

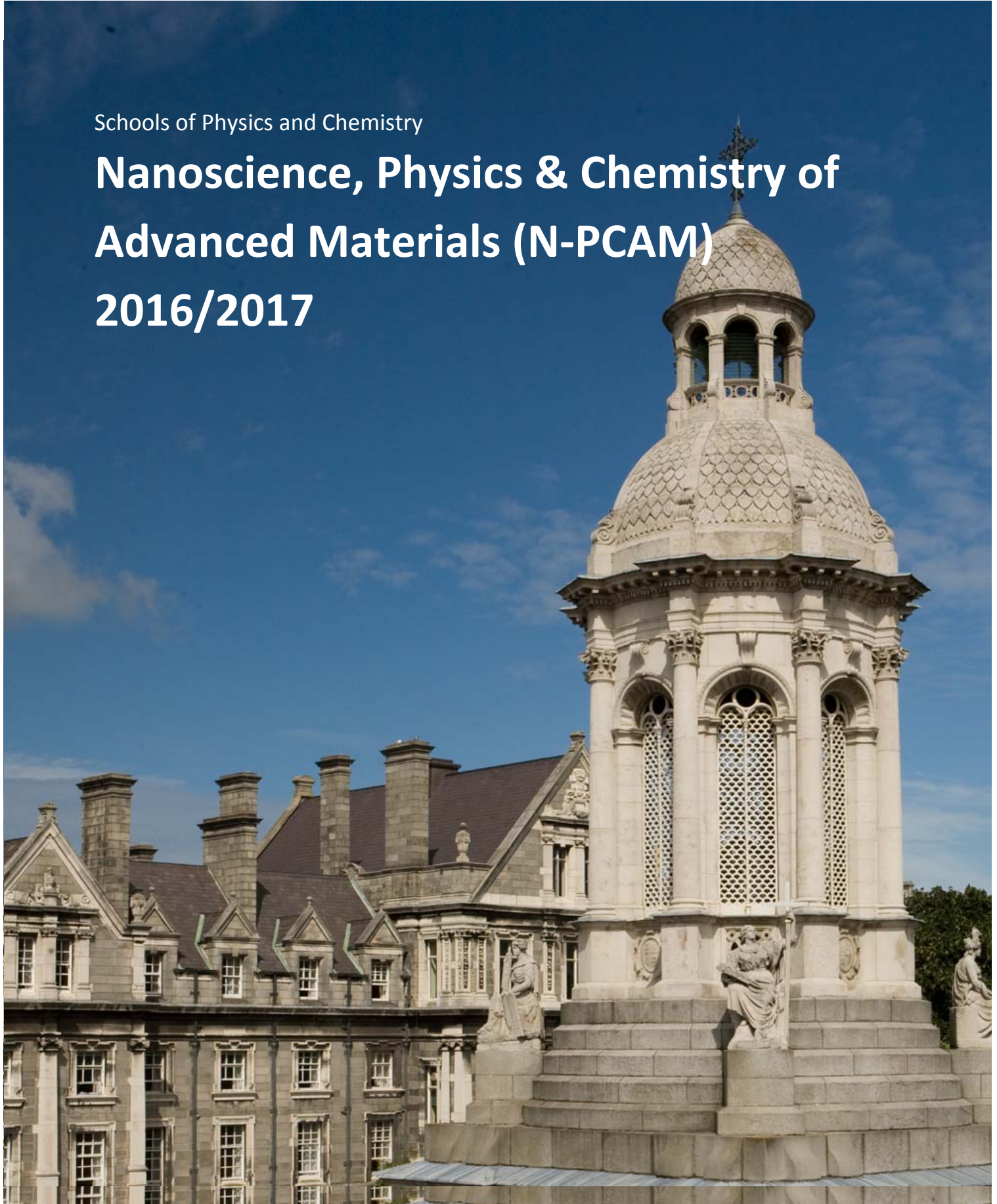


Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Schools of Physics and Chemistry

Nanoscience, Physics & Chemistry of Advanced Materials (N-PCAM)

2016/2017



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Nanoscience, Physics & Chemistry of Advanced Materials

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Nanoscience, Physics & Chemistry of Advanced Materials is a moderatorship taught jointly by the Schools of Physics and Chemistry. Administration of this course switches between Physics and Chemistry and is currently with the School of Chemistry (see contact details below). Building on the foundation courses taken in the Freshman years, students follow in-depth courses across the spectrum of modern physics, physical chemistry, materials science and nanoscience.

Learning Outcomes

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

- Articulate in written and oral form a foundation level of knowledge and understanding of Physics, Chemistry and Mathematics.
- Apply key concepts in Physics and Chemistry and key concepts in the Physics and Chemistry of Materials.
- Design and perform experiments in materials physics and chemistry, using modern physical and chemical experimental methodologies and instrumentation, with particular reference to materials, and analyse the results obtained from these experiments.
- 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.
- 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.
- Work effectively and safely in a laboratory environment operating within the proper procedures and regulations for safe handling and use of chemicals and instruments.
- Design and perform appropriate experiments to address materials physics and chemistry problems, and analyse the results.
- Update their knowledge and to undertake further study with a high degree of autonomy.

JUNIOR SOPHISTER

Junior Sophister:	The JS year consists of lectures, tutorials and practical work delivered in modules, as listed below. Students receive training in communication skills within the practical module.
Safety:	In order to reinforce and extend laboratory skills, rising Junior Sophister students are required to attend a day-long workshop on Chemical and Laboratory Safety to be held on 22 September 2016 . Attendance at this workshop is compulsory.
Mandatory Modules:	All modules specified below are mandatory.
Assessment & Examination Procedures:	The lecture material will be examined in examination papers taken during the Annual examination period. Examined modules are weighted according to their respective credit rating, giving a total of 45 credits. Note that for 2016/17 5 ECTS of what was a 20-ECTS lab module (CH3093) will be rolled in with the exam mark for CH3304, to give a 10-ECTS module. Communications skills and career development form part of the continuous-assessment module CH3093. A portion of the practical work will include some training in techniques used in materials science and nanoscience within the Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN).
JS marks contribute to 35% of the final degree Moderatorship mark	

JUNIOR SOPHISTER MODULES - 60 ECTS

Module Code & Name	Semester (S)	Description	ECTS
CH3104, Solid State Materials	S2	This module covers topics such as inorganic polymers, structural inorganic chemistry, synthetic methodologies and characterization techniques of solid state materials	5
CH3303, Quantum Mechanical Concepts in Physical Chemistry	S1	This module deals with quantum mechanics, spectroscopy and group theory	5
CH3304, Molecular Thermodynamics and Kinetics	S2	This module deals with thermodynamics and statistical mechanics, electrochemistry and kinetics	*10
CH3403, Analytical Methods	S1	This module deals with both the fundamental principles and application of spectroscopic and other characterization techniques. Topics such as analytical chemistry, organic spectroscopy and structural methods in inorganic chemistry will be covered	5
CH3093, Practical in Advanced Materials	S1 & S2	In this module students complete a number of advanced experiments in Physics, Chemistry and Materials Science. Minor components include training in communication skills, personal and career development and attendance at School Seminars	*15
PY3P01, Quantum Mechanics	S1	This module covers solution of the Schrödinger Equation in specific topics, such as angular momentum and the hydrogen atom	5
PY3P02, Electromagnetic Interactions I	S2	This module covers the fundamentals of electromagnetic theory together with quantum optics and lasers	5
PY3P03, Condensed Matter I	S1	This module introduces condensed matter concepts, such as crystal structure and thermal and electronic properties of matter	5
PY3P04, Condensed Matter II	S2	This module extends the discussion of condensed matter into the key areas of magnetic properties and the physics of semiconductors	5

SENIOR SOPHISTER

Senior Sophister:	<p>The SS year consists of lectures, tutorials and practicals delivered in modules, as listed below.</p> <p>The major component of the practical module is an independent research project in nanoscience, physics, chemistry or advanced materials, which may be carried out at a facility off-campus during the first term. Projects are also hosted by the Schools of Chemistry and Physics and by CRANN. Projects external to Trinity College are either hosted by cognate universities or research institutes. A component of problem solving and scientific comprehension is also included in this module.</p>
Mandatory Modules:	All modules specified below are mandatory.
Assessment & Examination Procedures:	<p>The lecture material will be examined by module in examination papers taken during the Annual examination period. Two modules may be examined in a single examination paper. Examined modules are weighted according to their respective credit rating, giving a total of 35 ECTS. A paper on problem solving ability and scientific comprehension, together with assessment of the research project, contributes 25 ECTS in the ratio 30:70, respectively.</p>
SS marks contribute to 65% of the final degree Moderatorship mark	

SENIOR SOPHISTER MODULES - 60 ECTS

Module Code & Name	Semester 1 or 2	Description	ECTS
CH4107 Advanced Physical Chemistry II	S2	This core module involves lectures in quantum chemistry and solid state chemistry	5
CH4601 Materials Chemistry 1	S2	This module deals with thermodynamics and statistical mechanics, electrochemistry and kinetics	5
CH4602 Materials Chemistry 2	S2	This module involves lectures in photochemistry and organic polymers	5
PY4P03, Condensed Matter III	S2	This module covers metal physics and superconductivity together with semiconductor devices	5
PY4P04, Nanoscience	S2	This module covers the modified properties of nanoscale matter, its fabrication and potential applications	5
PY4P06, Modern Optics	S2	This module covers optical properties of materials and nonlinear optics	5
PY4N07, Advanced Topics in Nanoscience	S2	This module consists of specialist courses in polymer physics, thin films and diffraction, imaging and spectroscopy of nanostructures	5
PY4NP1 Practical in Nanoscience	S1	This module combines a major research project with a component of general problem solving in physics and chemistry	25

Contact Details

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Appendix 1: Regulations regarding passing exams by compensation and aggregation to each year

This extract is important for all students:

Faculty of Engineering, Mathematics and Science

Annual examinations

18 Students must sit their annual examinations, which are held in the Trinity term, and must complete all other assessment components, as required. Junior and Senior Freshman students who have failed in the annual examinations must take a supplemental examination at the beginning of Michaelmas term. An expanded form of the following regulations giving further details of compensation requirements and other matters is available on request at the Science Course Office.

19 To gain a pass in each of the Freshman years, students must achieve an overall credit-weighted average mark of at least 40 per cent (grade III) and accumulate 60 credits by (a) passing all modules outright or (b) passing by compensation. To pass by compensation students must either pass outright modules totalling 55 credits and achieve a minimum mark of 30 per cent in the failed module, or pass outright modules totalling 50 credits and achieve a minimum mark of 35 per cent in any failed module(s). Junior and Senior Freshman students who do not pass at the annual examination session, either outright or by compensation, must complete supplemental assessments in all modules in which they did not achieve a mark of at least 40 per cent (grade III) by taking such assessment components, as required, during the supplemental examination period at the beginning of Michaelmas term.

Students who do not qualify to rise with their year and whose overall average mark is 35 per cent or higher, either in the annual or the supplemental examination can, as provided under general College regulations, repeat their year in order to improve their performance.

20 To pass the Sophister years, students must achieve an overall credit-weighted average mark of at least 40 per cent (grade III) and accumulate 60 credits either by (a) passing all modules outright or (b) passing by compensation or aggregation. Whether passing by compensation or aggregation students must pass outright modules totalling at least 40 credits in addition to achieving a 40 per cent (grade III) credit-weighted average, or higher, for the year. Compensation will be permitted in modules totalling a maximum of 20 credits provided that a minimum mark of 30 per cent has been attained in any failed module(s). Further, passing by aggregation will be permitted if a mark of less than 30 per cent has been achieved in a module or modules carrying up to a maximum of 10 credits provided that a mark of at least 30 per cent has been achieved in any remaining failed module(s). The designation of certain modules, or module components, as non-compensatable may reduce the level of compensation permitted in either Sophister year. There are no supplemental examinations in the Sophister years.

To qualify to proceed to the Senior Sophister year, students sitting the Junior Sophister examination must achieve an overall credit-weighted average mark of 45 per cent or higher in the overall examination.

Students who achieve an overall mark of 35 per cent or higher, but who do not qualify to proceed to moderatorship, can, as provided under general College regulations, repeat the Junior Sophister year in order to improve their performance.

21 Students whose overall mark is 34 per cent or lower in their annual examinations and supplemental examinations (if applicable) are not permitted to repeat their year and must withdraw from science.

Ordinary degree of B.A.

22 Students who pass the Junior Sophister annual examinations may have the ordinary B.A. degree conferred if they do not choose, or are not allowed, to proceed to the Senior Sophister year. Except by special permission of the University Council, on the recommendation of the Science Course Director, the ordinary degree of B.A. may be conferred only on candidates who have spent at least three years in the University.

Moderatorship examination

23 The Junior and Senior Sophister examinations constitute part I and part II of the moderatorship examination. There are no supplemental examinations. Students unavoidably absent from the moderatorship examination in their final year may apply to the Senior Lecturer to

Appendix 2: Description of the European Credit Transfer System (ECTS)

The European Credit Transfer and Accumulation System (ECTS) is an academic credit system based on the estimated student workload required to achieve the objectives of a module or programme of study. It is designed to enable academic recognition for periods of study, to facilitate student mobility and credit accumulation and transfer. The ECTS is the recommended credit system for higher education in Ireland and across the European Higher Education Area.

The ECTS weighting for a module is a **measure of the student input or workload** required for that module, based on factors such as the number of contact hours, the number and length of written or verbally presented assessment exercises, class preparation and private study time, laboratory classes, examinations, clinical attendance, professional training placements, and so on as appropriate. There is no intrinsic relationship between the credit volume of a module and its level of difficulty.

The European **norm for full-time study over one academic year is 60 credits**. The Trinity academic year is 40 weeks from the start of Michaelmas Term to the end of the annual examination period 1 ECTS credit represents 20-25 hours estimated student input, so a 10-credit module will be designed to require 200-250 hours of student input including class contact time and assessments.

ECTS credits are awarded to a student only upon successful completion of the course year.

Progression from one year to the next is determined by the course regulations. Students who fail a year of their course will not obtain credit for that year even if they have passed certain component courses. Exceptions to this rule are one-year and part-year visiting students, who are awarded credit for individual modules successfully completed.

Appendix 3: College regulation regarding plagiarism – extract from the College Calendar 2016/17

PLAGIARISM

Simply put, plagiarism is the presentation of the work of someone as your own - the university takes plagiarism offences extremely seriously. Information on what constitutes plagiarism and how the university deals with it can be found in the central repository on plagiarism:

<http://tcd-ie.libguides.com/plagiarism>

All students must complete our [Ready Steady Write plagiarism tutorial](http://tcd-ie.libguides.com/plagiarism/ready-steady-write) ([http:// http://tcd-ie.libguides.com/plagiarism/ready-steady-write](http://tcd-ie.libguides.com/plagiarism/ready-steady-write)) and sign a declaration when submitting course work, whether in hard or soft copy or via Blackboard, confirming that you understand what plagiarism is and have completed the tutorial.

COLLEGE REGULATION REGARDING PLAGIARISM: EXTRACT FROM THE COLLEGE CALENDAR 2016/17

82 General

It is clearly understood that all members of the academic community use and build on the work and ideas of others. It is commonly accepted also, however, that we build on the work and ideas of others in an open and explicit manner, and with due acknowledgement.

Plagiarism is the act of presenting the work or ideas of others as one's own, without due acknowledgement.

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.

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

Plagiarism is considered to be academically fraudulent, and an offence against academic integrity that is subject to the disciplinary procedures of the University.

83 Examples of Plagiarism

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) procuring, whether with payment or otherwise, the work or ideas of another;
- (d) quoting directly, without acknowledgement, from books, articles or other sources, either in printed, recorded or electronic format, including websites and social media;
- (e) paraphrasing, without acknowledgement, the writings of other authors.

Examples (d) and (e) 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.

84 Plagiarism in the context of group work

Students should normally 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, submitting work which is the product of collusion with other students may be considered to be plagiarism.

When work is submitted as the result of a group project, it is the responsibility of all students in the group to ensure, so far as is possible, that no work submitted by the group is plagiarised.

85 Self plagiarism

No work can normally be submitted for more than one assessment for credit. Resubmitting the same work for more than one assessment for credit is normally considered self-plagiarism.

86 Avoiding plagiarism

Students should ensure the integrity of their work by seeking advice from their lecturers, tutor or supervisor on avoiding plagiarism. All schools and departments must include, in their handbooks or other literature given to students, guidelines on the appropriate methodology for the kind of work that students will be expected to undertake. In addition, a general set of guidelines for students on avoiding plagiarism is available on <http://tcd-ie.libguides.com/plagiarism>.

87 If plagiarism as referred to in §82 above is suspected, in the first instance, the Director of Teaching and Learning (Undergraduate), or their designate, will write to the student, and the student's tutor advising them of the concerns raised. The student and tutor (as an alternative to the tutor, students may nominate a representative from the Students' Union) will be invited to attend an informal meeting with the Director of Teaching and Learning (Undergraduate), or their designate, and the lecturer concerned, 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 them to attend. If the student does not in this manner agree to attend such a meeting, the Director of Teaching and Learning (Undergraduate), or designate, 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.

88 If the Director of Teaching and Learning (Undergraduate), or designate, 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 §87 above must state their agreement in writing to the Director of Teaching and Learning (Undergraduate), or designate. If the facts of the case are in dispute, or if

the Director of Teaching and Learning (Undergraduate), or designate, 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.

89 If the offence can be dealt with under the summary procedure, the Director of Teaching and Learning (Undergraduate), or designate, will recommend one of the following penalties:

- (a) Level 1: Student receives an informal verbal warning. The piece of work in question is inadmissible. The student is required to rephrase and correctly reference all plagiarised elements. Other content should not be altered. The resubmitted work will be assessed and marked without penalty;
- (b) Level 2: Student receives a formal written warning. The piece of work in question is inadmissible. The student is required to rephrase and correctly reference all plagiarised elements. Other content should not be altered. The resubmitted work will receive a reduced or capped mark depending on the seriousness/extent of plagiarism;
- (c) Level 3: Student receives a formal written warning. The piece of work in question is inadmissible. There is no opportunity for resubmission.

90 Provided that the appropriate procedure has been followed and all parties in §87 above are in agreement with the proposed penalty, the Director of Teaching and Learning (Undergraduate) should in the case of a Level 1 offence, inform the course director and where appropriate the course office. In the case of a Level 2 or Level 3 offence, the Senior Lecturer must be notified and requested to approve the recommended penalty. The Senior Lecturer will inform the Junior Dean accordingly. The Junior Dean may nevertheless implement the procedures as referred to under conduct and college regulations §2.

91 If the case cannot normally be dealt with under the summary procedures, it is deemed to be a Level 4 offence and will be referred directly to the Junior Dean. Nothing provided for under the summary procedure diminishes or prejudices the disciplinary powers of the Junior Dean under the 2010 Consolidated Statutes.

College Calendar 2016-17

¹The 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.

Appendix 4: Scheme for the marking of examination answers in Sophister years

Mark Range	Criteria
90-100	IDEAL ANSWER; showing insight and originality and wide knowledge. Logical, accurate and concise presentation. Evidence of reading and thought beyond course content. Contains particularly apt examples. Links materials from lectures, practicals and seminars where appropriate.
80-89	OUTSTANDING ANSWER; falls short of the 'ideal' answer either on aspects of presentation or on evidence of reading and thought beyond the course. Examples, layout and details are all sound.
70-79	MAINLY OUTSTANDING ANSWER; falls short on presentation and reading or thought beyond the course, but retains insight and originality typical of first class work.
65-69	VERY COMPREHENSIVE ANSWER; good understanding of concepts supported by broad knowledge of subject. Notable for synthesis of information rather than originality. Sometimes with evidence of outside reading. Mostly accurate and logical with appropriate examples. Occasionally a lapse in detail.
60-64	LESS COMPREHENSIVE ANSWER; mostly confined to good recall of coursework. Some synthesis of information or ideas. Accurate and logical within a limited scope. Some lapses in detail tolerated.
55-59	SOUND BUT INCOMPLETE ANSWER; based on coursework alone but suffers from a significant omission, error or misunderstanding. Usually lacks synthesis of information or ideas. Mainly logical and accurate within its limited scope and with lapses in detail.
50-54	INCOMPLETE ANSWER; suffers from significant omissions, errors and misunderstandings, but still with understanding of main concepts and showing sound knowledge. Several lapses in detail.
45-49	WEAK ANSWER; limited understanding and knowledge of subject. Serious omissions, errors and misunderstandings, so that answer is no more than adequate.
40-44	VERY WEAK ANSWER; a poor answer, lacking substance but giving some relevant information. Information given may not be in context or well explained, but will contain passages and words, which indicate a marginally adequate understanding.
35-39	MARGINAL FAIL; inadequate answer, with no substance or understanding, but with a vague knowledge relevant to the question.
30-34	CLEAR FAILURE; some attempt made to write something relevant to the question. Errors serious but not absurd. Could also be a sound answer to the misinterpretation of a question.
0-29	UTTER FAILURE; with little hint of knowledge. Errors serious and absurd. Could also be a trivial response to the misinterpretation of a question.

Appendix 4: Guidelines on Marking for Project/Dissertation Assessment

Mark Range	Criteria
85-100	Exceptional project report showing broad understanding of the project area and excellent knowledge of the relevant literature. Exemplary presentation and analysis of results, logical organisation and ability to critically evaluate and discuss results coupled with insight
70-84	A very good project report showing evidence of wide reading, with clear presentation and thorough analysis of results and an ability to critically evaluate and discuss research findings. Clear indication of some insight and originality. A very competent and well presented report overall but falling short of excellence in each and every aspect.
60-69	A good project report which shows a reasonably good understanding of the problem and some knowledge of the relevant literature. Mostly sound presentation and analysis of results but with occasional lapses. Some relevant interpretation and critical evaluation of results, though somewhat limited in scope. General standard of presentation and organisation
50-59	A moderately good project report which shows some understanding of the problem but limited knowledge and appreciation of the relevant literature. Presentation, analysis and interpretation of the results at a basic level and showing little or no originality or critical evaluation. Insufficient
40-49	A weak project report showing only limited understanding of the problem and superficial knowledge of the relevant literature. Results presented in a confused or inappropriate manner and incomplete or erroneous analysis. Discussion and interpretation of result severely limited, including some basic misapprehensions, and lacking any originality or critical
20-39	An unsatisfactory project containing substantial errors and omissions. Very limited understanding, or in some cases misunderstanding of the problem and very restricted and superficial appreciation of the relevant literature. Very poor, confused and, in some cases, incomplete presentation of the results and limited analysis of the results including some serious errors. Severely limited discussion and interpretation of the results revealing little or no ability to relate experimental results to the existing literature. Very poor overall standard of presentation
0-19	A very poor project report containing every conceivable error and fault. Showing virtually no real understanding or appreciation of the problem and of the literature pertaining to it. Chaotic presentation of results, and in some cases incompletely presented and virtually non-existent or inappropriate or plainly wrong analysis. Discussion and interpretation seriously confused or wholly erroneous revealing basic misapprehensions.

Schedule of Grades	
I	=70%+
II-1	= 60-69%
II-2	= 50-59%
III	= 40-49%
F-1	= 30-39%
F-2	= 0-29%
U.G.	= Ungraded