2
Class Coordinator:		Tel: Email:	
Teaching Staff: To be appointed			
Pre-requisites: Suitable understanding of Electromagnetic theory, quantum mechanics and atomic physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12	0	20	144	200

CLASS ASSESSMENT

Format: Continuous and Examination

1st Attempt 100 % Examination.

Re-sit: 100 % Examination

GENERAL AIMS

The course provides an introduction to advanced applications of ultra high intensity laser

LEARNING OUTCOMES

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems.

SYLLABUS

Theory of laser plasma interaction: plasma description, linear waves, non-linear effects, parametric interaction.

High power laser pulse interactions with dense targets: Overview of laser-solid interactions; energy absorption mechanism; ion acceleration; sheath acceleration and radiation pressure acceleration; hydrodynamics; shock waves; inertial fusion energy.

Micro-machining with femtosecond lasers.

Laser-plasma wakefield accelerators.

Free-electron lasers.


Ultrafast optics, nonlinear optics.

High harmonic generation.

RECOMMENDED TEXT / READING**Recommended text(s):**

Lasers by A. E. Siegman Stanford Press

Physics of Laser Plasma interactions W. L. Kruer, Westview Press

	FACULTY OF SCIENCE		
	CLASS DESCRIPTOR		
Advanced Topics in Applied Physics Fluorescence Spectroscopy			
Class Code: 12 507	Class Name: Advanced Topics in Applied Physics Fluorescence Spectroscopy		
Type: Optional	Level: 5	Credits: 20	Semester: 1
Class Coordinator: Dr O. J. Rolinski	Tel: 4614 Email: o.j.rolinski@strath.ac.uk		
Teaching Staff: Dr O. J. Rolinski			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		30	134	200

CLASS ASSESSMENT

Examination and Continuous Assessment
 1st Attempt 70 % Examination and 30 % Project
 Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to the use of fluorescence as a tool to gaining detailed information about microenvironments

LEARNING OUTCOMES


Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS

(A) Background. Measurement of fluorescence and phosphorescence, fluorescent molecules, basic characteristics of fluorescence. Quantum-mechanical fundamentals of fluorescence. Instrumentation for the steady-state and time-resolved measurements. Reconvolution methods. Excited state kinetics, solvation, fluorescence quenching, resonance energy transfer, molecular reorientations.
 (B) Sensing applications. Sensors based on the measurements of steady-state spectra. The lifetime sensors based on fluorescence decay and anisotropy measurements. Applications of fluorescence resonance energy transfer (FRET) for: selective detection of nM concentrations of analytes, determining the nm structure of macromolecules, fluorescence nano-tomography and its potential in bio- and medical structural sensing.

RECOMMENDED TEXT / READING

J.R.Lakowicz, "Principles of fluorescence spectroscopy", Third Edition, Springer 2007.

	FACULTY OF SCIENCE		
	CLASS DESCRIPTOR		
Physics in Medicine and Biology			
Class Code: 12 510	Class Name: Physics in Medicine and Biology		
Type: Compulsory	Level: 5	Credits: 30	Semester: 2
Class Coordinator: Dr C. Trager-Cowan	Tel: 3465	Email: c.trager-cowan@strath.ac.uk	
Teaching Staff: Prof. A. Cunningham, Dr C. Trager-Cowan, Dr O. J. Rolinski			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		90	174	300

CLASS ASSESSMENT

Examination and Continuous Assessment

1st Attempt 30 % project 50 % Examination and 20 % continuous assessment

Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to a) to provide an advanced understanding of the application of mathematics to biophysical systems, b) provide the student with a basic understanding of cellular processes described in terms of mathematical models based on statistical physics, c) give the student with a basic understanding of the physics and applications of medical instrumentation.

LEARNING OUTCOMES

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS

Part A Mathematics for Biophysical Applications

I. Elementary fluid dynamics.

Shear. Simple hydrostatics. Compressibility Lines of flow, streamlines and flow tubes. Viscosity. Parabolic flow in tubes. Poiseuille's equation. Bernoulli's equation. Flow work. Vascular resistance. Reynold's number and turbulence.

II. Mathematical models of time-dependent processes.

Exponential growth and decay. Half life and doubling time. Multiple decay processes. Linear differential equations with constant coefficients. The characteristic equation. Solutions for systems described by first-order and second-order equations. Oscillations and damping. The logistic equation.

III. Control of dynamical systems.

Open and closed loop systems. Biological examples: directional control of muscular activity, hormone levels, blood pressure. Black box models and transfer functions. Response of open and closed loop systems to disturbances. Time response of systems with feedback to specific forcing functions. The step response function for first-order and second-order systems. Period doubling in the discrete logistic equation as a route to chaos.

IV. Mathematical models of re-settable biological oscillators.

The radial isochron model: equations and graphical behaviour. Limit cycles and timing pulses. The geometry of phase resetting and its consequences.

V. Fourier synthesis.

Geometric representation of a harmonic oscillator. The Fourier series. Sine and cosine amplitude spectra. Conditions for convergence. Fourier series for even and odd functions. Derivation of Fourier series for a square wave and a sawtooth from first principles. The Fourier integral for non-periodic signals. Examples of transients: exponential decay, square pulse. Power spectra (the Parseval formula). Complex notation for Fourier series and integral.

VI. The Fourier transform.

Dependence of transform on function type. Mathematical properties, linear behaviour, differentiation, convolution.

VII. Fourier-related applications in signal analysis.

Sampled data, aliasing and the Nyquist criterion. Cross-correlation, auto-correlation. The relationship between the autocorrelation function and the power spectrum. Autocorrelation functions and the retrieval of signals from noise.

VIII. Fourier methods in optics and image formation.

Forward and inverse Fourier transforms for rectangular and delta functions. The convolution integral, definition and properties. Equivalence of convolution of functions and multiplication of their Fourier transforms. The diffraction grating as the convolution of a delta function and spacing function. Fraunhofer diffraction patterns as spatial Fourier transforms. Image formation by a lens as two consecutive Fourier transforms. Diffraction limit of lens resolution. The line spread function, point spread function and optical transfer function. Modulation and Phase transfer functions.

IX. Biomedical image reconstruction.

Derivation of Fourier coefficients from multiple scanner projections, interpolation in the Fourier plane, and inversion to give two-dimensional images. A simplified look at the technique of filtered back projection.

Part B Physics of Cellular Processes

1. Systems of many particles
2. Diffusion
3. Transport through neutral membranes
4. Summary of electricity
5. Impulses of nerve and muscle cells
6. Electricity and magnetism on the cellular level
7. Ions in solution.
8. Monitoring cellular process (guest lecture)

Part C Medical Imaging

. Use of Light

- (i) Atomic energy levels, quantum numbers and atomic emission and absorption spectra.
- (ii) Molecular energy levels - vibrational and rotational transitions.
- (iii) Blackbody radiation.
- (iv) Absorption cross-section, absorption and scattering coefficients.
- (v) Radiant energy, radiant flux, radiance, radiant intensity, irradiance, radiant exposure. How would you measure them?
- (vi) Infrared radiation from the body, biological applications of infrared light.
- (vii) The interaction of blue and UV light with the skin.
- (viii) The biological applications of visible and UV light, e.g., laser surgery, hyperthermia, photodynamic therapy.

II. Interaction of Photons and Charged Particles with Matter & X-rays etc: Imaging and Therapy

- (i) Scattering cross-section, linear attenuation coefficient, mass attenuation coefficient.
- (ii) Rayleigh scattering, the photoelectric effect, the Compton effect, pair production.
- (iii) X-rays used in diagnostic radiology: range of x-ray energies used in diagnostic radiology; the instrumentation required to obtain an x-ray image, the scattering mechanism dominating the contrast in an x-ray image, the factors which determine the resolution of an x-ray image - the factors limiting instrument

performance, what is imaged in an x-ray image.

(iv) Computed tomography (CT): range of x-ray energies used for CT imaging, the instrumentation required to obtain a CT image, the scattering mechanism dominating the contrast in a CT image, the factors which determine the resolution of a CT image - the factors limiting instrument performance, what is imaged in a CT image.

(v) X-ray radiation therapy: range of x-ray energies used for x-ray radiation therapy, the instrumentation required for x-ray radiation therapy.

(vi) The use of electron and proton beams for radiation therapy.

(vii) The radiation dose and depth-dose function for x-ray imaging, CT and radiation therapy.

III. Nuclear Physics and Nuclear Medicine

(i) The dependence of Z versus $A-Z$ for stable nuclei where A is the mass number and Z is the atomic number (number of protons).

(ii) The dependence of the average binding energy per nucleon versus A .

(iii) The generation of gamma rays, alpha particles, beta particles, Auger electrons and positrons.

(iv) The physical and biological properties of radiopharmaceuticals and tracers.

(v) Positron emission tomography (PET): the instrumentation required to obtain a PET image, the factors which determine the resolution of a PET image - the factors limiting instrument performance, what is imaged in a PET image (functional versus anatomical information).


(vi) Radiotherapy: the use of radioactive isotopes for radiotherapy.

(vii) Radiation in the environment.

RECOMMENDED TEXT / READING

J.R.Lakowicz, "Principles of fluorescence spectroscopy", Third Edition, Springer 2007.

C J Martin, Interaction of ionising radiations with matter (in Practical Radiation Protection in Health Care, eds C. J. Martin and D. G Sutton) (Oxford, 2002).

		FACULTY OF SCIENCE CLASS DESCRIPTOR Project	
Class Code: 12 520		Class Name: Project	
Type: Compulsory	Level: 5	Credits: 40	Semester: 1 and 2
Class Coordinator: Prof. K. P. O'Donnell		Tel:	Email: k.p.odonnell@strath.ac.uk
Teaching Staff: To be appointed			
Pre-requisites:			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
0	0	0	0	400	400

CLASS ASSESSMENT**Format:** Continuous**1st Attempt:** 100 % Continuous Assessment comprising written report 30 %, oral presentation 10 %, viva 30 % and supervisor mark 30 %**Re-sit:** As above**CLASS FEEDBACK**

Students will receive continual feedback on how they are performing on the project through regular weekly meeting with project supervisor(s). Students will also undertake a training-oral at beginning of 2nd semester with feedback on performance being provided after the oral.

GENERAL AIMS

This is the MSci Project is designed to follow on from the BSc project undertaken in 4th year and will allow students to further develop as independent learners

LEARNING OUTCOMES

By the end of the course a student shall;


- Be able to undertake a research project with minimal guidance
- Be able to present and defend their work in a variety of ways

SYLLABUS

Students gain experience of research techniques by performing an open-ended research project that continues the studies made in 4th year. The topic may be practical, theoretical, or computation physics or a mixture of all three. The work is normally carried out in the research laboratories under the individual supervision of an experienced researcher.

RECOMMENDED TEXT / READING

Reading related to project area

		FACULTY OF SCIENCE CLASS DESCRIPTOR Project	
Class Code: 12 521		Class Name: Project	
Type: Compulsory	Level: 5	Credits: 60	Semester: 1 and 2
Class Coordinator: To be appointed		Tel:	Email:
Teaching Staff: To be appointed			
Pre-requisites:			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
0	0	0	0	600	600

CLASS ASSESSMENT

Format: Continuous

1st Attempt: 100 % Continuous Assessment comprising written report 30 %, oral presentation 10 %, viva 30 % and supervisor mark 30 %

Re-sit: As above

CLASS FEEDBACK

Students will receive continual feedback on how they are performing on the project through regular weekly meeting with project supervisor(s). Students will also undertake a training-oral at beginning of 2nd semester with feedback on performance being provided after the oral.

GENERAL AIMS

This is the project for MSci Biophysics and MSci Physics and Mathematical Finance students and is designed to allow students to further develop as independent learners

LEARNING OUTCOMES

By the end of the course a student shall;


- Be able to undertake a research project with minimal guidance
- Be able to present and defend their work in a variety of ways

SYLLABUS

Students gain experience of research techniques by performing an open-ended research project. The topic may be practical, theoretical, or computation physics or a mixture of all three. The work is normally carried out in the research laboratories under the individual supervision of an experienced researcher.

RECOMMENDED TEXT / READING

Reading related to project area

	FACULTY OF SCIENCE CLASS DESCRIPTOR Advanced Topics in Physics		
	Class Code: 12 591	Class Name: Advanced Topics in Physics	
Type: Optional	Level: 5	Credits: 20	Semester: 1
Class Coordinator: Dr P. McKenna		Tel: 5712 Email: p.mckenna@strath.ac.uk	
Teaching Staff: Dr P. McKenna			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		0	164	200

CLASS ASSESSMENT

Examination
 1st Attempt 100 % Examination
 Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to introduce students to nuclear physics

LEARNING OUTCOMES


Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS

- Introduction and basic concepts
 - The nucleus and it's properties
 - Revision of basic Quantum Mechanics concepts
- Principles of nuclear physics
 - Nuclear structure
 - Nuclear instability
 - Nuclear reactions
- Applications of nuclear physics
 - Interaction with matter
 - Detectors and Instrumentation
 - Laser-driven nuclear physics
 - Biological effects and nuclear medicine
 - Fission energy
 - Fusion energy
 - Nuclear astrophysics

RECOMMENDED TEXT / READING

Nuclear Physics: Principles and applications by John Lilley
 Introductory Nuclear Physics by K.S.Krane
 Quantum Physics of atoms, molecules, solids, nuclei and particles by R Eisberg and R Resnick of fluorescence spectroscopy", Third Edition, Springer 2007.

		FACULTY OF SCIENCE CLASS DESCRIPTOR	
		Advanced Topics in Theoretical Physics Advanced Quantum Theory and Elementary Particle Physics	
Class Code: 12 594		Class Name: Advanced Topics in Theoretical Physics Advanced Quantum Theory and Elementary Particle Physics	
Type: Optional	Level: 5	Credits: 20	Semester: 2
Class Coordinator: Prof. N. R. Badnell		Tel: 5712 Email: badnell@phys.strath.ac.uk	
Teaching Staff: Prof. N. R. Badnell			
Pre-requisites: 12 494 Special Topics in Theoretical Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		20	144	200

CLASS ASSESSMENT

Examination and Continuous Assessment
 1st Attempt 75 % Examination and 25 % Essay
 Re-sit 100 % examination

GENERAL AIMS

The class provides an introduction to the Standard Model of Particle Physics

LEARNING OUTCOMES


Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUS

Lagrangian Mechanics, Electromagnetism, Dirac's Equation & its solution, Electrodynamics, Quantization (QED), Spontaneous Symmetry Breaking (Higgs), Massive Gauge Fields, the Weinberg-Salam Electro-Weak theory for leptons, Electro-Weak interactions of quarks, Strong Interactions (QCD).

RECOMMENDED TEXT / READING

***-An Introduction to the Standard Model of Particle Physics, W.N. Cottingham and D.A. Greenwood (CUP): ISBN 0521588324 paperback.
 *-Quantum Field Theory, C. Itzykson and J.-B. Zuber (McGraw-Hill)

	FACULTY OF SCIENCE CLASS DESCRIPTOR Advanced Topics in Nonlinear Physics		
	Class Code: 12 595	Class Name: Advanced Topics in Nonlinear Physics	
Type: Optional	Level: 5	Credits: 20	Semester: 2
Class Coordinator: Dr F. Papoff		Tel: 3178 Email: papoff@phys.strath.ac.uk	
Teaching Staff: Dr F. Papoff			
Pre-requisites: 12 376 Nonlinear Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	12		20	144	200

CLASS ASSESSMENT

Examination and Continuous Assessment
 1st Attempt 60 % Examination and 40 % continuous assessment
 Re-sit 100 % examination

GENERAL AIMS

The aim of the class is to extend a student's awareness of nonlinear physics

LEARNING OUTCOMES

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems

SYLLABUSSynchronization

Nonlinear oscillator with external driving force, coupled nonlinear oscillators with applications to neurons and lasers. Averaging and reduced models. Phase synchronization and complete synchronization. Synchronization of chaotic oscillators. Effect of noise.

Spatially Extended Nonlinear Systems


Formation of spatial structures and Linear Stability Analysis. Turing instability and morphogenesis in biological systems. Dispersion relations, stationary and traveling waves, stationary patterns and patterns periodic in space and time.

Nonlinear Waves

Shock waves and gradient catastrophe. Solitons, solitonic waves and their applications to propagation of laser pulses in fibers and formation of super continuum. First order equations and method of the characteristics. Introduction to complexity.

RECOMMENDED TEXT / READING

Nuclear Physics: Principles and applications by John Lilley
 Introductory Nuclear Physics by K.S.Krane
 Quantum Physics of atoms, molecules, solids, nuclei and particles by R Eisberg and R Resnick of fluorescence spectroscopy", Third Edition, Springer 2007.

	FACULTY OF SCIENCE CLASS DESCRIPTOR Physics of Cellular Processes		
	Class Code: PH 508	Class Name: Physics of Cellular Processes	
Type: Compulsory / Optional	Level: 5	Credits: 10	Semester: 2
Class Coordinator: Dr C. Trager-Cowan		Tel: 3465	Email: c.trager-cowan@strath.ac.uk
Teaching Staff: Dr O. J. Rolinski			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
8	4		30	58	100

CLASS ASSESSMENT

Format Examination and Continuous Assessment

1st Attempt 70 % Examination 30 % coursework

Re-sit 100 % Examination

GENERAL AIMS

This course will provide the student with a basic understanding of cellular processes described in terms of mathematical models based on statistical physics.

LEARNING OUTCOMES

Students will understand definitions and principles of statistical physics used for modelling cellular processes, describe selected physiological processes in terms of these principles, identify the role of physical methods in life sciences.


SYLLABUS

The specific topics include:

1. Systems of many particles
2. Diffusion
3. Transport through neutral membranes
4. Summary of electricity
5. Impulses of nerve and muscle cells
6. Electricity and magnetism on the cellular level
7. Ions in solution.
8. Monitoring cellular process (guest lecture)

RECOMMENDED TEXT / READING

R.K.Hobbie, Intermediate Physics for Medicine and Biology, Springer, New York, 1997.

	FACULTY OF SCIENCE		
	CLASS DESCRIPTOR		
Physics and Medical Diagnostics and Treatment			
Class Code: PH 509	Class Name: Physics and Medical Diagnostics and Treatment		
Type: Compulsory / Optional	Level: 5	Credits: 10	Semester: 2
Class Coordinator: Dr C. Trager-Cowan	Tel: 3465	Email: c.trager-cowan@strath.ac.uk	
Teaching Staff: Dr C. Trager-Cowan			
Pre-requisites: None			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
8	4		30	58	100

CLASS ASSESSMENT

Format Examination and Continuous Assessment

1st Attempt 70 % Examination 30 % coursework

Re-sit 100 % Examination

GENERAL AIMS

The general aim of the class is to provide the student with a basic understanding of the physics and applications of medical instrumentation.

LEARNING OUTCOMES

Students will demonstrate an understanding of the topics listed in the syllabus and apply their knowledge to describe how physics can assist medical imaging.

SYLLABUS**I. Use of Light**

- (i) Atomic energy levels, quantum numbers and atomic emission and absorption spectra.
- (ii) Molecular energy levels - vibrational and rotational transitions.
- (iii) Blackbody radiation.
- (iv) Absorption cross-section, absorption and scattering coefficients.
- (v) Radiant energy, radiant flux, radiance, radiant intensity, irradiance, radiant exposure. How would you measure them?
- (vi) Infrared radiation from the body, biological applications of infrared light.
- (vii) The interaction of blue and UV light with the skin.
- (viii) The biological applications of visible and UV light, e.g., laser surgery, hyperthermia, photodynamic therapy.

II. Interaction of Photons and Charged Particles with Matter & X-rays etc: Imaging and Therapy

- (i) Scattering cross-section, linear attenuation coefficient, mass attenuation coefficient.
- (ii) Rayleigh scattering, the photoelectric effect, the Compton effect, pair production.
- (iii) X-rays used in diagnostic radiology: range of x-ray energies used in diagnostic radiology; the instrumentation required to obtain an x-ray image, the scattering mechanism dominating the contrast in an x-ray image, the factors which determine the resolution of an x-ray image - the factors limiting instrument performance, what is imaged in an x-ray image.
- (iv) Computed tomography (CT): range of x-ray energies used for CT imaging, the instrumentation required to obtain a CT image, the scattering mechanism dominating the contrast in a CT image, the factors which determine the resolution of a CT image - the factors limiting instrument performance, what is imaged in a CT image.


- (v) X-ray radiation therapy: range of x-ray energies used for x-ray radiation therapy, the instrumentation required for x-ray radiation therapy.
- (vi) The use of electron and proton beams for radiation therapy.
- (vii) The radiation dose and depth-dose function for x-ray imaging, CT and radiation therapy.

III. Nuclear Physics and Nuclear Medicine

- (i) The dependence of Z versus $A-Z$ for stable nuclei where A is the mass number and Z is the atomic number (number of protons).
- (ii) The dependence of the average binding energy per nucleon versus A .
- (iii) The generation of gamma rays, alpha particles, beta particles, Auger electrons and positrons.
- (iv) The physical and biological properties of radiopharmaceuticals and tracers.
- (v) Positron emission tomography (PET): the instrumentation required to obtain a PET image, the factors which determine the resolution of a PET image - the factors limiting instrument performance, what is imaged in a PET image (functional versus anatomical information).
- (vi) Radiotherapy: the use of radioactive isotopes for radiotherapy.
- (vii) Radiation in the environment.

RECOMMENDED TEXT / READING

C J Martin, Interaction of ionising radiations with matter (in Practical Radiation Protection in Health Care, eds C. J. Martin and D. G Sutton) (Oxford, 2002).

	FACULTY OF SCIENCE		
	CLASS DESCRIPTOR		
Advanced Topics in Astronomy			
Class Code: PH 525	Class Name: Advanced Topics in Astronomy		
Type: Optional	Level: 5	Credits: 20	Semester: 1
Class Coordinator: Dr H Fraser	Tel: 3420	Email: h.fraser@strath.ac.uk	
Teaching Staff: Dr H Fraser			
Pre-requisites: 12 321 Quantum Physics, 12 328 Electromagnetic Theory, 12 320 Thermal and Statistical Physics			

CLASS DELIVERY (HOURS):

LECTURES	TUTORIALS	LABORATORIES	ASSIGNMENTS	SELF STUDY	TOTAL
24	24		30	122	200

CLASS ASSESSMENT

Examination

1st Attempt 60 % Examination 40 % continuous assessment

Re-sit 100 % examination

GENERAL AIMS

The aim of this course is to give an understanding of the variety of concepts required to understand our local space environment.

LEARNING OUTCOMES

Students will be able to demonstrate knowledge of topics listed in syllabus and be able to apply that knowledge to related problems including

By the end of the course a student shall;

Show a good understanding of the Physics of the Interstellar Medium.

Use a combination of observational examples, theory and basic physics to describe evidence for gas, dust, magnetic fields and dynamical conditions in interstellar space.

Describe the key regions of interstellar space.

Describe the physical conditions found there, as well as using simple models to explain their evolution during the star formation cycle.

Focus on the observational, theoretical and laboratory methods employed in modern astronomy to understand the role of molecules in various stages of the star-formation process.

Using gas and solid phase-chemical processes, explain interstellar chemical reactivity and non-Arrhenius behaviour in the gas-phase, catalytic formation of molecules in the solid state, and physical processes leading to solid-state desorption and phase change processes.

Solve mathematical problems based around interstellar physics as illustrated in lectures, and apply their knowledge to solving like-minded examples.

Understand the importance of chemistry as a 'clock' to probe star-formation.

Solve problems based around molecular astrophysics as illustrated, and be able to apply their knowledge to solving like-minded examples.

Through a self-study literature review, students will be encouraged to apply their lecture knowledge to ongoing real-time advances in the field, enhancing their research and data dissemination skills.

Show how recent research is improving our understanding of star and planet formation, and the potential for the emergence of life beyond the Earth, through observational and experimental evidence.

Make coherent presentations to their peer group on the subject area, and use the questions and answer discussions for peer – teaching and learning.

SYLLABUS**Part I – The Physics of the Interstellar Medium (ISM)**

1. Introduction, what is the ISM?
2. Basic Astronomy - Definition of Terms - Distances (AU, parsecs, arc-minutes etc), Luminosity (solar luminosity), Spectral (luminosity) classifications, MKK system, Stellar Mass (in terms of solar mass), Hertzsprung-Russell (HR) diagram & branches - AGB stars (carbon / oxygen rich), T-Tauri stars
3. Continuum Emission/ Absorption - black body radiation, Bremsstrahlung & Synchrotron radiation, Bound-free / free-free transitions in atoms & molecules, The cosmic microwave background radiation, The Interstellar Radiation Field, Habing & Draine models
4. Evidence for Interstellar Gas
5. Evidence for Interstellar Dust
6. Heating and Cooling Processes in the ISM
7. Dynamics of the ISM
8. Interstellar regions – examples

Part II – Star Formation and the Origin of Solar Systems

1. Introduction - The Star Formation Cycle, ISM regions – overview of conditions, Dense, Diffuse ISM, 'Regions' of Star Formation, Elemental Abundance (ISM regions vs. stellar abundance)
2. Basic Observational Astronomy, Celestial coordinates, Constellations, "Local" Star-Forming Regions
3. Molecules in the ISM
4. Molecule Formation
5. Interstellar Dust Formation (& Destruction)
6. Planet Formation
7. Origins of Life

RECOMMENDED TEXT / READING

The Physics of the Interstellar Medium, JE Dyson & DA Williams IoP Publishing (Graduate Series in Astronomy) 2nd Ed. (1997) ISBN 0-77503-0460-X

The Physics and Chemistry of the Interstellar Medium, AGM Tielens CUP (2005) ISBN 0521826349

Astrochemistry – from astrochemistry to astrobiology, AM Shaw Wiley (2006) ISBN 0-470-09137 1

Stars, Nebulae & The Interstellar Medium, CR Kitchin IoP Publishing (1987) ISBN 0-85274-580-X

The Physics of Stars, AC Philips John Wiley & Sons (1994) ISBN 0 471 94155 7

APPENDIX 2 – DEGREE REGULATIONS

BSc with Honours in Applied Physics
BSc with Honours in Laser Physics and Optoelectronics
BSc with Honours in Physics
BSc in Physics and Applied Physics

Fourth Year

15.17.8 All students shall undertake classes amounting to no fewer than 120 credits as follows:

Compulsory Classes		Level	Credits
12 421	Project	4	40
12 419	Physical Science 2	4	10
PH 352	Quantum Physics and Electromagnetism	3	20

together with classes appropriate to the chosen course:

Applied Physics/Physics

Optional Classes

Level 3 and 4 classes chosen from Regulation 15.17.9 to bring the total credits up to a minimum of 120 credits with at least 90 at Level 4.

Laser Physics and Optoelectronics

Compulsory Classes		Level	Credits
12 423	Semiconductor Physics and Devices	4	10
PH 418	Topics in Photonics	4	20

Optional Classes

Level 3 and 4 classes chosen from Regulation 15.17.9 to bring the total credits up to a minimum of 120 credits with at least 90 at Level 4.

A student already holding a pass in any compulsory class may substitute an approved optional class.

Final Honours Classification

15.17.15 On successful completion of the fourth year curriculum, a candidate will be awarded 120 Level 4 credits under the class code PH 400.

15.17.16 The final Honours classification will normally be based on:

- (i) the first assessed attempt at compulsory and specified optional classes at Level 3 and above taken in the third and fourth years;
- (ii) if appropriate, an oral examination.

Award

15.17.17 **BSc with Honours:** In order to qualify for the award of the degree of BSc with Honours in the chosen course, a candidate must have accumulated no fewer than 480 credits from the relevant course curriculum. These must include no fewer than 180 at Levels 3 and 4 or above of which a minimum of 90 must be at Level 4 or above.

15.17.18 **BSc:** In order to qualify for the award of BSc in Physics and Applied Physics, a candidate must have accumulated no fewer than 360 credits from the course curriculum. These must include no fewer than 60 credits at Level 3 or above and at least 180 credits at Level 2 or above from the compulsory and optional classes taken from the course curriculum.

BSc with Honours in Physics with Teaching BSc in Physics with Teaching

Fourth Year

15.29.67 All students shall undertake classes amounting to no fewer than 120 credits as follows:

Compulsory Classes		Level	Credits
PH 352	Quantum Physics and Electromagnetism	3	20
12 418	Physical Concepts	4	10
12 490	Communicating Physics	4	10
X9 458	Educational Studies 1	4	20
X9 462	Educational Studies 2	4	20
X9 463	Pedagogy and Placement Learning 2	4	20
X9 499	Pedagogy and Curriculum Physics with Science 2	4	20

***Block Placement 1 – February/March (31 days)

***Block Placement 2 – April/May (17 days)

Note: Education classes start in the first week of October.

15.29.71 Final Honours Classification

The final Honours classification will normally be based on:

- (i) the first assessed attempt at compulsory and specified optional classes taken in the third and fourth years
- (ii) if appropriate, an oral examination.

Award

15.29.72 **BSc with Honours:** In order to qualify for the award of the degree of BSc with Honours in Physics with Teaching, a candidate must have accumulated no fewer than 480 credits from the course curriculum. These must include

- (i) the credits for all the compulsory Level 4 Education classes taken individually;
- (ii) no fewer than 180 credits at Level 3 or above of which a minimum of 90 must be at Level 4 or above.

15.29.73 **BSc:** In order to qualify for the award of the degree of BSc in Physics with Teaching, a candidate must have accumulated no fewer than 440 credits from the course curriculum which must include the credits for all the compulsory Level 4 Education classes taken individually.

15.29.74 A candidate who fails to satisfy the requirements for the award of the degree of BSc with Honours in Physics with Teaching or the BSc in Physics with Teaching may be transferred to the degree of BSc in Physics provided the appropriate progress regulations are satisfied.

BSc with Honours in Mathematics and Physics
BSc in Mathematics and Physics
Fourth Year

15.15.57 All Honours students shall take classes amounting to no fewer than 120 credits as follows:

Compulsory Class	Level	Credits
11 407 Mathematics and Physics*	4	120

* 11 407 *Mathematics and Physics* comprises a project in either Mathematics or Physics and Level 4 classes chosen from Regulations 15.15.6 and 15.17.8. The curriculum must include at least 50 credits of classes from each regulation.

Curriculum (Part-time study)

15.15.58 In each academic year, students studying on a part-time basis shall normally undertake a curriculum of at least 60 credits chosen from the appropriate full-time curriculum.

Progress (Full-time study)

15.15.59 In order to progress to the second year of the course, a student must normally have accumulated at least 90 credits from the course curriculum, including those for the classes *MA 101 Mathematics 1A* and *MA 102 Mathematics 2A*, and no fewer than 40 credits in Physics classes.

15.15.60 In order to progress to the third year of the Bachelor degree course, a student must normally have accumulated at least 190 credits from the course curriculum.

15.15.61 In order to progress to the third year of the Honours degree course, a student must have accumulated at least 220 credits from the course curriculum.

15.15.62 In order to progress to the fourth year of the course, a student must normally have accumulated at least 360 credits from the course curriculum. In addition a student must normally have achieved an approved standard of performance with regard to level of study and academic attainment.

Progress (Part-time study)

15.15.63 In order to progress to the next full-time equivalent year of the course, a part-time student must normally satisfy the appropriate progress requirements for full-time study.

15.15.64 In any one academic year, a part-time student shall not normally carry more than 25 outstanding credits from one academic year to the next.

Final Honours Classification

15.15.65 On successful completion of the fourth year, a candidate will be awarded 120 Level 4 credits under the class code 11 407.

15.15.66 The final Honours classification will normally be based on:

- (i) the first assessed attempt at compulsory and optional classes taken in the third and fourth years;
- (ii) if appropriate, an oral examination.

Award

15.15.67 **BSc with Honours:** In order to qualify for the award of the degree of BSc with Honours in Mathematics and Physics, a candidate must have accumulated no fewer than 480 credits from the course curriculum. These must include no fewer than 180 credits at Level 3 and 4 or above of which a minimum of 90 must be at Level 4 and must include those for all the third and fourth year compulsory and optional Mathematics and Physics classes.

15.15.68 **BSc:** In order to qualify for the award of the degree of BSc in Mathematics and Physics, a candidate must have accumulated no fewer than 360 credits from the course curriculum. These must include no fewer than 160 credits from second and third year compulsory and optional Mathematics and Physics classes of which a minimum of 60 must be at Level 3 or above.

MSci in Biophysics**Fourth Year and Fifth Year**

16.17.8 All students will normally take classes which will aggregate the total of accumulated credits to 600 (and must bring the total studied at Level 5 to at least 130 credits) as follows:

Compulsory Classes		Level	Credits
12 332	Instrumentation	3	20
12 417	Introduction to Scientific Programming, Design and Development	4	10
12 425	Ethics for Science and Engineering	4	10
12 478	Managing Technological Innovation	4	10
12 488	Research Skills	4	10
PH 952	Research Project	5	60
59 501	Computational Neuroscience and Electrophysiology	5	30
BB 501	Bioinformatics	5	20
PH 416	Imaging Instrumentation	4	10
PH 508	Physics of Cellular Processes	5	10
PH 509	Physics and Medical Diagnostics	5	10

Optional Classes

Level 3, 4 or 5 classes chosen from Regulation 15.17.9 to bring the total credits up to at least 600 including at least 90 credits at Level 4 and 140 credits at Level 5.

Progress

16.17.13 In order to progress to the fifth year of the course, a student must normally have accumulated at least 460 credits from the course curriculum.

Final Assessment

16.17.14 On successful completion of the fourth and fifth year, a candidate will be awarded 130 credits under the class code PH 419 and 110 credits under the class code *PH 501*.

16.17.15 The final classification for the degree of MSci in Biophysics will normally be based on:

- (i) the first assessed attempt at all compulsory and specified optional classes at Level 3 and above in the fourth and fifth year curricula;
- (ii) if appropriate, an oral examination.

Award

16.17.16 **MSci:** In order to qualify for the award of the degree of MSci in Biophysics, a candidate must have accumulated no fewer than 600 credits from the course curriculum. These must include no fewer than 230 credits at Levels 4 and 5 of which a minimum of 120 must be at Level 5.

16.17.17 Notwithstanding Regulation 16.1.32, the degree will be classified in accordance with Regulation 15.1.33.

Transfer

16.17.18 A candidate who fails to satisfy the progress or award requirements for the degree of MSci in Biophysics may be transferred to the appropriate degree in Physics provided the appropriate progress regulations are satisfied. Candidates may alternatively apply for transfer to the degree of BSc with Honours in Natural Sciences (Biophysics).

16.17.19
to 16.17.30

(Numbers not used)

MSci in Applied Physics
MSci in Photonics
MSci in Physics
MSci in Physics with Visual Simulation

Fourth and Fifth Year Curriculum

16.17.40 All students shall normally undertake classes which will aggregate the total of accumulated credits to no fewer than the total required for the award of the degree (600) and must include at least 120 credits at Level 5.

Compulsory Classes (All courses)		Level	Credits
12 419	Physical Science 2	4	10
12 421	Project	4	40
12 478	Managing Technological Innovation	4	10
12 520	Project	5	40

together with classes appropriate to the chosen course:

Applied Physics

Compulsory Classes

12 439	Instrumentation Systems	4	10
12 493	Special Topics in Applied Physics	4	10
12 507	Advanced Topics in Applied Physics	5	20

Optional Classes

Level 4 or 5 classes chosen from Regulation 15.17.9 to bring the total credits up to at least 600 including a minimum of 120 at Level 5 and 210 at Levels 4 and 5.

Photonics

Compulsory Classes

12 423	Semiconductor Physics and Devices	4	10
12 483	Quantum and Nonlinear Physics	4	10
12 485	Special Topics in Optics	4	10
PH 418	Topics in Photonics	4	20
12 502	Advanced Topics in Solid State Physics	5	20
12 503	Advanced Topics in Optics	5	20

Optional Classes

Level 4 or 5 classes chosen from Regulation 15.17.9 to bring the total credits up to at least 600 including a minimum of 120 at Level 5 and 210 at Levels 4 and 5.

Physics

Compulsory Classes

12 423	Semiconductor Physics and Devices	4	10
12 481	Atomic and Molecular Physics	4	10
12 486	Special Topics in Physics	4	10
12 496	Advanced Computational Physics	4	10
12 591	Advanced Topics in Physics	5	20

Optional Classes

Level 4 or 5 classes chosen from Regulation 15.17.9 to bring the total credits up to at least 600 including a minimum of 120 at Level 5 and 210 at Levels 4 and 5.

Physics with Visual Simulation

Compulsory Classes

12 423	Semiconductor Physics and Devices	4	10
12 481	Atomic and Molecular Physics	4	10
12 486	Special Topics in Physics	4	10
12 496	Advanced Computational Physics	4	10

12 591 and either	Advanced Topics in Physics	5	20
12 494 or	Special Topics in Theoretical Physics 1	4	10
PH 402	Special Topics in Theoretical Physics 2	4	10

Optional Classes

Level 4 or 5 classes chosen from Regulation 15.17.9 to bring the total credits up to at least 600 including a minimum of 120 at Level 5 and 210 at Levels 4 and 5.

16.17.41 In addition, if not already taken, a student may undertake *12 437 Industrial Project* during the summer vacation following Fourth Year.

Progress

16.17.46 In order to progress to the fifth year of the course, a student must normally have accumulated at least 460 credits from the course curriculum.

Final Assessment

16.17.47 On successful completion of the minimum number of Level 5 classes in the fourth and fifth year curriculum, a candidate will be awarded 120 Level 5 credits under the class code PH 500 and 120 Level 4 credits under the class code PH 400.

16.17.48 The final classification for the degree of MSci in the chosen course will normally be based on:

- (i) the first assessed attempt at compulsory and specified optional classes taken at Levels 4 and 5 in the fourth and fifth year curricula;
- (ii) if appropriate, an oral examination.

Award

16.17.49 **MSci:** In order to qualify for the award of the degree of MSci in the chosen course, a candidate must have accumulated no fewer than 600 credits from the course curriculum. These must include no fewer than 210 credits at Levels 4 and 5 of which a minimum of 120 must be at Level 5.

16.17.50 Notwithstanding Regulation 16.1.32, the degree will be classified in accordance with Regulation 15.1.33.

Transfer

16.17.51 A candidate who fails to satisfy the progress or award requirements for the degree of MSci may be transferred to the BSc with Honours in the chosen course provided the appropriate progress regulations are satisfied.

MSci in Physics and Mathematical Finance

Fourth and Fifth Year Curriculum

16.17.68 All students shall normally undertake classes which will aggregate the total of accumulated credits to no fewer than the total required for the award of the degree (600) and must include at least 120 credits at Level 5.

Compulsory Classes		Level	Credits
12 496	Advanced Computational Physics	4	10
PH 952	Research Project	5	60
53 483	Data Analysis 1	4	10
53 484	Data Analysis 2	4	10
AG 302	Security Analysis	3	15
AG 303	Empirical Methods in Finance	3	15
AG 306	Security Analysis (<i>from session 2011-12</i>)	3	20
AG 307	Treasury Management and International Finance (<i>from Session 2011-12</i>)	3	20
MA 301	Partial Differential Equations 1	3	10
MA 311	Partial Differential Equations 2	3	10

together with
either

no fewer than 30 credits chosen from (*until session 2011-12*):

40 414	Pricing of Securities in Financial Markets	4	10
40 415	Management of Investments in Securities	4	10
40 436	Empirical Projects in Corporate Finance	4	10
40 437	Empirical Projects for Security Analysis	4	10

or

no fewer than 40 credits chosen from (*from session 2012-13*):

40 XXX	Asset Pricing	4	20
40 XXX	Advanced Portfolio Analysis	4	20
40 XXX	Advanced Derivatives	4	20
40 XXX	Behavioural Finance	4	20
40 XXX	Corporate Financing	4	20
40 XXX	Corporate Investment Theory and Policy	4	20
40 XXX	International Financial Management	4	20

Optional Classes

Level 4 and 5 classes chosen with the approval of the Adviser of Study from the list in Regulation 15.17.9 to bring the total credits up to at least 600 including a minimum of 210 at Levels 4 and 5 of which at least 120 must be at Level 5.

If not already taken, a student may undertake *12 437 Industrial Project* during the summer vacation following Fourth Year.

Progress

16.17.73 In order to progress to the fifth year of the course, a student must normally have accumulated at least 460 credits from the course curriculum.

Final Assessment

16.17.74 On successful completion of the minimum number of Level 5 classes in the fourth and fifth year curriculum, a candidate will be awarded 120 Level 5 credits under the class code PH 500.

16.17.75 The final classification for the degree of MSci in Physics and Mathematical Finance will normally be based on:

- (i) the first assessed attempt at compulsory and specified optional classes taken at Levels 3, 4 and 5 in the fourth and fifth year curricula;
- (ii) if appropriate, an oral examination.

Award

16.17.76 **MSci:** In order to qualify for the award of the degree of MSci in Physics and Mathematical Finance, a candidate must have accumulated no fewer than 600 credits from the course curriculum. These must include no fewer than 210 credits at Levels 4 and 5 of which a minimum of 120 must be at Level 5.

16.17.77 Notwithstanding Regulation 16.1.32, the degree will be classified in accordance with Regulation 15.1.33.

Transfer

16.17.78 A candidate who fails to satisfy the progress or award requirements for the degree of MSci may be transferred to the BSc degree in the chosen course provided the appropriate course regulations are satisfied.

APPENDIX 3 - Prizes and Rubric for their Award

Astronomical Society of Glasgow Prize (£50)

Offered annually by the Astronomical Society of Glasgow for award to the most distinguished student in the final examinations for a BSc Honours or MSci degree in Mathematics or Physics.

2Professor James Blyth Memorial Prize (£15 in books)

Founded in 1908 by students and friends as a tribute to the memory of Professor James Blyth MA LLD FRSE Professor of Natural Philosophy in the Glasgow and West of Scotland Technical College from 1880 to 1906. Awarded to a meritorious student in the first year class in Physics.

2Kelvin Prizes (two: £45 in books or instruments)

Founded in 1962 by Mrs Hilda M Beilby, daughter-in-law of a former Head of the Governors of the Royal Technical College, Sir George T. Beilby LLD DSc FRS, to commemorate the name of her grand-uncle, Lord Kelvin. One prize awarded to a meritorious student in the final year of an undergraduate course in the Department of Mathematics and the other to a meritorious student in the final year of an undergraduate course in the Department of Physics.

2Malcolm Kerr Prizes (six: £15)

Provided by an endowment arising under the terms of the Deed of Settlement of the late Malcolm Kerr, stationer in Glasgow. Four prizes awarded to meritorious students in the first year class in Physics, and two to meritorious students in the first year class in Biology.

Frank Leslie Prize (£50)

Founded in 2000 by the Department of Mathematics, in association with the Department of Physics, in commemoration of the late Professor Frank M Leslie DSc FRSE FRS, Professor in the Department of Mathematics from 1979 to 2000. Awarded to a meritorious student in the final year of the joint honours BSc course in Mathematics and Physics.

A. S. McLaren Prize in Physics (£20)

Founded in 1978 by the former School of Mathematics, Physics and Computer Science as a memorial to Mr A S McLaren, Lecturer and Senior Lecturer in the former Department of Natural Philosophy from 1946 to 1977. Awarded annually on the recommendation of the Head of the Department of Physics to the student who achieves the best performance in the second year Physics Laboratory.

2Professor James Muir Prize (£18)

Founded in 1939 under an endowment by students and friends to commemorate Professor James Muir MA DSc ARCST FlntSP Professor of Natural Philosophy in the Royal Technical College from 1906 to 1938. Awarded to a meritorious student in the final year of the course for a BSc or MSci degree in Physics.

Fred Stern Memorial Prize

Founded in 1978 by students and friends as a tribute to the memory of Dr Fred Stern, Lecturer in the Royal College of Science and Technology from 1957 to 1964, and in the University of Strathclyde from 1964 to his death in 1977. Awarded, on the nomination of the Head of the Department of Physics, to students in that Department who have exceptionally distinguished themselves, either by attainment or improvement. The prize money shall be used for a purpose proposed by the recipient, and agreed by the Head of Department, but this shall always include a suitable book. The amount of the prize shall be determined by the Head of Department, by reference to the accumulated value of the endowment at the time.

Richard Thornely Memorial Prize

Founded in 1987 to the memory of Dr F R Thornley, lecturer in the University of Strathclyde from 1976 to his death in 1987. Awarded, on the nomination of the Head of the Department of Physics, to a third or fourth year undergraduate in the Department of Physics for written work dealing with a specific problem in Physics or Applied Physics, whose solution has social, moral philosophical, cultural, or technological implications. The work will be judged on both the discussion of these implications and on the depth of scientific understanding.

APPENDIX 4 - ASSESSMENT PROCEDURES FOR STUDENTS WHO WILL GRADUATE IN 2012

FINAL YEAR CREDIT MARK AVERAGE SCHEME (FYCMAS) (All degrees)

PLEASE NOTE THAT MARK YOU ACHIEVE FOR YOUR 1ST ATTEMPT AT AN EXAMINATION WILL DETERMINE THE LEVEL OF DEGREE AWARD. **RE-SITTING A FAILED EXAMINATION WILL ONLY IMPROVE YOUR TRANSCRIPT AND NOT YOUR DEGREE AWARD.**

The award of the degree is determined by the number of credits accrued a student over the period of study. A student who is short of credits but otherwise satisfies all of the requirements to be awarded a given degree will be awarded 120 credits under the class code PH 400 / PH 500 provided that the credit mark average (CMA) of 120 compulsory or approved optional class credits taken in the final year reaches the pass mark for the degree. The 120 credits awarded under PH 400 / PH 500 are instead of those included in the CMA. In the case of Biophysics the super class codes are PH 419 and PH 501.

Note: The vacation Industrial Project mark (**12.437**) is **NOT AVAILABLE** for inclusion in the CMA.

The assessment of students for the award of BSc Honours or MSci degrees is made by the Joint Honours Board which comprises External Examiners and all Academic Staff. Students who wish to notify the Joint Honours Board of extenuating circumstances that may have affected their performance in the Final examination(s) must communicate these in writing, and must be accompanied by appropriate documentary evidence, to the Head of Department at least two weeks prior to the meeting of the Honours Board.

FINAL YEAR COMPOSITE MARK

BSc Honours Physics, Laser Physics and Optoelectronics, Applied Physics

The **composite mark** is determined to be the credit-weighted average mark of 90 credits at Level 3 and 90 credits at Level 4, taken from the compulsory and approved optional classes for the appropriate Years 3 and 4 curricula. The marks included are those from the first attempt.

Note 1: **12 359** Pass Degree Option 1, **12 360** Pass Degree Options 2 and **12 437** Industrial Project are **NOT AVAILABLE** for inclusion in the composite mark.

Note 2: **ONLY ONE** mark from **12 418** Physical Concepts, **12 425** Ethics for Science & Engineering, **12 478** Managing Technological Innovation, **12 488** Research Skills, **12 489** Physics in Society, **12 490** Communicating Physics may be included in the composite mark.

BSc Honours in Physics with Teaching

The algorithm for award is given by $0.3*(\text{Year 3 average}) + 0.7*(\text{Year 4 average})$

BSc Honours in Mathematics and Physics

The **composite mark** is by the Faculty approved Faculty of Science Algorithm.

BSc Honours Assessment (Physics) One Year

As for the normal BSc Honours assessment except that the **composite mark** is determined from 120 credits at Levels 3 and 4, including at least 90 credits at Level 4.

MSci Physics, Photonics, Applied Physics, Physics and Visual Simulation , Physics and Mathematical Finance

The **composite mark** is determined to be the credit-weighted average mark of 210 credits at Levels 3 (Physics and Mathematical Finance **ONLY**), 4 and 5 (All degrees), taken from the compulsory and approved optional classes for the appropriate Years 4 and 5 curricula. The marks included are those from the first attempt.

Note 1: **ONLY ONE** marks from **12 418** Physical Concepts, **12 425** Ethics for Science & Engineering, **12 488**

Research Skills, **12 489** Physics in Society, **12 490** Communicating Physics may be included in the composite mark.

Note 2: The mark for the class **12 437** Industrial Project is **NOT AVAILABLE** for inclusion in the composite mark.

MSci Biophysics

The **composite mark** is determined to be the credit-weighted average mark of 210 credits at Levels 3, 4 and 5, taken from the compulsory and approved optional classes for the appropriate Years 4 and 5 curricula. The marks included are those from the first attempt.

Note 1: ONLY ONE marks from **12 418** Physical Concepts, **12 489** Physics in Society, **12 490** Communicating Physics may be included in the composite mark.

Note 2: The mark for the class **12 437** Industrial Project is **NOT AVAILABLE** for inclusion in the composite mark.

MSci Assessment for BSc Honours for Photonics, Applied Physics, Physics and Visual Simulation, Physics and Mathematical Finance

A candidate who fails to satisfy the requirements for the award of an MSci degree may be assessed for the degree of BSc Honours in Physics (Physics, Physics with Visual Simulation, Physics and Mathematical Finance, or Laser Physics Optoelectronics (Photonics), or Applied Physics (Applied Physics)).

Note 1: 12 521 Research Project may be counted as 40 credits at Level 4.

Note 2: ONLY ONE marks from **12 418** Physical Concepts, **12 425** Ethics for Science & Engineering (Biophysics excluded), **12 488** Research Skills, **12 489** Physics in Society, **12 490** Communicating Physics may be included in the composite mark.

Note 3: The mark for the class **12 437** Industrial Project is **NOT AVAILABLE** for inclusion in the composite mark.

The Faculty of Science Composite Mark Algorithm

The Faculty Composite mark Algorithm shall be
$$C = \frac{\sum w_i c_i m_i}{\sum w_i c_i}$$

where c_i is the credit value of the class, m_i is the percentage mark gained in the class.

For Honours Degrees the sum is over all level 3 and level 4 classes in a students required curriculum, and $w_i = 1$ for level 3 classes and 3 for level 4 classes. Where a curriculum for the award of an honours degree includes level 5 classes these shall be included in the algorithm as if they were Level 4 classes where this is to the benefit of the student.

For Integrated Masters the sum is over all level 4 and level 5 classes in a students required curriculum, and $w_i = 1$ for level 4 classes and 3 for level 5 classes.

Alternatively, denoting the credit weighted average (CWA) mark for level 3, 4 and 5 classes by $L3$, $L4$ and $L5$ respectively, this can be calculated **for Honours** by

$$C = \frac{mL3 + 3nL4}{m + 3n}$$

where m and n are the numbers of credits at Level 3 and Level 4 respectively; and **for Integrated Masters** by

$$C = \frac{mL4 + 3nL5}{m + 3n}$$

where m and n are the numbers of credits at Level 4 and Level 5 respectively.

Where a curriculum contains the **same number** of credits (normally 120) at both levels included in the algorithm, the calculation is equivalent to

For Honours: $0.25 * L3 + 0.75 * L4$

For Integrated Masters: $0.25 * L4 + 0.75 * L5$.

FINAL YEAR ORAL EXAMINATIONS

You may be requested to attend for oral examination. The external examiners decide who to invite for an oral examination are decided by the.

Candidates might be called for oral examination for many possible reasons, e.g.

- a) their mark falls close to a possible degree class boundary,
- b) as a "bench mark" candidate for comparison with other candidates.

It is important to understand that your performance at an oral examination can only positively aid your assessment and not reduce an existing assessment.

The oral examinations will last for around 15 minutes each and are held from 9.00 a.m. on the morning of the day of the Joint Honours Examination Board. The list of required candidates is announced then, and it is the responsibility of each candidate to make themselves available at that time. (Often the external examiners will make the list available about 4.30 p.m. the previous day. You may telephone from that time to enquire. Alternatively, if you leave a contact number, we will endeavour to contact you to advise you that you are needed.)

The date of the Joint Honours Board (and hence of the oral examinations) is generally announced on the notice boards outside JA.8.05 several months beforehand.

Topics discussed during the oral examination will reflect the breadth of physics as a discipline and may make reference to specific questions in final year examination papers for that academic session or the project.

Timetable – Semester 1

	9:00am–10.00am	10.00am–11.00am	11.00am–12.00pm	12.00pm–1.00pm	1.00pm–2.00pm	2.00pm–3.00pm	3.00pm–4.00pm	4.00pm–5.00pm
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								

Timetable – Semester 2

	9:00am–10.00am	10.00am–11.00am	11.00am–12.00pm	12.00pm–1.00pm	1.00pm–2.00pm	2.00pm–3.00pm	3.00pm–4.00pm	4.00pm–5.00pm
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								

