26 School of Physical Sciences

PH700		Physics Research Project				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	60 (30)	100% Project	Hughes Dr M (SPS)

Availability

This is not available as a wild module.

Contact Hours

5 hours module introduction, talks guidance and feedback on talks;
40 days conducting supervisor-guided research (a minimum of 280 timetabled hours);
2 days project 'conference' (approx. 14 hours).

Total hours of study, including private study: 600 hours.

Learning Outcomes

An ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions.
An ability to solve problems in physics using appropriate mathematical tools.
An ability to execute and analyse critically the results of an experiment or investigation and draw valid conclusions. To evaluate the level of uncertainty in these results and compare them with expected outcomes, theoretical predictions or with published data; thereby to evaluate the significance of their results in this context.
An ability to interpret mathematical descriptions of physical phenomena.
An ability to plan an experiment or investigation under supervision and to understand the significance of error analysis.
A working knowledge of a variety of experimental, mathematical and/or computational techniques applicable to current research within physics.
An ability to present and interpret information graphically.
An ability to communicate scientific information, in particular to produce clear and accurate scientific reports.
A familiarity with laboratory apparatus (including relevant aspects of Health & Safety), theories and techniques.
The systematic and reliable recording of experimental data or derivation of theoretical results.
An ability to make use of appropriate texts, research-based materials or other learning resources as part of managing their own learning. C&IT skills which show fluency at the level and range needed for project work such as familiarity with a programming language, simulation software or the use of mathematical packages for manipulation and numerical solution of equations.
An ability to communicate complex scientific ideas, the conclusion of an experiment, investigation or project concisely, accurately and informatively.
Experimental skills showing the competent use of specialised equipment, the ability to identify appropriate pieces of equipment and to master new techniques and equipment.
An ability to make use of research articles and other primary sources.
Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems; an ability to formulate problems in precise terms and to identify key issues, and the confidence to try different approaches in order to make progress on challenging problems. Numeracy is subsumed within this area.
Investigative skills in the context of independent investigation including the use of textbooks and other available literature, databases, and the interaction with colleagues to extract important information.
Communication skills in the area of dealing with surprising ideas and difficult concepts, including listening carefully, reading demanding texts and presenting complex information in a clear and concise manner. C&IT skills are an important element to this.
Analytical skills – associated with the need to pay attention to detail and to develop an ability to manipulate precise and intricate ideas, to construct logical arguments and to use technical language correctly.
Personal skills – the ability to work independently, to use initiative, to organise oneself to meet deadlines and to interact constructively with other people.

Method of Assessment

Coursework 100%. Students are required both to write a formal report of the work and to present their findings as a talk, such as would be contributed to a scientific conference. The conference-style presentation is filmed, and the resulting DVD used to provide detailed feedback. The work is also subject to an oral examination. The final mark will be obtained from four separate assessments: 1) the progress, aptitude and general diligence (15%), 2) the progress report (55%), 3) an oral examination (15%) and 4) a talk (%15).

Preliminary Reading

None; appropriate background reading will be suggested by individual project supervisors

Pre-requisites

None.

Restrictions

School of Physical Sciences
Procedures for Projects Involving Human Participation

It is a University requirement that any final year project undergraduate, postgraduate or staff research project involving human participants should be subject to a procedure to determine whether ethics approval is needed. The procedure employed by SPS and the Faculty of Science are described here:
http://www.kent.ac.uk/stms/faculty/adminprocedures/research-ethics/index.html

Undergraduate projects PH600, PH603, PS620, CH620, PS720, PS740 and PH700
Each project proposal collected from academics will include an ethics approval checklist designed to determine if ethical approval is required from the faculty i.e. does the project involve human participants. It is the responsibility of convenors to ask supervisors to fill in these checklists with students. If the answer to any of the questions on the checklist is yes please see below;

The following text will be introduced into the information pack or the handbooks of the module:

“Before you commence any work, it is important that the ethics of that work be considered; for example, taking fingerprints or collecting images of faces of your colleagues etc. Your supervisor will discuss any ethics issues with you and you should keep a copy of the documentation”

For projects involving human participants other than those conducting the project itself, students and their supervisors are required to read, note and act upon the guidelines available at
http://www.kent.ac.uk/stms/faculty/adminprocedures/research-ethics/index.html to obtain approval from the Sciences Research Ethics (Human Participation) Advisory Group.

Further information on Ethics can be obtained from Dr Donna Arnold, SPS representative on the Sciences Research Ethics Advisory Group.

Synopsis *

Aims:
To provide an experience of open-ended research work.
To begin to prepare students for postgraduate work towards degrees by research or for careers in R&D in industrial or government/national laboratories.
To deepen knowledge in a specialised field and be able to communicate that knowledge orally and in writing.
Syllabus
All MPhys students undertake a laboratory, theoretical or computationally-based project related to their degree specialism. These projects may also be undertaken by Diploma students. A list of available project areas is made available during Stage 3, but may be augmented/revised at any time up to and including Week 1 of Stage 4. As far as possible, projects will be assigned on the basis of students' preferences – but this is not always possible: however, the project abstracts are regarded as 'flexible' in the sense that significant modification is possible (subject only to mutual consent between student and supervisor). The projects involve a combination of some or all of: literature search and critique, laboratory work, theoretical work, computational physics and data reduction/analysis. The majority of the projects are directly related to the research conducted in the department and are undertaken within the various SPS research teams.

PH709 Space Astronomy and Solar System Science

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	M	15 (7.5)	70% Exam, 30% Coursework	Lowry Prof S

Availability

This is not available as a wild module.

Contact Hours

30 contact hours, including: 26 hours of lectures, 2 hours of workshops, and class tests.

In addition, 120 hours of self-study are required.

Learning Outcomes

An ability to identify relevant principles and laws when dealing with problems in Space Astronomy and Solar System Science, and to make approximations necessary to obtain solutions.
An ability to solve problems in astronomy, astrophysics and space science using appropriate mathematical tools.
An ability to use mathematical techniques and analysis to model physical behaviour in Space Astronomy and Solar System Science.
An ability to comment critically on how spacecraft and space telescopes (operating at various wavelengths) are designed, their principles of operation, and their use in solar system exploration and astronomy & astrophysics research.
An ability to solve advanced problems in astronomy, astrophysics and space science using appropriate mathematical tools.
An ability to interpret mathematical descriptions of physical phenomena in Space Astronomy and Solar System Science.
An ability to work within the space sciences area that is well matched to the frontiers of knowledge, the science drivers that underpin government funded research and the commercial activity that provides hardware or software solutions to challenging scientific problems in these fields.
An ability to present and interpret information graphically.
An ability to make use of appropriate texts, research-based materials, other primary sources or other learning resources as part of managing their own learning.
An ability to discuss coherently the origin and evolution of Solar Systems and be able to evaluate claims for evidence of Solar Systems other than our own.
Ability to identify relevant principles, make relevant approximations and solve problems using a mathematical approach.
Students should become fluent in current trends and methods as regards to space astronomy and Solar System exploration.
Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems; an ability to formulate problems in precise terms and to identify key issues, and the confidence to try different approaches in order to make progress on challenging problems. Numeracy is subsumed within this area.
Investigative skills in the context of independent investigation including the use of textbooks and other available literature and databases, to extract important information.
Communication skills in the area of dealing with surprising ideas and difficult concepts, including listening carefully, reading demanding texts.
Analytical skills – associated with the need to pay attention to detail and to develop an ability to manipulate precise and intricate ideas, to construct logical arguments and to use technical language correctly.

Method of Assessment

Final Examination (70%);
2 class tests (15% each).

Preliminary Reading

Wertz and Larson, Space Mission Analysis and Design, 3rd Edition

Jones, Discovering the Solar System, 2nd Edition

Taylor, Solar System Evolution, 2nd Edition

Other reading:
Davies; Astronomy from Space: The Design and Operation of Orbiting Observatories, Wiley

Encrenaz, Bibring and Blanc; The Solar System, Springer

Jakosky: The Search for Life on Other Planets

Gilmour & Sephton: Introduction to Astrobiology

Carroll and Ostlie, Modern Astrophysics (2nd ed)

Pre-requisites

None.

Synopsis *

SYLLABUS:

Space Astronomy
Why use space telescopes; other platforms for non-ground-based astronomical observatories (sounding rockets, balloons, satellites); mission case study; what wavelengths benefit by being in space; measurements astronomers make in space using uv, x-ray and infra-red, and examples of some recent scientific missions.

Exploration of the Solar System
Mission types from flybys to sample returns: scientific aims and instrumentation: design requirements for a spacecraft-exploration mission; how to study planetary atmospheres and surfaces: properties of and how to explore minor bodies (e.g. asteroids and comets): current and future missions: mission case study; how space agencies liaise with the scientific community; how to perform calculations related to the orbital transfer of spacecraft.

Solar System Formation and Evolution
The composition of the Sun and planets will be placed in the context of the current understanding of the evolution of the Solar System. Topics include: Solar system formation and evolution; structure of the solar system; physical and orbital evolution of asteroids.

Extra Solar Planets
The evidence for extra Solar planets will be presented and reviewed. The implications for the development and evolution of Solar Systems will be discussed.

Life in Space
Introduction to the issue of what life is, where it may exist in the Solar System and how to look for it.

PH711 Rocketry and Human Spaceflight

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	15 (7.5)	70% Exam, 30% Coursework	Lowry Prof S

Availability

This is not available as a wild module.

Contact Hours

30 contact hours, including lectures (26 hours), 2 workshop sessions (2 hours) and class tests.

In addition 120 hours of directed reading and self-study are required.

Learning Outcomes

Aspects of the theory and practice of space science, and of those aspects upon which space science depends in relation to rocketry and Human Space Flight (a knowledge of key physics, especially for rocketry).
An understanding of relevant fundamental laws and principles of physics, along with their application to rocketry and human spaceflight.
An ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions.
An ability to solve problems in rocketry and human spaceflight using appropriate mathematical tools.
An ability to use mathematical techniques and analysis to model physical behaviour.
An ability to solve advanced problems in rocketry and human spaceflight using appropriate mathematical tools, to translate problems into mathematical statements and apply their knowledge to obtain order of magnitude or more precise solutions as appropriate.
An ability to interpret mathematical descriptions of physical phenomena.
An ability to present and interpret information graphically.
An ability to make use of appropriate texts, research-based materials, other primary sources or other learning resources as part of managing their own learning.
To develop an appreciation of the design, construction and testing of space vehicles and their operation.
To understand the basic physiological changes the human body is subject to in space.
To develop an appreciation of the uses of space for science and by astronaut.
Ability to identify relevant principles, discuss in an informed fashion, make relevant descriptions or approximations (mathematical or otherwise) and solve problems.
Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems; an ability to formulate problems in precise terms and to identify key issues, and the confidence to try different approaches in order to make progress on challenging problems. Numeracy is subsumed within this area.
Investigative skills in the context of independent investigation including the use of textbooks and other available literature and databases to extract important information.
Communication skills in the area of dealing with surprising ideas and difficult concepts, including listening carefully, reading demanding texts.
Analytical skills – associated with the need to pay attention to detail and to develop an ability to manipulate precise and intricate ideas, to construct logical arguments and to use technical language correctly.

Method of Assessment

Coursework (30% - includes 2 class tests at 15% each);
Final Examination (70%).

Preliminary Reading

Recommended Text:
Fortescue, Stark and Swinerd, Spacecraft Systems Engineering, 3rd ed, Wiley, 2003

Other recommended reading:
Wetz and Larson, Space Mission Analysis and Design, 3rd Edition,
Sutton, Rocket Propulsion Elements
Sidi, Spacecraft Dynamics and Control
Background reading (In addition, a fuller reading list will be distributed in the lectures):
McNamara: Into the Final frontier, pub. Harcourt
Nicogossian, Huntoon and Pool: Space Physiology and Medicine, pub Lea & Febiger
Turner: Rocket and Spacecraft Propulsion, pub. Praxis

Pre-requisites

PH508

Synopsis *

Flight Operations: Control of spacecraft from the ground, including aspects of telecommunications theory.

Propulsion and attitude control: Physics of combustion in rockets, review of classical mechanics of rotation and its application to spacecraft attitude determination and control.

Impact Damage: The mechanisms by which space vehicles are damaged by high speed impact will be discussed along with protection strategies.

Human spaceflight: A review of human spaceflight programs (past and present). Life-support systems. An introduction to some major topics in space medicine; acceleration, pressurisation, radiation, etc.

International Space Station: Status of this project/mission will be covered.

PH712 Cosmology and Interstellar Medium

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
4	Canterbury	Spring	M	15 (7.5)	70% Exam, 30% Coursework	Froebrich Dr D

Availability

This is not available as a wild module.

Contact Hours

Lectures and class tests (30 hours).
Total study time 150 hrs (including private study time).

Learning Outcomes

Knowledge and understanding of aspects of the theory and practice of astronomy, astrophysics and space science, and of those aspects upon which astronomy, astrophysics and space science depends.
A systematic understanding of most fundamental laws and principles of physics and of astronomy, astrophysics and space science, along with their application – some of which are at (or are informed by) the forefront of the discipline. An ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions.
An ability to solve problems in physics using appropriate mathematical tools.
An ability to use mathematical techniques and analysis to model physical behaviour.
An ability to comment critically on how spacecraft are designed, their principles of operation, and their use to access and explore space, and on how telescopes (operating at various wavelengths) are designed, their principles of operation, and their use in astronomy and astrophysics research.
An ability to solve advanced problems in physics using appropriate mathematical tools, to translate problems into mathematical statements and apply their knowledge to obtain order of magnitude or more precise solutions as appropriate.
An ability to interpret mathematical descriptions of physical phenomena.
A working knowledge of a variety of experimental, mathematical and/or computational techniques applicable to current research within physics.
An enhanced ability to work within in the astronomy, astrophysics and space science areas that is well matched to the frontiers of knowledge, the science drivers that underpin government funded research and the commercial activity that provides hardware or software solutions to challenging scientific problems in these fields.
An ability to present and interpret information graphically.
An ability to make use of appropriate texts, research-based materials or other learning resources as part of managing their own learning.
An ability to make use of research articles and other primary sources.
Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems; an ability to formulate problems in precise terms and to identify key issues, and the confidence to try different approaches in order to make progress on challenging problems. Numeracy is subsumed within this area.
Analytical skills – associated with the need to pay attention to detail and to develop an ability to manipulate precise and intricate ideas, to construct logical arguments and to use technical language correctly.

Method of Assessment

Coursework 30%, including class tests;
Final exam 70%.

Preliminary Reading

Dyson & Williams, The Physics of the Interstellar Medium, IOP Publishing ISBN 0 7503 0460 X
Peacock, Cosmological Physics, CUP, ISBN 0 521 42270 1
Rowan-Robinson, Cosmology, OUP, ISBN 0198518587
Bowers & Deeming Astrophysics vol. 2 ISBN 0867200189
Carroll, Press & Turner, 1992, Annual Reviews of Astronomy and Astrophysics, 30, 499-542

Pre-requisites

PH503, PH507, PH607

Synopsis *

SYLLABUS:
Interstellar Medium
The major properties of the Interstellar Medium (ISM) are described. The course will discuss the characteristics of the gaseous and dust components of the ISM, including their distributions throughout the Galaxy, physical and chemical properties, and their influence the star formation process. The excitation of this interstellar material will be examined for the various physical processes which occur in the ISM, including radiative, collisional and shock excitation. The way in which the interstellar material can collapse under the effects of self-gravity to form stars, and their subsequent interaction with the remaining material will be examined. Finally the end stages of stellar evolution will be studied to understand how planetary nebulae and supernova remnants interact with the surrounding ISM.

Extragalactic astrophysics
Review of FRW metric; source counts; cosmological distance ladder; standard candles/rods.
High-z galaxies: fundamental plane; Tully-Fisher; low surface brightness galaxies; luminosity functions and high-z evolution; the Cosmic Star Formation History
Galaxy clusters: the Butcher-Oemler effect; the morphology-density relation; the SZ effect
AGN and black holes: Beaming and superluminal motion; Unified schemes; Black hole demographics; high-z galaxy and quasar absorption and emission lines;

PH722 Particle and Quantum Physics

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Autumn	M	15 (7.5)	70% Exam, 30% Coursework	Strange Prof P

Availability

This is not available as a wild module.

Contact Hours

28 hours of lectures.

This module is expected to occupy 150 total study hours.

Learning Outcomes

Ability to identify relevant physical principles, make mathematical descriptions or approximations and solve problems using a mathematical approach.
Familiarity with how particle physics experiments work.
Ability to discuss particle physics in the language of particles and fields.
An understanding of the formalism of quantum mechanics and the ability to cast physical problems into it.

Enhancement of problem solving abilities, particularly mathematical approaches to problem solving.
To use appropriate sources as part of directed self-learning.
Enhancement of the ability to interpret theory.
An improved ability to manipulate precise and complex ideas and to construct logical arguments.

Method of Assessment

70% final examination; 30% coursework, including class tests.

Preliminary Reading

B. R. Martin, Nuclear and Particle Physics, Wiley, (2006).

M Thomson, Modern Particle Physics, Cambridge (2013)
A Bettini, Introduction to Elementary Particle Physics (QC794.6.575)
S McMurry, Quantum Mechanics, Prentice-Hall (1993)

F Mandl, Quantum Mechanics, Wiley (1992)

Pre-requisites

PH502, PH503

Synopsis *

• Approximation Methods, perturbation theory, variational methods.
• Classical/Quantum Mechanics, measurement and the correspondence principle.
• Uncertainty Principle and Spin precession .
• Key Experiments in Modern Quantum Mechanics (Aharonov-Bohm, neutron diffractyion in a gravitational field, EPR paradox).
• Experimental methods in Particle Physics (Accelerators, targets and colliders, particle interactions with matter, detectors, the LHC).
• Feynman Diagrams, particle exchange, leptons, hadrons and quarks.
• Symmetries and Conservation Laws.
• Hadron flavours, isospin, strangeness and the quark model.
• Weak Interactions, W and Z bosons.

PH751 Research Review

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	15 (7.5)	100% Coursework	Smith Prof M (PS)

Contact Hours

This module is essentially self-taught; there is no curriculum. The students will be assigned a tutor for the module who can advise them on the subject, direct them to the relevant literature and advise them on the subject as and when required. They are expected to spend a total of 150 hours on this module.

In order to write the review, a student is expected to read a minimum of 4-6 journal and review papers. The student is required to present a dissertation based on the contents of these papers.

Milestone 1: Students provide a list of potential supervisors/themes by end of Week 6. This is deliberately Week 6 since students may not be familiar with Kent research areas.

Milestone 2: By Week 8 students should be provided with the list of seminal papers to provide the fundaments for their review.

Milestone 3: Students arrange a brief discussion with their appointed tutors in Week 11.

Week 14: Students meet with Convenor for a feedback session.

Week 18: Students email Tutor and Convenor with a half-complete draft for approval and feedback.

Learning Outcomes

An appreciation of the "state of the art" in a chosen focused area of Physics.

An ability to explain complex physical arguments to an audience of experts.

An ability to make a critical analysis of specialist literature.

An understanding at the frontier of knowledge in a subject.

An ability to make a critical analysis of published scientific literature.

Enhancement of the ability to interpret theory.

An ability to present information graphically and textually at an advanced intellectual level.

An ability to explain complex physical arguments to a scientifically literate, but non-specialist audience.

An ability to produce a substantial piece of independent work.

Method of Assessment

Coursework 100%. 80% Review Article, 20% oral presentation. All learning outcomes are tested in the review article itself, while the ability to communicate to a scientifically literate, but non-specialist audience is also tested orally in the presentation.

Preliminary Reading

None; appropriate background reading will be suggested by individual project supervisors

Pre-requisites

None.

Synopsis *

In consultation with a member of staff the student will choose a topic within any branch of physics for which appropriate supervision is available and write an article on that topic that would be suitable for publication in the scientific literature as a review article.

PH752 Magnetism and Superconductivity

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	15 (7.5)	70% Exam, 30% Coursework	Quintanilla Dr J

Availability

This is not available as a wild module.

Contact Hours

28 hours of lectures. Voluntary examples/revision classes will also be provided.

Learning Outcomes

An understanding of the underlying physics of magnets and superconductors.
An appreciation of the rich variety of physics dependent correlated electrons.
An ability to solve problems in the science of magnetism and superconductivity.
An appreciation of the role of magnets and superconductors in devices and industry.
Enhancement of problem solving abilities, particularly mathematical approaches to problem solving.
To use appropriate sources as part of directed self-learning.
Enhancement of the ability to interpret theory.
A deeper appreciation of the connection of the role played by fundamental science in society generally.

Method of Assessment

70% final examination, 30% coursework including class tests.

Preliminary Reading

Core texts:
S. Blundell; Magnetism in Condensed Matter, Oxford University Press (2001)
J.F. Annett; Superconductivity, Superfluids and Condensates, Oxford University Press (2004)
Additional reading:
S. Elliot: The Physics and Chemistry of Solids (1998)
D.C. Mattis The theory of magnetism made simple (2004)
Tilley and Tilley; Superfluidity and Superconductivity, (1990)

Pre-requisites

PH606

Synopsis *

Introduction, electrons in solids
Superconductivity: Introduction to properties of superconductors, Thermodynamics and electrodynamics of superconductors, Type I and Type II superconductors, the flux lattice
Superconducting phase transitions
Microscopic superconductivity, correlations lengths, isotope effect, Cooper pairs, Froehlich Interaction, BCS theory.
High Tc superconductors, superfluids, liquid helium.
Magnetism, magnetometry and measuring techniques
Localised and itinerant magnetic moments, spin and orbital moments, magnetic moments in solids
Paramagnetism
Exchange interactions, direct, indirect and superexchange, Magnetic structures, ferro, ferri, antiferromagnetism
Neutron and x-ray scattering
Spin waves, magnons
Magnetic phase transitions
See also http://blogs.kent.ac.uk/strongcorrelations/teaching/superconductivity-and-magnetism

PH754 Euromasters Project

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	120 (60)	100% Project	Smith Prof M (PS)

Contact Hours

Five days per week for 24 weeks. Contact with supervisor as appropriate, collaboration with other members of the research group.

Learning Outcomes

Personal skills such as the ability to work independently and as part of a group, to use initiative, time management and the ability to meet deadlines.

The ability to perform research at the forefront of a research topic.

The ability to write a large scale report on research.

Method of Assessment

Coursework 100%.

The dissertation required at the end of the project and the interim report after two months have the objectives of encouraging students to write clearly and express their understanding of their work in appropriate formal ways. The presentations during the final conference and after two months are designed to develop comparable oral and public speaking skills.

The quality of the work undertaken as represented in the project report and the oral presentation will contribute towards the final mark with approximate weightings of 80% and 20%.

At the end of Year 2, students will submit a dissertation of circa 100 pages and make a second presentation to a conference of Euromasters students, including the next cohort, supervisors and others who may be interested in learning about the work.

Preliminary Reading

None; appropriate background reading will be suggested by individual project supervisors

Pre-requisites

Progression from Stage 1 of the Euromasters programme.

Restrictions

School of Physical Sciences Procedures for Projects Involving Human Participation: It is a University requirement that any final year undergraduate, postgraduate or staff research project involving human participation should be subject to a procedure to determine whether ethics approval is needed. The procedures employed within the SPS are described below. Undergraduate Projects, PH600, PH603, PS620, PS720, PS740, CH620 and PH700 Each project proposal collected from academics will include an answer to the question “Does the project involve human participation?”. It is the responsibility of convenors to ask supervisors to check the Yes or No box. If Yes is ticked, please see below: The following text will be introduced into the information pack or the handbooks of the module: “Before you commence any work, it is important that the ethics of that work be considered; for example, taking fingerprints, or collecting images of faces of your colleagues, etc.. Your supervisor will discuss any ethics issues with you and you should keep a copy of the documentation." For projects involving human participants other than those conducting the project itself, students and their supervisors are required to read, note and act upon the guidelines available at http://www.kent.ac.uk/stms/faculty-office/adminprocedures/research-ethics/handbook.html to obtain approval from the Sciences Research Ethics (Human Participation) Advisory Group.” Taken from a document by Adrian Podoleanu, SPS’ representative on the above ethics Group, October, 2012.

Synopsis *

• A student, supervisor and project will be brought together consensually and a one year research project will be performed within one of the SPS research groups. This will be completely equivalent to a current research masters degree.

PH800 Biomedical Optics

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	15 (7.5)	70% Exam, 30% Coursework	Podoleanu Prof A

PS700		Physical Science Research Investigation				
Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
3	Canterbury	Whole Year	M	15 (7.5)	100% Project	Smith Prof M (PS)

Availability

This is not available as a wild module.

Contact Hours

10 hours of lectures, 4 hours of tutorial/workshop sessions with the convenor or with specialist supervisors, and an extended written exercise.

Learning Outcomes

Engagement and familiarity with recent and current research methods, results and publications.
<ii> An ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions.
<ii> An ability to execute and analyse critically the results of an experiment or investigation and draw valid conclusions. To evaluate the level of uncertainty in these results and compare them with expected outcomes, theoretical predictions or with published data; thereby to evaluate the significance of their results in this context
 Confidence in their ability to interpret complex technical information and to communicate it in a wide variety of professional situations.
 Self-direction and originality in applying and adapting problem-solving skills to unfamiliar, complex and open-ended situations.
 The independent learning ability required for continuing professional development.
 To establish advanced research skills needed at a postgraduate level or graduate level in other sectors.
 The capacity to undertake advanced scientific investigations, advanced problem solving and data analysis in a research environment.
 Ability to communicate scientific ideas through presentations and written reports.
 To gain knowledge of how postgraduate research is structured and funded.
 Time management and forward planning skills.

Method of Assessment

100% coursework. The coursework assesses students' familiarity with and ability to implement current research methods.

Preliminary Reading

 http://www.epsrc.ac.uk/
 http://www.scitech.ac.uk
On writing proposals:
 https://www.epsrc.ac.uk/funding/howtoapply/preparing
Peer Review:
 http://www.rin.ac.uk/our-work/communicating-and-disseminating-research/peer-review-guide-researchers
GUIDES FOR WRITING A FUNDING PROPOSAL
 http://www.learnerassociates.net/proposal/
 http://www.learnerassociates.net/proposal/

Pre-requisites

None.

Synopsis *

Aims:
<ii> Students will develop a number of skills related to the Investigation and planning of research. Students will learn how to search and retrieve information from a variety of locations (databases, websites, journals, proceedings etc). They will learn how to compile professionally-produced documents such as the report of their own investigation in a direction of their choice. In addition, students will subsequently provide an outline proposal for funding for future research activity.

Through two Colloquium Reports, students will learn to write high-impact articles with a critical analysis of research presented by others. They will exercise presentation skills and present critical reviews and referee's reports of the research of others.

SYLLABUS:
The Research Project (60%)
Identification of a research area and the issues to tackle
Investigation of an unresolved issue comparing experiments and models, comparing approaches, assumptions and statistical methods.
Production of a dissertation
Proposal for future novel work as a short Case for Support for a PhD or research outside university environment
Project Management: Scheduling research programmes, Gantt, PERT charts.
Project Management: Costing of research, full economic cost, direct and indirect costs.
Poster presentation of the research

Research Review and Evaluation (40%)
Evaluation of Research: Colloquium attendance/viewing.
Science Communication: Preparation of two colloquium reports as a science magazine article with impact
Referee report on the colloquiums: strengths, weaknesses of both the speaker and the research quality.

Details of the work to be done will be announced by the convenor during the first two weeks of the academic year.

PS701 Topics in Functional Materials

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	15 (7.5)	80% Exam, 20% Coursework	

Availability

This is not available as a wild module.

Contact Hours

28 hours of lectures, 3 hours of examples classes.

Learning Outcomes

A systematic understanding and a critical awareness of current topics of interest in materials research.
A comprehensive understanding of techniques applicable for synthesis and purification of materials.
A comprehensive understanding of techniques applicable for chemical and physical characterisation methods of materials.
A critical awareness of the applications of materials in industry.
A systematic understanding of knowledge relating to materials.
An ability to apply the knowledge to solve problems in materials.
An understanding of the fundamental phenomena of the electronic structure of materials.
An appreciation of the key driving forces in nanoscience and knowledge of selected important nanomaterials and phenomena at the forefront of the discipline.
Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems, extending to situations where evaluations have to be made on the basis of limited information.

Method of Assessment

Examination: 80%; Coursework: 20%.

Preliminary Reading

• Wright, Molecular Crystals, Cambridge University Press, 1995, [QD921].
• Solid state chemistry and its applications - Anthony West, Anthony R. West 2014
• Smart and Moore, Introduction to Solid State Chemistry, Chapman & Hall, 1992, [QD454].
• Agullo-Lopez, Catlow and Townsend, Point Defects in Materials, Academic, 1988, [QC 176.8.D3].
• A. P. Sutton, "The electronic structure of materials", Oxford University Press ISBN: 0198517548
• Interrante and Hamden-Smith, "Chemistry of Advanced Materials" Wiley, 1998 [TA403]
• Philibert "Atom Movements", Editions de Physique, 1991 [QC176]
• Dieter Vollath "Nanomaterials: An Introduction to Synthesis, Properties and Applications"
• Supplemented by up-to-date research literature from "Web of Science" and lecturers' own research publications in peer-reviewed journals.

Pre-requisites

None.

Synopsis *

Chemists and physicists are now playing an important role in the growing field of materials research. More recently there has been a growing interest, driven by technological needs, in materials with specific functions and this requires a combination of physics and chemistry. For example, new materials are needed for the energy industry (batteries and fuel cells), for the optics and electronics industry (semiconductors, lasers and wave-guides), and for the environment (sensors, actuators and 'smart' materials). The aim of this module is to introduce students to this area of modern materials and techniques.

Examples of the topics that might typically be covered are:
1. Crystal growth and defects.
2. Liquid crystals.
3. Magnetism and Magnetic Materials.
4. X-ray absorption spectroscopy (XAS).
5. Nanomaterials.
6. Multiferroics.

PS702 Contemporary and Advanced Issues in Forensic Science

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	15 (7.5)	70% Exam, 30% Coursework	Shepherd Dr C
2	Canterbury	Whole Year	M	15 (7.5)	70% Project, 30% Coursework	Shepherd Dr C

Availability

This is not available as a wild module.

Contact Hours

Tutorials, 18 hours.

Learning Outcomes

A deep specialist knowledge and experience of techniques within particular areas of forensic science.
Engagement and familiarity with recent and current research methods, results and publications.
A clear recognition of the constraints and opportunities of the environment in which professional forensic science is carried out.
A familiarity with the moral and ethical issues involved in the practice of forensic science.
Confidence in their ability to interpret complex technical information and to communicate it in a wide variety of professional situations.
A deep appreciation of the need and application of quality standards supporting the delivery of forensic science.
Self-direction and originality in applying and adapting problem-solving skills to unfamiliar, complex and open-ended situations.
The independent learning ability required for continuing professional development.

Method of Assessment

Presentation (30 mins including questions), 30%;
Dissertation (5,000 words), 70%.

Preliminary Reading

The Templeman Library has extensive holdings of recently published texts and journals relevant to this module.
Examples include:
Gill.P Misleading DNA Evidence, Reasons For Miscarriages Of Justice, 2014
Gunn. A Essential Forensic Biology,2009
Ubelaker, D.H.. Forensic Science: Current Issues, Future Directions. 2013
Heard, B.J. Forensic Ballistics in Court: Interpretation and Presentation of Firearms Evidence. Oxford: Wiley-Blackwell, 2013.
Kintz, P., & Kintz, P. Toxicological aspects of drug-facilitated crimes.2014
Stuart, B. Forensic Analytical Techniques. 2013
Lentini, J.J. Scientific Protocols for Fire Investigation. Second edition. Boca Raton, Fla.: CRC Press, 2013.
Carlin, M, and Dean J.R. Forensic Applications of Gas Chromatography. 2013
Journal of Forensic Sciences [0022-1198]
Forensic Science International [0379-0738]
Journal of the Forensic Science Society [0015-7368]

Pre-requisites

None.

Synopsis *

This module enables students from a variety of backgrounds (e.g. graduates in Forensic Science, Chemistry, Biochemistry, Forensic Biology etc.) to develop their expertise within selected areas of forensic science. Areas for development (e.g. crime scene analysis, ballistics, drug analysis, face recognition, DNA, etc.) will be identified during an initial meeting of the module convenor with each student.
Students will then be assigned a supervisor in the appropriate area who will guide them towards appropriate learning resources such as lecture and practical materials within the School's portfolio of modules, textbooks and research journals, as well as providing tutorial guidance throughout the module. Guidance will be also given in preparing the dissertation and the presentation. Students will be expected to present verbally, and in writing, the background and advances (focussing on the last ten years) in their selected area of expertise.

PS704 Major Incident Management

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	15 (7.5)	100% Coursework	Green Mr R(PS)
2	Canterbury	Whole Year	M	15 (7.5)	60% Exam, 40% Coursework	Green Mr R(PS)

Availability

This is not available as a wild module.

Contact Hours

24 Lectures.
Table top major incident planning exercise.

Learning Outcomes

Understand the processes involved with emergency management.
Imparting an understanding of how major incidents are managed at local, national, and international levels.
Management of finite resources in order to achieve set goals.
Understand evidential prioritisation in relation to major incidents
Develop the ability to manage logistics simulated incidents.
Understand the reporting requirements associated with major incidents.
Management resources and personnel under strict time pressure.
Problem solving in real time incidents and simulated exercises.
Ability to gather information and data from numerous sources and to use such information to synthesis a response to highly fluid incident.
Ability to interact with personnel in order to extract accurate information and to take command of a major incident.
Ability to gather data from numerous sources and to critically evaluate that data in light of current practice and legislation.

Method of Assessment

Critical evaluation of a historic case study: 60%;
Table top major incident exercise: 40%.
Real time and time limited management of simulated major incident using resource maps which reflect actual emergency service deployment.

Preliminary Reading

Introduction to Emergency Management, Haddow. 2008. ISBN: 978-0-7506-8514-6
Aircraft Safety, Kraues. 2003 ISBN: 0-07-140974-2
Maritime Safety: The Human Factors. Trafford. 2009. Book Guild Publishing ISBN-13: 978-1846243790
Homeland Security in the UK: Future Preparedness for Terrorist Attack since 9/11: Wilkinson.2007 ISBN-13: 978-0415383752
Blackstone's Counter-Terrorism Handbook: Stainforth. 2010 OUP: ISBN-13: 978-0199597109
Derail: Why Trains Crash. Faith: 2000. Channel 4 Publishing: ISBN-13: 978-0752271651

Pre-requisites

None.

Synopsis *

The module will cover incident management from a tactical/regional and national/ strategic perspective using the four stage model: Identification, preparation, mitigation, and recovery.
A range of actual and potential incidents will be covered including air accident, marine accident, rail and road incident, terrorist attacks, and industrial and chemical incidents.
This will be achieved using lectures, critical evaluation of case studies, and real time simulated incident exercises.
Students will be required to examine all aspects of scene and major incident management, disaster planning and related legislation.
This will encompass emergency management and planning legislation, damage limitation, evacuation plans, logistical support, inter-agency operation and cooperation, and personnel management.

PS713 Substances of Abuse

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	15 (7.5)	70% Exam, 30% Coursework	Biagini Dr S

Availability

This is not available as a wild module.

Contact Hours

Approximately 16 hours will be spent on timetabled lectures, 8h spent on timetabled student presentations.

Learning Outcomes

To acquire a knowledge and understanding of the theoretical chemistry and the principles of analysis and identification of several chemicals that are related to substances of abuse.
Display an ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to the subject areas identified in the syllabus.
Display an ability to apply such knowledge to qualitative and quantitative problem solving in the relevant subject area.
Display an ability to communicate complex scientific topic in the form of an audio-visual presentation.

Method of Assessment

Examination: 70%, Coursework: 30%.

Preliminary Reading

Clarke's Analytical Forensic Toxicology, Pharmaceutical Press;1 edition (30 Jun 2008)
ISBN-10: 0853697051; ISBN-13: 978-0853697053.

Michael D. Cole; The Analysis of Controlled Substances: A Systematic Approach. Cole2003.
ISBN 0-471-49253-1.

Coleman, Michael D., Human Drug Metabolism: an introduction, 2010. ISBN: 13-9780470742167

Perrine, Daniel M., The Chemistry of Mind-Altering Drugs: History, Pharmacology and Cultural Context, 1996. ISBN: 13-9780841232532

Stevens, A., Drugs, Crime and Public Health: the political economy of drug policy, 2011. ISBN: 13-9780203844168

Pre-requisites

CH314

Synopsis *

Elements of synthetic organic chemistry and medicinal chemistry which are relevant to substances of abuse.
The theoretical chemistry and principles of analysis and identification of several substances that are substances of abuse. The following are indicative:
o amphetamines and related compounds
o LSD and related compounds
o Cannabis and Cannabis products
o opiate compounds
o cocaine and related compounds
o certain controlled pharmaceutical drugs.

PS717 Modern Approaches to Incident Management

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
3	Canterbury	Whole Year	M	30 (15)	100% Coursework	Barker Dr R

Availability

This is not available as a wild module.

Contact Hours

 24 hours of lectures
• Table top major incident planning exercise
• Critical case evaluation and report
• Live Incident briefing, preparation, and execution
• Court report preparation and presentation

Learning Outcomes

Understand the processes involved with emergency management.
Imparting an understanding of how major incidents are managed at local, national, and international levels.
Develop skills in managing major incidents from a forensic perspective at local and national levels.
Management of finite resources in order to achieve set goals.
Understand evidential prioritisation in relation to major incidents
Develop the ability to manage personnel in live incidents.
Develop the ability to manage logistics in live and simulated incidents.
Management of evidence recovery, storage and analysis.
Understand the reporting requirements associated with major incidents.
Develop skills in the writing of such reports as evidential submissions.
Understand the challenges associated with presenting such reports at court under hostile cross examination.
Management of time, resources, and personnel.
Problem solving in real time incidents and in simulated exercises.
Ability to gather information and data from numerous sources and to use such information to synthesis a response to highly fluid forensic investigations.
Ability to interact with personnel in order to extract accurate information and to take command of a major incident.
Presentation skills to professional level.

Method of Assessment

Critical evaluation of a historic case study: 35%
Tabletop major incident planning exercise: 15%
Monitored real time management of a limited incident: 15%
Preparation of incident management report: 20%
Tribunal presentation of incident management report: 15%

Preliminary Reading

Core text: Introduction to Emergency Management, Haddow. 2008. ISBN: 978-0-7506-8514-6

Recommended reading:
Aircraft Safety, Kraues. 2003 ISBN: 0-07-140974-2
Maritime Safety: The Human Factors. Trafford. 2009. Book Guild Publishing ISBN-13: 978-1846243790
Homeland Security in the UK: Future Preparedness for Terrorist Attack since 9/11: Wilkinson.2007 ISBN-13: 978-0415383752
Blackstone's Counter-Terrorism Handbook: Stainforth. 2010 OUP: ISBN-13: 978- 0199597109
Derail: Why Trains Crash. Faith: 2000. Channel 4 Publishing: ISBN-13: 978-0752271651
Air Accident Investigation. Owen. 2001. ISBN: 1 85206 607 X
The Terrorism Reader: 4th Edition. Whittaker. 2012. ISBN. 978 0 415 68731 7

Pre-requisites

None.

Synopsis *

The module will cover incident management from a tactical/regional and national/strategic perspective using the four stage model: Identification, preparation, mitigation, and recovery.
A range of actual and potential incidents will be covered including air accidents, marine accidents, rail accidents, terrorist attacks, and industrial, nuclear and chemical incidents.
This will be achieved using lectures, critical evaluation of case studies, real time and simulated incident exercises using our new crime scene house and garden, and the preparation and presentation at court of incident command reports.
Students will be required to examine all aspects of scene and major incident management, disaster planning and related legislation. This will encompass emergency management and planning legislation, damage limitation, evacuation plans, logistical support, inter-agency operation and cooperation, personnel management, evidence prioritisation, preparing incident reports, and presenting such reports at court.

PS740 Forensic Science Research Project MSCI

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Whole Year	M	60 (30)	100% Project	Arnold Dr D

Availability

This is not available as a wild module.

Contact Hours

Minimum of 2 days per week for 22 weeks.
This module is expected to occupy 600 total study hours including the contact hours above.

Learning Outcomes

• To build on the research independence gained in year 3 as part of PS720 (Advanced Forensic Science Laboratory).
• To establish advanced research skills at M level.
• The capacity to undertake advanced scientific investigations, advanced problem solving and data analysis in a research environment.
• Ability to communicate scientific ideas through presentations and written reports.
• In conjunction with PS700 (Physical Science Research Planning) to gain knowledge of how research is structured and funded.
• Time management and forward planning skills

Method of Assessment

100% coursework, this can be broken down into the following;
 Project report (50%) - this report will include a detailed account, analysis and interpretation of the experiments conducted in the laboratory including a detailed literature review.
 Oral presentation (20%) - this presentation will be aimed at communicating the aims and motivations of the research conducted as well as presenting background information, key results and conclusions.
 Supervisor mark (20%) - this will allow the supervisor to assess the students' progress and competency within the laboratory.
 Progress report (10%) - the progress report will allow for the assessment of the project about half way through and allow for the student to assess their own progress in relation to their objectives as well as assess what is required moving forward.

Preliminary Reading

Appropriate learned journals and texts as set by project supervisor and sourced by student

Pre-requisites

Completion of Stage 3 Forensic Science to a prescribed threshold (50% average mark with no credits to be awarded by compensation).

Restrictions

School of Physical Sciences
Procedures for Projects Involving Human Participation

It is a University requirement that any final year project undergraduate, postgraduate or staff research project involving human participants should be subject to a procedure to determine whether ethics approval is needed. The procedure employed by SPS and the Faculty of Science are described here:
http://www.kent.ac.uk/stms/faculty/adminprocedures/research-ethics/index.html

Undergraduate projects PH600, PH603, PS620, CH620, PS720, PS740 and PH700
Each project proposal collected from academics will include an ethics approval checklist designed to determine if ethical approval is required from the faculty i.e. does the project involve human participants. It is the responsibility of convenors to ask supervisors to fill in these checklists with students. If the answer to any of the questions on the checklist is yes please see below;

The following text will be introduced into the information pack or the handbooks of the module:

“Before you commence any work, it is important that the ethics of that work be considered; for example, taking fingerprints or collecting images of faces of your colleagues etc. Your supervisor will discuss any ethics issues with you and you should keep a copy of the documentation”

For projects involving human participants other than those conducting the project itself, students and their supervisors are required to read, note and act upon the guidelines available at
http://www.kent.ac.uk/stms/faculty/adminprocedures/research-ethics/index.html to obtain approval from the Sciences Research Ethics (Human Participation) Advisory Group.

Further information on Ethics can be obtained from Dr Donna Arnold, SPS representative on the Sciences Research Ethics Advisory Group.

Synopsis *

Students will undertake a project from an available project listing and will work under the guidance of a supervisor. The student will be encouraged to develop some level of research independence within the project remit appropriate of an M-level masters' student. The project will be assessed on a number of criteria which will include the project work (the amount, quality etc appropriate for the level), effort put in by the student, the preparation of a written report and an oral presentation session. The student's progress will be assessed at the end of the first term through some form of progress report. This will also involve some degree of forward planning such that the students assess their own project requirements for the following term allowing the student to learn time management and forward planning skills.

Aims:
• To conduct individual masters level research.
• To develop research independence such that the student can take responsibility for the research direction of the project within the confines of the project remit.
• To further deepen the student's knowledge within a specific research area.
• To prepare students for independent research careers in industry or at PhD level.
• To further enhance student's abilities for scientific communication through oral presentations and report writing.
• Time management and forward planning skills

PS780 MSC Research Project

Version	Campus	Term(s)	Level	Credit (ECTS)	Assessment	Convenor
2	Canterbury	Spring	M	60 (30)	100% Project	Barker Dr R

Contact Hours

Supervisor meetings 7 hours (~1 hour every 2 weeks)
Laboratory work 252 hours (14 week x 3 days/week)
Presentation 2 hours

This module is expected to occupy 600 total study hours including the contact hours.

Learning Outcomes

To build on the research independence gained in PS720 (Advanced Forensic Science Laboratory) which is taken in the Autumn and Spring terms.

To establish advanced research skills at postgraduate level.

The capacity to undertake advanced scientific investigations, advanced problem solving and data analysis in a research environment.

Ability to communicate scientific ideas through presentations and written reports.

Time management and forward planning skills.

Method of Assessment

This module is assessed by 100% coursework. Progress Report (10%), Presentation (20%), Supervisors mark (20%), Dissertation (50%)

Preliminary Reading

The Templeman Library has extensive holdings of recently published texts and journals relevant to this module.

Examples include:
Journal of Forensic Sciences [0022-1198]

Forensic Science International [0379-0738]

Journal of the Forensic Science Society [0015-7368]

Pre-requisites

Successful completion of Stage 1 of Forensic Science MSc-T

Synopsis *

Students will undertake a project from an available project listing and will work under the guidance of a supervisor. The student will be encouraged to develop some level of research independence within the project remit appropriate of a postgraduate master's student.

The project will be assessed on a number of criteria which will include the project work (the amount, quality etc appropriate for the level), effort put in by the student, the preparation of a written report and an oral presentation session. The student's progress will be assessed mid way through the research project through some form of progress report. This will also involve some degree of forward planning such that the students assess their own project requirements for the following term allowing the student to learn time management and forward planning skills.