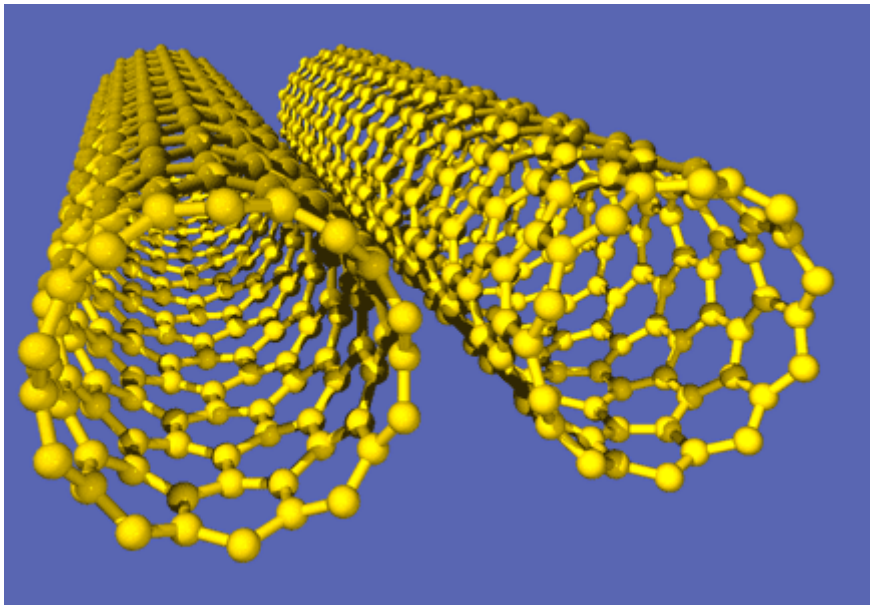
UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Physics and Chemistry of Advanced Materials



Sophister Programme

The Physics and Chemistry of Advanced Materials

http://www.tcd.ie/Chemistry/nanoscience/*

Course Director: Dr Cormac McGuinness (Physics)
cormac.mcguinness@tcd.ie

New Materials, from stone to steel to silicon, have always had a key role to play in the progress of civilization. Our lives today are being rapidly transformed by developments like optical communication which is based on the perfection of glass fibre. What distinguishes the modern investigation of materials is that it is firmly grounded in basic science. Complex instruments and sophisticated theories combine to provide fundamental insights into the microscopic properties of materials, which in turn makes it possible to design new materials for specific purposes and to generate new applications for these materials.

"The Physics and Chemistry of Advanced Materials" is a joint course taught by the Chemistry http://www.tcd.ie/Chemistry/) and Physics Departments (http://www.tcd.ie/Physics/).

PCAM is funded by the Irish government under the National Development Plan 2007-2013 and aided by the European Social Fund (ESF) under the Human Capital Investment Operational Programme 2007-2013

NDP
National Development Plan 2007 - 2013

Ireland's EU Structural Funds Programmes 2007 - 2013

Co-funded by the Irish Government and the European Union

The *Sami Nasr Institute for Advanced Materials* (above) provides 2500 m^2 of modern teaching space and 3500 m^2 of leading-edge materials research space within the one building.

* There is much detailed information about the course on the website.

Physics and Chemistry of Advanced Materials (TRO76)

Course Advisor: Dr. C. McGuinness
cormac.mcguinness@tcd.ie

Course WEB ADDRESS: http://www.tcd.ie/Advanced_Materials/

Physics and Chemistry of Advanced Materials is a moderatorship taught jointly by the Schools of Physics and Chemistry. Building on the foundation courses taken in the Freshman years, students follow in-depth courses across the spectrum of modern physics, chemistry and materials science.

JUNIOR SOPHISTERS

The JS year consists of lectures, tutorials and practical delivered in modules, as listed below. Students receive training in communication skills within the practical module.

MANDATORY MODULES:
All modules are mandatory

Assessment and Examination Procedures
Students will be advised of the examination in Hilary Term

JS marks contribute to 35% of the final degree.

SENIOR SOPHISTERS

The SS year consists of lectures, tutorials and practicals delivered in modules, as listed below. A major component of the practical module is an independent research project, which may be carried out at a facility off-campus. A component of problem solving completes this module

MANDATORY MODULES:
All modules are mandatory

Assessment and Examination Procedures
Students will be advised of the examination in Hilary Term. Modules in Physics and in Chemistry are examined according to the rules of the respective schools. A special paper on problem solving ability together with assessment of the research project contributes 25 ECTS in the ratio 30:70, respectively.

The final Moderatorship mark includes a JS carry-forward of 35%

JUNIOR SOPHISTER MODULES **60 ECTS**

PY3P01 Quantum Physics I **5 ECTS**
This module covers solution of the Schrödinger Equation in specific topics, such as angular momentum and the hydrogen atom.

PY3P02 Electromagnetic Interactions I **5 ECTS**
This module covers the fundamentals of electromagnetic theory together with quantum optics and lasers.

PY3P03 Condensed Matter I **5 ECTS**
This module introduces condensed matter concepts such as crystal structure and thermal and electronic properties of matter.

PY3P04 Condensed Matter II **5 ECTS**
This module extends the discussion of condensed matter into the key areas of magnetic properties and the physics of semiconductors.

CH3303 Quantum Mechanical Concepts in Physical Chemistry **5 ECTS**
This module deals with quantum mechanics, spectroscopy and group theory.

CH3304 Molecular Thermodynamics and Kinetics **5 ECTS**
This module deals with thermodynamics and statistical mechanics, electrochemistry and kinetics.

CH3104 Solid State Materials **5 ECTS**
This module covers topics such as inorganic polymers, structural inorganic chemistry, synthetic methodologies and characterisation techniques of solid state materials.

CH3403 Analytical Methods **5 ECTS**
This module deals with both the fundamental principles and application of spectroscopic and other characterisation techniques. Topics such as analytical chemistry, organic spectroscopy and structural methods in inorganic chemistry will be covered.

CH3085 Practical in Advanced Materials **20ECTS**
In this module students complete a number of advanced experiments in Physics, Chemistry and Materials Science, as well as exposure to the fundamental tools of modern nanoscience. Minor components include training in communication skills, personal and career development and attendance at School Seminars.

SENIOR SOPHISTER MODULES **60 ECTS**

PY4P03 Condensed Matter III **5 ECTS**
This module covers metal physics and superconductivity together with semiconductor devices.

PY4P04 Nanoscience **5 ECTS**
This module covers the modified properties of nanoscale matter, its fabrication and potential applications.

PY4P06 Photonics **5 ECTS**
This module covers optical properties of materials and nonlinear optics.

PY4M07 Advanced Topics in Physics – Advanced Materials **5 ECTS**
This module consists of specialist courses in polymer physics and thin films.

CH4107 Advanced Physical Chemistry II **5 ECTS**
This core module involves lectures in quantum chemistry and solid state chemistry. It encompasses units CH4007 and CH4009.

CH4601 Materials Chemistry 1 - [Previously CH4110] **5 ECTS**
This module involves courses in matter transfer and computational techniques. It encompasses units CH4022 and CH4063.

CH4602 Materials Chemistry 2 - [Previously CH4111] **5 ECTS**
This module involves courses in photochemistry and organic polymers. It encompasses units CH4064 and CH4061.

PY4MP1 Practical in Advanced Materials **25 ECTS**
This module combines a major research project with components of general problem solving in Physics and Chemistry and Materials Science and in critical analysis of current topics of research in materials science.

Students will be advised of the structure and rubric of examination papers in Hilary Term.

The External Examiner may require students to take a viva voce examination as part of the Moderatorship (Degree).

Henderson-Lloyd Prize in Advanced Materials: This prize is awarded annually to the SS student who has achieved the highest score in the Moderatorship Examinations. Professors Henderson and Lloyd were instrumental in setting up the Materials degree programme in Trinity College Dublin.

APPENDIX 1

COLLEGE REGULATION REGARDING PLAGIARISM – EXTRACT FROM THE COLLEGE CALENDAR

Plagiarism [Students are reminded to check the current College Calendar for changes in College Policy]

81 Plagiarism is interpreted by the University as the act of presenting the work of others as one's own work, without acknowledgement.
Plagiarism is considered as academically fraudulent, and an offence against University discipline. The University considers plagiarism to be a major offence, and subject to the disciplinary procedures of the University.

General regulations and information
H18 Calendar 2012-13

82 Plagiarism can arise from deliberate actions and also through careless thinking and/or methodology. The offence lies not in the attitude or intention of the perpetrator, but in the action and in its consequences.

Plagiarism can arise from actions such as:

(a) copying another student's work;
(b enlisting another person or persons to complete an assignment on the student's behalf;
(c) quoting directly, without acknowledgement, from books, articles or other sources, either in printed, recorded or electronic format;
(d) paraphrasing, without acknowledgement, the writings of other authors.

Examples *(c)* and *(d)* in particular can arise through careless thinking and/or methodology where students:

(i) fail to distinguish between their own ideas and those of others;
(ii) fail to take proper notes during preliminary research and therefore lose track of the sources from which the notes were drawn;
(iii) fail to distinguish between information which needs no acknowledgement because it is firmly in the public domain, and information which might be widely known, but which nevertheless requires some sort of acknowledgement;
(iv) come across a distinctive methodology or idea and fail to record its source.

All the above serve only as examples and are not exhaustive.

Students should submit work done in co-operation with other students only when it is done with the full knowledge and permission of the lecturer concerned. Without this, work submitted which is the product of collusion with other students may be considered to be plagiarism.

83 It is clearly understood that all members of the academic community use and build on the work of others. It is commonly accepted also, however, that we build on the work of others in an open and explicit manner, and with due acknowledgement. Many cases of plagiarism that arise could be avoided by following some simple guidelines:

(i) Any material used in a piece of work, of any form, that is not the original thought of the author should be fully referenced in the work and attributed to its source. The material should either be quoted directly or paraphrased.

Either way, an explicit citation of the work referred to should be provided, in the text, in a footnote, or both. Not to do so is to commit plagiarism.

(ii) When taking notes from any source it is very important to record the precise words or ideas that are being used and their precise sources.

(iii) While the Internet often offers a wider range of possibilities for researching particular themes, it also requires particular attention to be paid to the distinction between one's own work and the work of others. Particular care should be taken to keep track of the source of the electronic information obtained from the Internet or other electronic sources and ensure that it is explicitly and correctly acknowledged.

84 It is the responsibility of the author of any work to ensure that he/she does not commit plagiarism.

85 Students should ensure the integrity of their work by seeking advice from their lecturers, tutor or supervisor on avoiding plagiarism. All schools and departments should include, in their handbooks or other literature given to students, advice on the appropriate methodology for the kind of work that students will be expected to undertake.

86 If plagiarism as referred to in §81 above is suspected, in the first instance, the head of school will write to the student, and the student's tutor advising them of the concerns raised and inviting them to attend an informal meeting with the head of school, and the lecturer concerned, [The director of teaching and learning (undergraduate) may also attend the meeting as appropriate. As an alternative to their tutor, students may nominate a representative from the Students' Union to accompany them to the meeting.] in order to put their suspicions to the student and give the student the opportunity to respond. The student will be requested to respond in writing stating his/her agreement to attend such a meeting and confirming on which of the suggested dates and times it will be possible for the student to attend. If the student does not in this manner agree to attend such a meeting, the head of school may refer the case directly to the Junior Dean, who will interview the student and may implement the procedures as referred to under CONDUCT AND COLLEGE REGULATIONS §2.

87 If the head of school forms the view that plagiarism has taken place, he/she must decide if the offence can be dealt with under the summary procedure set out below. In order for this summary procedure to be followed, all parties attending the informal meeting as noted in §86 above must state their agreement in writing to the head of school. If the facts of the case are in dispute, or if the head of school feels that the penalties provided for under the summary procedure below are inappropriate given the circumstances of the case, he/she will refer the case directly to the Junior Dean, who will interview the student and may implement the procedures as referred to under CONDUCT AND COLLEGE REGULATIONS §2.

88 If the offence can be dealt with under the summary procedure, the head of school will recommend to the Senior Lecturer one of the following penalties: *(a)* that the piece of work in question receives a reduced mark, or a mark of zero; *or (b)* if satisfactory completion of the piece of work is deemed essential for the student to rise with his/her year or to proceed to the award of a degree, the student may be required to resubmit the work. However the

student may not receive more than the minimum pass mark applicable to the piece of work on satisfactory re-submission.

89 Provided that the appropriate procedure has been followed and all parties in §86 above are in agreement with the proposed penalty, the Senior Lecturer may approve the penalty and notify the Junior Dean accordingly. The Junior Dean may nevertheless implement the procedures as referred to under CONDUCT AND COLLEGE REGULATIONS §2.

APPENDIX 2

Physics and Chemistry of Advanced Materials Moderatorship Learning Outcomes

On successful completion of this programme students will be able to:

1. Articulate in written and oral form a foundation level of knowledge and understanding of Physics, Chemistry and Mathematics.
2. Apply key concepts in Physics and Chemistry and key concepts in the Physics and Chemistry of Materials.
3. Design, perform, and analyze the results obtained from, experiments in materials physics and chemistry, using modern physical and chemical experimental methodologies and instrumentation, with particular reference to materials.
4. Demonstrate skills in problem solving, critical thinking and analytical reasoning, and be able to effectively communicate the results of their work to chemists, physicists, material scientists and others, both verbally and in writing.
5. Use modern library searching and retrieval methods to obtain information pertinent to the identification and solution of problems in the physics and chemistry of materials, and the exploration of new research areas.
6. Work effectively and safely in a laboratory environment operating within the proper procedures and regulations for safe handling and use of chemicals and instruments.
7. Design and perform appropriate experiments to address materials physics and chemistry problems, and analyse the results.
8. Update their knowledge and to undertake further study with a high degree of autonomy.