PROGRAMME DOCUMENT FOR RESEARCH DEGREE PROGRAMMES

1.General Information

Programme Title	Doctor of Philosophy (PhD)/Master of Philosophy (MPhil) in Applied Physics
Programme Code:	From 2018/19 cohort onwards 11601 (full-time FD/FTD/FTM) 11601 (part-time PD/PTD/PTM) Before 2018/19 cohort 88011 (full-time PhD), 88111 (part-time PhD), 88012 (full-time MPhil), 88112 (part-time MPhil)
Host Department	Department of Applied Physics
Medium of Instruction	English
Mode of Study	Full-time/Part-time (FT/PT)
Duration	4-Year PhD FT: 48 months normal, 72 months maximum PT: 96 months normal, 108 months maximum 3-Year PhD FT: 36 months normal, 60 months maximum PT: 72 months normal, 84 months maximum 2-Year MPhil FT: 24 months normal, 36 months maximum PT: 48 months normal, 60 months maximum
Requirement for Graduation	**Coursework Components** 4-Year PhD - At least 22 credits 3-Year PhD - At least 15 credits 2-Year MPhil - At least 9 credits **Research Components** A thesis and an oral examination on the thesis are required for both PhD and MPhil.
Final Award	M.Phil. or Ph.D. degree dependent on the enrollment

2.Programme Structure

Coursework components:	4-Year PhD (22 credits) Ethics: Research, Professional & Personal Perspectives (1 credit) Research Seminars III (4 credits) Practicum (2 credits) 5 Elective Subjects (15 credits) 3-Year PhD (15 credits) Ethics: Research, Professional & Personal Perspectives (1 credit) Research Seminars II (3 credits) Practicum (2 credits) 3 Elective Subjects (9 credits) 2-Year MPhil (9 credits) Ethics: Research, Professional & Personal Perspectives (1 credit) Research Seminars I (2 credits) 2 Elective Subjects (6 credits) **With effect from 2018/19 cohort onwards**, all RPg students shall be required to take two English enhancement subjects, namely ELC6001 "Presentation Skills for Research Students" and ELC6002 "Thesis Writing for Research Students". For exemption, RPg students need to pass the Research Language Skills Assessment (RLSA). Before thesis submission, students are required to take and pass the English enhancement subjects.
Research components:	Students are required to submit a thesis when their study is completed. The thesis should summarize the findings of the student's original and independent research. An oral examination on the submitted thesis is required for the student. The oral examination comprises the following parts where the sequence is to be determined by individual board of examiners (BoE): • A closed session in which the BoE holds a preliminary discussion in the student's absence. • A full oral presentation by the student to the BoE and others in attendance. • An open question period, involving the members of the BoE and others in attendance. Questions from the floor must be addressed through the Chair of the BoE, who will exercise discretion on the appropriateness of a question to be put forward to the examinee. • A session involving further discussion between the student and the BoE. • A closed session, in which the BoE assesses the thesis and the student's performance in the student's absence. • A closed session, in which the BoE informs the student of the BoE's recommendations.

3.The Rationale, Aims and Intended Learning Outcome of the Programme

University Overarching Aims of Research Degree Programmes	**Intended Learning Outcomes of M.Phil. and Ph.D. Programmes***
The research degree programmes are designed in such a way to enable the student to: a. acquire competence in research methods and scholarship; and b. display sustained independent effort and independent original thought.	Upon completion of the programmes, Ph.D. and M.Phil. students will be able to a1. solve theoretical or/and experimental problems of the related research field of studies with the previous accumulated knowledge and problem solving skills, a2. communicate clearly and effectively in English, excel in report writing and presentation skill, a3. collaborate smoothly with others in team work, demonstrate a sense of responsibility, accountability, leadership and team spirit, b1. develop capability of independent thinking, and c1. possess a desire for life-long learning and self-learning.
The PhD programmes should target to produce academics or industrial R & D professionals.	In addition to the above learning outcomes (a1-a3,b1-b2 and c1), PhD students are also expected to be able to a4. Have more in-depth understanding on the knowledge of the research subjects and expected to have stronger publication record. b2. Expected to discover new problems and formulate the problems to analyze, evaluate, synthesize and propose solutions to problems of a general nature with innovative/creative ideas where appropriate. c2. Can develop a future career in their field of professions making use of their depth foundation built in the study as academics, researchers or industrial R&D professionals.

4.**The Curriculum**

M.Phil /Ph.D. in Applied Physics

Stage/ Semester	Subject Code	Subject	Credit	Compulsory/ Elective	Pre-requisite	Remarks
1/1	HTI6081	Ethics: Research, Professional & Personal Perspectives	1	C	None	
All	AP601	Research Seminars I	2	C	None	Students are recommended to complete one credit per year (for full-time students) or per two years (for part-time students) to fulfil the above- mentioned requirement, with an overall assessment grade of Pass and Fail. However, as deemed appropriate by the Chief Supervisor, they are allowed to complete at most two credits per year (for full-time students) or per two years (for part-time students to fulfil the research seminar credit requirement.
All	AP602	Research Seminars II	3	C	None	
All	AP603	Research Seminars III	4	C	None	
D	AP605	Practicum	2	C	None	Students are allowed to complete these two credits any time before they graduate. They can choose to complete these two credits in two different semesters or within the same semester, subject to the approval of the Chief Supervisor. Stipend recipients are allowed to fulfill part of their departmental training requirement through the completion of these compulsory training credits. For students who are required to undertake teaching supporting activities, they should be required to complete the training programmes orgainsed by the EDC and ELC before the commencement of any teaching supporting activities.
D	AP616	Smart Materials and Structures	3	E	None	
D	AP617	Advanced Instrumentation for Materials Analysis	3	E	None	

D	AP618	Science and Technology of Micro- and Nano-systems	3	E	None	
D	AP619	Microfabrication Laboratory	3	E	None	
D	AP620	Atomistic View of Matter: Modeling & Simulation	3	E	None	
D	AP621	Advanced Electron Microscopy: Theory and Practice	3	E	None	
D	AP6911	**Guided study** in Physics of Low-Dimensional Materials	3	E	None	For the number of guided study subjects that can be taken, no more than 10 credits for 4-year full-time PhD/8-year part-time PhD, No more than 6 credits for 3-year full-time PhD/6-year part-time PhD, and No more than 4 credits for 2-year full-time PhD/4-year part-time PhD, are allowed.
D	AP6912	**Guided Study** in Polymer Electronics	3	E	None	
D	AP6913	**Guided Study** in Optical Properties of Luminescent Materials	3	E	None	
D	AP6914	**Guided Study** in Ferroelectric Materials	3	E	None	
D	AP6915	**Guided Study** on Research Topics in Applied Physics	3	E	None	
D	ELC6001	Presentation Skills for Research Students	Nil	C	None	Before thesis submission, students are required to take and pass this English enhancement subjects.
D	ELC6002	Thesis Writing for Research Students	Nil	C	None	Before thesis submission, students are required to take and pass this English enhancement subjects.

D – dependent on the arrangement from offering department.

Elective subjects (E) offered by other departments/universities

For PhD or MPhil students who find difficulty in taking the suggested elective courses from the curriculum, they could propose other available

research postgraduate subjects offered by other departments/universities as their elective courses but subject to approval from DRC.

Curriculum Map

The curriculum map gives a holistic view of the programme to which each intended learning outcome will be taught and assessed in the programme (see "The Rationale, Aims and Intended Learning Outcome of the Programme" section). The corresponding curriculum map is given in the Appendix - **Attachment II**.

5.**Summary of the Subject Information**

Subject Code	Subject Name	Credit	Pre-requisite	Teaching Methods	Assessment Methods
HTI6081	Ethics: Research, Professional & Personal Perspectives	1	None	Lecture/seminar/ workshop	Report /presentation
AP601	Research Seminars I	2	None	seminar/ workshop/ conference	Attendance/ report
AP602	Research Seminars II	3	None	seminar/ workshop/ conference	Attendance/ report
AP603	Research Seminars III	4	None	seminar/ workshop/ conference	Attendance/ report
AP605	Practicum	2	None	Lecture and Hands-on experiments	SFQ, HoD/DoS/delegate review
AP616	Smart Materials and Structures	3	None	Lecture and Hands-on experiments	Continuous assessment and examination
AP617	Advanced Instrumentation for Materials Analysis	3	None	Lecture and Hands-on experiments	Continuous assessment and examination
AP618	Science and Technology of Micro- and Nano-systems	3	None	Lecture and Hands-on experiments	Continuous assessment and examination
AP619	Microfabrication Laboratory	3	None	Lecture and Hands-on experiments	Continuous assessment and Test
AP620	Atomistic View of Matter: Modeling & Simulation	3	None	Lecture and Hands-on experiments	Continuous assessment and examination
AP621	Advanced Electron Microscopy: Theory and Practice	3	None	Lecture and Hands-on experiments	Continuous assessment and examination
AP6911	Guided study in Physics of Low-Dimensional Materials	3	None	Personal supervision and training	Report
AP6912	Guided Study in Polymer Electronics	3	None	Personal supervision and training	Report
AP6913	Guided Study in Optical Properties of Luminescent Materials	3	None	Personal supervision and training	Report
AP6914	Guided Study in Ferroelectric Materials	3	None	Personal supervision and training	Report
AP6915	Guided Study on Research Topics in Applied Physics	3	None	Personal supervision and training	Report
ELC6001	Presentation Skills for Research	Nil	None	Seminar	Continuous assessment

	Students				
ELC6002	Thesis Writing for Research Students	Nil	None	Seminar	Continuous assessment

The detailed Subject Description Forms of all subjects are given in the Appendix.

6. Terms and Conditions

This Programme Document is subject to review and changes which the programme offering Faculty/Department/School can decide to make from time to time. Students will be informed of the changes as and when appropriate.

This Document should be read together with the "Regulations and Administrative Procedures for the Degrees of MPhil and PhD" and the "Research Student Handbook".

Appendix

1) Attachment II – Curriculum Map for Individual Research Degree Programme

2) Attachment III – Subject Description Form
    - HTI6081
    - AP601
    - AP602
    - AP603
    - AP605
    - AP616
    - AP617
    - AP618
    - AP619
    - AP620
    - AP621
    - AP6911
    - AP6912
    - AP6913
    - AP6914
    - AP6915
    - ELC6001
    - ELC6002

Curriculum Map for Individual Research Degree Programme

Programme Title: M.Phil. /Ph.D. in Applied Physics

Hosted by: Department of Applied Physics

Programme Outcomes	**Subject HTI6081**	**Subjects ELC6001 ELC6002**	**Seminar AP601 – 603**	**Practicum AP605**	**Subjects AP616 – 619**	**Subject AP620**	**Subject AP621**	**Subjects AP6911– 6915**	**Thesis**
1. The students will be able to solve theoretical and experimental problems of the related research field of studies with the previous accumulated knowledge and problem solving skills; and have more in-depth understanding on the knowledge of the research subjects and expected to have stronger publication record.			√		√	√	√	√	√
2. The students will be able to communicate clearly and effectively in English, excel in report writing and presentation skill; collaborate smoothly with others in team work; demonstrate a sense of responsibility, accountability, leadership and team spirit.	√	√		√					√
3. The students will be able to develop independent thinking; and be expected to discover new problems and formulate the problems to analyze, evaluate, synthesize and propose solutions to problems of a general nature with innovative/creative ideas where appropriate.			√		√	√	√	√	√
4. The students will be able to possess a desire for life-long learning and selflearning; and can develop a future career in his/her field of professions making use of their depth foundation built in the study as teachers, researchers or industrial R&D professionals.	√		√	√					√

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	HTI6081
Subject Title	Ethics: Research, Professional & Personal Perspectives
Credit Value	1
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	To instill in students a deep appreciation of ethical guidelines and codes of conduct that they can apply in their research studies at PolyU and in their future professional and personal lives.
Intended Learning Outcomes	On successful completion of this subject, students will be able to: 1. Demonstrate knowledge and understanding of the need for ethical behavior and guiding codes of ethics in research and the professions. 2. Understand, discuss and apply ethical principles and codes across a range of disciplines and scenarios 3. Demonstrate awareness of current ethical issues and problems in relation to their own discipline and research area 4. Critically analyze and discuss scenarios cases of possible or actual ethical misconduct 5. Discuss how the guiding principles of ethics in research extend and apply to business, professional and personal codes of conduct and why this important to integrity and the well-being of business, the professions and our community. 6. Show a fundamental understanding of the issues of copyright, plagiarism and proper citation, and be able to apply this in their own work.
Subject Synopsis/ Indicative Syllabus	The need for ethics training and the meaning of ethical behavior in research: case studies, disasters and learning by the mistakes of others: • Philosophy and codes of ethics and their origins. • Culture, religion and the law – how these relate to ethical codes of conduct. • Obtaining ethical approval for a research project: procedures and processes. • Ethics in life science, humanities, education, business and industry: common issues, guiding principles, discipline specific scenarios • Ethics and human behavior: individual, professional and societal responsibilities. • Recent ethical issues affecting Hong Kong and society in general • Ethical use of information in thesis writing: understanding copyright, plagiarism and proper citation.

<table>
<tr><td>Teaching/Learning Methodology</td><td>Lecture/seminar/workshop</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td></td><td></td><td></td><td></td></tr>
<tr><td>1. Discipline specific scenario/case study analysis (to be graded by chief supervisor of each RPgs)</td><td>50</td><td>✓</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Group assignment (e.g. debate, presentation, production of written material such as a poster or booklet)</td><td>50</td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

a. Discipline specific scenario/case study analysis will assess ability to identify and analyze ethical issues in the student’s own discipline and to present a coherent and detailed critique and plan on how these could be avoided or resolved (giving sources and written work accompanied by a Turn-it-in Report).

b. The group assignment will assess the student’s ability to identify, discuss and analyze ethical principles and issues from a wide perspective, and evaluate how individual, professions and societies benefit from following ethically acceptable behavior and practices.</td></tr>
<tr><td>Student Study Effort Expected</td><td colspan="2">
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture/seminar/workshop</td><td>15 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study and group work</td><td>30 Hrs.</td></tr>
<tr><td>• Assignment preparation</td><td>15Hrs.</td></tr>
<tr><td>Total student study effort</td><td>60 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>Materials from the Hong Kong Ethics development website
(http://www.icac.org.hk/hkedc/eng/library2.asp)
Materials from EthicsWeb.ca
(http://www.ethicsweb.ca/resources/professional/issues.html)
Selected readings and videos
Declaration of Helsinki (revised 2008)</td></tr>
</table>

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP601
Subject Title	Research seminars I
Credit Value	2
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	The main objectives of this series of research seminars/workshops are to • provide an opportunity for our research students and research staff to present the latest results of their research achievement to their peers, • bring together research students, research staff, and professors within AP department to exchange and share knowledge and experience on various aspects of scientific research, • provide an in-depth analysis and study of specific research topics and update the knowledge of recent development in the related research communities, and to • invite local and oversea research scientists/professors to present their recent advancement and/or to explain their view in the future development of research areas of excellent. Hence, this series of research seminars/workshops will • bring together research students, research staff, academicians and experts to exchange and share knowledge and experience on various aspects of scientific research with the invited speakers, and • improve our connection and visibility to the research communities.
Intended Learning Outcomes	Upon completion of the research seminars /workshops, students will be able to: • achieve instant critical thinking – analysis and evaluation of assumption, claims, evidence, and arguments during the short period of discussion as well as raise questions. • improve information literacy – develop capability to distinguish different kinds of information sources, composing search strategies, and retrieving useful and relevant information. • refill communication skill – demonstrate the capability in written and spoken (English as a medium) to present and discuss research information within the scientific community and society. • establish networking – get to know researchers and scientists in their field of studies.
Subject Synopsis/ Indicative Syllabus	• Nanomaterials included 2D materials • Photonic Materials and Devices • Smart Materials and Devices • Theoretical and Computational Physics

<table>
<tr><td>Teaching/Learning Methodology</td><td>In order to stimulate and motivate the students' interest in the seminar/workshop participation, the hottest and latest advancement research topics will be presented. This will lead to the students' further exploration of potential novel research directions and studies as well as stimulate the students' creative thinking.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes (per year)</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Attendance in 10 research seminars</td><td>40</td><td>✓</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Submission of one technical report on one of the research seminars</td><td>30</td><td></td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>3. Presentation</td><td>30</td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
</table>
a) Attendance in research seminars/workshops, b) language proficiency, c) writing skill for technical report. The overall assessment grade is of Pass or Fail.
</td></tr>
<tr><td>Student Study Effort Expected (per year)</td><td>
<table>
<tr><td>Contact:</td><td></td></tr>
<tr><td>▪ Seminar attendance</td><td>20 Hrs.</td></tr>
<tr><td>▪ Present at seminar/workshop/conference</td><td>2 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-learning, report writing and independent learning</td><td>18 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>40 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>Provided by the speakers of the seminars/workshops</td></tr>
</table>

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP602
Subject Title	Research seminars II
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	The main objectives of this series of research seminars/workshops are to • provide an opportunity for our research students and research staff to present the latest results of their research achievement to their peers, • bring together research students, research staff, and professors within AP department to exchange and share knowledge and experience on various aspects of scientific research, • provide an in-depth analysis and study of specific research topics and update the knowledge of recent development in the related research communities, and to • invite local and oversea research scientists/professors to present their recent advancement and/or to explain their view in the future development of research areas of excellent. Hence, this series of research seminars/workshops will • bring together research students, research staff, academicians and experts to exchange and share knowledge and experience on various aspects of scientific research with the invited speakers, and • improve our connection and visibility to the research communities.
Intended Learning Outcomes	Upon completion of the research seminars /workshops, students will be able to: • achieve instant critical thinking – analysis and evaluation of assumption, claims, evidence, and arguments during the short period of discussion as well as raise questions. • improve information literacy – develop capability to distinguish different kinds of information sources, composing search strategies, and retrieving useful and relevant information. • refill communication skill – demonstrate the capability in written and spoken (English as a medium) to present and discuss research information within the scientific community and society. • establish networking – get to know researchers and scientists in their field of studies.
Subject Synopsis/ Indicative Syllabus	• Nanomaterials included 2D materials • Photonic Materials and Devices • Smart Materials and Devices • Theoretical and Computational Physics

<table>
<tr><td>Teaching/Learning Methodology</td><td>In order to stimulate and motivate the students' interest in the seminar/workshop participation, the hottest and latest advancement research topics will be presented. This will lead to the students' further exploration of potential novel research directions and studies as well as stimulate the students' creative thinking.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes (per year)</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Attendance in 10 research seminars</td><td>40</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Submission of one technical report on one of the research seminars</td><td>30</td><td></td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>3. Presentation</td><td>30</td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
</table>

a) Attendance in research seminars/workshops, b) language proficiency, c) writing skill for technical report. The overall assessment grade is of Pass or Fail.
</td></tr>
<tr><td rowspan="5">Student Study Effort Expected (per year)</td><td>Contact:</td><td></td></tr>
<tr><td>▪ Seminar attendance</td><td>20 Hrs.</td></tr>
<tr><td>▪ Present at seminar/workshop/conference</td><td>2 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-learning, report writing and independent learning</td><td>18 Hrs.</td></tr>
<tr><td></td><td>Total student study effort</td><td>40 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Provided by the speakers of the seminars/workshops</td></tr>
</table>

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP603
Subject Title	Research seminars III
Credit Value	4
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	The main objectives of this series of research seminars/workshops are to • provide an opportunity for our research students and research staff to present the latest results of their research achievement to their peers, • bring together research students, research staff, and professors within AP department to exchange and share knowledge and experience on various aspects of scientific research, • provide an in-depth analysis and study of specific research topics and update the knowledge of recent development in the related research communities, and to • invite local and oversea research scientists/professors to present their recent advancement and/or to explain their view in the future development of research areas of excellent. Hence, this series of research seminars/workshops will • bring together research students, research staff, academicians and experts to exchange and share knowledge and experience on various aspects of scientific research with the invited speakers, and • improve our connection and visibility to the research communities.
Intended Learning Outcomes	Upon completion of the research seminars /workshops, students will be able to: • achieve instant critical thinking – analysis and evaluation of assumption, claims, evidence, and arguments during the short period of discussion as well as raise questions. • improve information literacy – develop capability to distinguish different kinds of information sources, composing search strategies, and retrieving useful and relevant information. • refill communication skill – demonstrate the capability in written and spoken (English as a medium) to present and discuss research information within the scientific community and society. • establish networking – get to know researchers and scientists in their field of studies.
Subject Synopsis/ Indicative Syllabus	• Nanomaterials included 2D materials • Photonic Materials and Devices • Smart Materials and Devices • Theoretical and Computational Physics

<table>
<tr><td>Teaching/Learning Methodology</td><td>In order to stimulate and motivate the students' interest in the seminar/workshop participation, the hottest and latest advancement research topics will be presented. This will lead to the students' further exploration of potential novel research directions and studies as well as stimulate the students' creative thinking.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes (per year)</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Attendance in 10 research seminars</td><td>40</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Submission of one technical report on one of the research seminars</td><td>30</td><td></td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>3. Presentation</td><td>30</td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
</table>
a) Attendance in research seminars/workshops, b) language proficiency, c) writing skill for technical report. The overall assessment grade is of Pass or Fail.
</td></tr>
<tr><td>Student Study Effort Expected (per year)</td><td>
<table>
<tr><td>Contact:</td><td></td></tr>
<tr><td>▪ Seminar attendance</td><td>20 Hrs.</td></tr>
<tr><td>▪ Present at seminar/workshop/conference</td><td>2 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-learning, report writing and independent learning</td><td>18 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>40 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>Provided by the speakers of the seminars/workshops</td></tr>
</table>

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP605
Subject Title	Practicum
Credit Value	2
Level	6
Pre-requisite / Co-requisite/ Exclusion	All PhD students, irrespective of funding source and mode of study, **must** complete two training credits before graduation.
Objectives	The main objectives of departmental training are to • gain experience throughout the engagement in teaching/research supporting activities for 6 hours/week in any 13-week semester (for 1 credit), and • provide more teaching experience and training opportunity in order to widen the students' exposure for the development of their academic career.
Intended Learning Outcomes	Upon completion of the training, students will be able to: • carry out independent teaching and research duties. • improve communication skill and excel in teaching capability.
Subject Synopsis/ Indicative Syllabus	To be defined by the student's HoD/DoS or his/her delegate.
Teaching/Learning Methodology	Students who are required to undertake teaching supporting activities in their training credits will be required to complete a training programme on organized by the EDC as required by the Department/School. Students who are required to interact directly with students in English as a part of their duties in supporting teaching and learning must demonstrate their language competence to fulfill the intended duties to the satisfaction of the host department. All eligible students except those who are native English speakers will also be required to successfully complete a language training programme offered by the ELC before taking up any teaching supporting activities.

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Submission of an assessment report</td><td>50</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>2. Student feedback questionnaires</td><td>50</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
</table>

a) Teaching ability, b) language proficiency and communication skill, c) writing skill for report. The overall assessment grade is of Pass or Fail.
</td></tr>
<tr><td rowspan="3">Student Study Effort Expected</td><td>Contact:</td><td></td></tr>
<tr><td>▪ Teaching/research supporting activities</td><td>156 Hrs</td></tr>
<tr><td>Total student study effort</td><td>156 Hrs</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Provided by the HoD/DoS or his/her delegate.</td></tr>
</table>

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP616
Subject Title	Smart Materials and Structures
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	To introduce knowledge in material science including • the fundamentals of smart materials, devices and electronics, in particular those related to the development of smart structures and products; and • the skills, knowledge and motivation in the design, analysis and manufacturing of smart structures and products, to research students from different disciplines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) understand the physical principles underlying the behavior of smart materials; b) understand the engineering principles in smart sensor, actuator and transducer technologies; c) use principles of measurement, signal processing, drive and control techniques necessary to developing smart structures and products; and d) appreciate and suggest improvement on the design, analysis, manufacturing and application issues involved in integrating smart materials and devices with signal processing and control capabilities to engineering smart structures and products.
Subject Synopsis/ Indicative Syllabus	• Overview of Smart Materials, Structures and Products Technologies • Smart Materials (Physical Properties) • Smart Sensor, Actuator and Transducer Technologies • Measurement, Signal Processing, Drive and Control Techniques • Design, Analysis, Manufacturing and Applications of Engineering Smart Structures and Products
Teaching/Learning Methodology	In order to stimulate and motivate the students' interest in the study of material science and related topics, three experiments on piezoelectric, electrostrictive, magnetostrictive, magnetoelectric, magnetorheological fluid, electrorheological fluid, shape memory and fiber-optic sensor materials will be introduced in the studies. These proposed practical examples will demonstrate the importance of material science in our everyday life.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	
1. Examination	60	✓	✓	✓	✓		
2. Continuous assessment	40	✓	✓	✓	✓		
Total	100 %						

Students should have a) a basic understanding on the physical principles of smart materials, b) engineering principles of using smart materials in devices and applications, c) a basic understanding in measurement techniques and d) some knowledge to advance the engineering of smart structures and products – these are the intended learning outcomes.

Assignments will strengthen the students' basic knowledge and the analytical skill to solve the problems related to material science. Tests will review their understanding of the course and examination will accelerate their knowledge's understanding and improve their manipulation on problem solving skills. Hence, the proposed assessment methods are necessary to assess the intended learning outcomes (i.e., items a, b, c & d).

Student Study Effort Expected

Class contact:	
▪ Lectures	27 Hrs.
Other student study effort:	
▪ Self-study	81 Hrs.
▪ Laboratory	12 Hrs.
Total student study effort	120 Hrs.

Reading List and References

- M.V. Gandhi and B.S. Thompson, Smart Materials and Structures, Chapman & Hall, London; New York, 1992 (ISBN: 0412370107).
- B. Culshaw, Smart Structures and Materials, Artech House, Boston, 1996 (ISBN: 0890066817).
- A.V. Srinivasan, Smart Structures: Analysis and Design, Cambridge University Press, Cambridge; New York, 2001 (ISBN: 0521650267).
- A.J. Moulson and J.M. Herbert, Electroceramics: Materials, Properties, Applications, 2nd Edition, John Wiley & Sons, Chichester, West Sussex; New York, 2003 (ISBN:0471497479).
- G. Gautschi, Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, Springer, Berlin; New York, 2002 (ISBN:3540422595).
- K. Uchino, Piezoelectric Actuators and Ultrasonic Motors, Kluwer Academic Publishers, Boston, 1997 (ISBN: 0792398114).
- G. Engdahl, Handbook of Giant Magnetostrictive Materials, Academic Press, San Diego, Calif.; London, 2000 (ISBN: 012238640X).
- K. Otsuka and C.M. Wayman, Shape Memory Materials, Cambridge

	University Press, Cambridge; New York, 1998 (ISBN: 052144487X). • Eric Udd, Fiber Optic Sensors: An Introduction for Engineers and Scientists, John Wiley & Sons, New York, 1991 (ISBN: 0471830070). • André Preumont, Vibration Control of Active Structures: An Introduction, 2nd Edition, Kluwer Academic Publishers, Dordrecht; Boston, 2002 (ISBN: 1402004966). • Hojjat Adeli, Control, Optimization, and Smart Structures: High-Performance Bridges and Buildings of the Future, John Wiley, New York, 1999 (ISBN: 047135094X). • T.T. Soong, Passive Energy Dissipation Systems in Structural Engineering, Wiley, Chichester; New York, 1997 (ISBN: 0471968218). • Robert E. Newnham, Properties of Materials, Oxford University Press, 2005 (ISBN-10:019852076X).

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP617
Subject Title	Advanced Instrumentation for Materials Analysis
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	To introduce knowledge in advanced instrumentation for materials analysis to research students from different disciplines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) have an understanding on the principles and applications of a selected range of advanced instruments for materials analysis, b) understand the methodology of materials testing for quality assurance and failure analysis, and c) develop students' experimental skills through laboratory work experience.
Subject Synopsis/ Indicative Syllabus	• Overview of the principles and techniques in materials characterization and failure analysis; testing codes and standards. • Non-destructive testing methods: dye penetration, magnetic particles inspection, eddy currents, ultrasonics and radiography. • Mechanical and thermal techniques: dynamic mechanical analysis, thermomechanical analysis, and differential scanning calorimetry. • Microscopy: TEM, SEM, AFM, SAM and SLAM. • Other structural, chemical and surface analyses: XRD, FTIR, Raman spectroscopy, RHEED, RBS, EDX, LIMS and other novel techniques using plasma and post-ionization. • Hands-on experiments of using some of the available advanced instruments/facilities in our research centers.
Teaching/Learning Methodology	In order to stimulate and motivate the students' interest in the study of material science and related topics, hands-on experiments will be offered for students to gain experience on the characterization of the electrical and physical properties of some materials.

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td>Specific assessment methods/tasks</td><td>% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td></td><td></td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>2. Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>

Students should have a) a basic understanding on the operation principles of some advanced instruments, b) gained knowledge in the quality assurance and failure analysis of materials, and c) developed experimental skills throughout the studies – these are the intended learning outcomes.

Assignments will strengthen the students' basic knowledge and the analytical skill to solve the problems related to different advanced measurement techniques for materials. Tests will review their understanding of the course and examination will accelerate their knowledge's understanding and improve their manipulation on problem solving. Hence, the proposed assessment methods are necessary to assess the intended learning outcomes (i.e., items a, b, & c).</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures/Seminar</td><td>27 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>81 Hrs.</td></tr>
<tr><td>▪ Laboratory</td><td>12 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>120 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>

Chuck Hellier,' Handbook of Nondestructive Evaluation', McGraw-Hill, 2001.
Peter J. Shull (Ed.),' Nondestructive Evaluation', Marcel Dekker, 2002.
Frank H. Chung and Deane K. Smith,' Industrial Applications of X-ray Diffraction', Marcel Dekker, 1999.
Joseph I. Goldstein,' Scanning Electron Microscopy and X-Ray Microanalysis: A Text for Biologists, Materials Scientists, and Geologists', Second Edition, Kluwer Academic, Publishers, 1992.
Charles E. Lyman, etal,' Scanning Electron Microscopy, X-Ray Microanalysis and Analytical Electron Microscopy: A Laboratory Workbook', Plenum Press, 1990.

</td></tr>
</table>

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP618
Subject Title	Science and Technology of Micro- and Nano- systems
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	To introduce knowledge in the field of micro- and nano- technologies to research students from different disciplines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) obtain a concept on the scope and recent development of the science and technology of micro- and nano-systems; b) gain the physical knowledge underlying the operation principles and design of micro- and nano-systems; c) gain the technical knowledge required for computer-aided design, fabrication, analysis and characterization of nano-structured materials, micro- and nano-scale devices; d) learn some typical or potentially applicable micro- and nano-systems at the frontier of the development of the field; e) gain hands-on experience on characterization and fabrication of some micro- and nano-systems.
Subject Synopsis/ Indicative Syllabus	• Overview of the science and technology of micro- and nano-systems • Physics in micro- and nano-systems: mechanics for micro- and nano-systems, fluid dynamics for micro- and nano- systems, heat conduction in micro- and nano- systems and quantum phenomena in nano-systems. • Micro- and nano-fabrication principles and techniques: basic micro- and nano-fabrication techniques, MEMS fabrication techniques, packaging, measurement techniques and computer-aided design. • Applications and devices : design of microaccelerometers and pressure sensors, microfluidic systems, biochemistry and medical applications, MEMS for information technology and nanoelectronics etc.
Teaching/Learning Methodology	In order to stimulate and motivate the students' interest in the study of material science and related topics, four experiments will be offered for the students to gain experience on nanoindentation, atomic force microscopy, carbon nanotube fabrication and operation of some MEMS devices. These proposed practical examples will demonstrate the

<table>
<tr><td></td><td>importance of material science in our everyday life.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>2. Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
Students should have a) a basic understanding on the development of the science and technology of micro- and nano- systems, b) gained knowledge in the operation principle and design of micro- and nano- systems, c) gained knowledge to use CAD to design and fabricate the nano-systems, d) learned problems related to the micro- and nano- technologies and e) obtained hands-on experience in micro- and nano- technologies – these are the intended learning outcomes.
Assignments will strengthen the students' basic knowledge and the analytical skill to solve the problems related to micro- and nano- technologies. Tests will review their understanding of the course and examination will accelerate their knowledge's understanding and improve their manipulation on problem solving skills. Hence, the proposed assessment methods are necessary to assess the intended learning outcomes (i.e., items a, b, c, d & e).
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures/Seminar</td><td>27 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>81 Hrs.</td></tr>
<tr><td>▪ Laboratory</td><td>12 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>120 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>

T.R. Hsu, MEMS & microsystems design and manufacture, Boston, McGraw Hill, 2002.
S.E. Lyshevski, Nano- and microelectromechanical systems, Boca Raton, CRC Press, 2001.
R. Waser (ed.), Nanoelectronics and information technology, Aachen, Wiley-VCH, 2003.
B. Bhushan, Springer handbook of nanotechnology, Berlin, Springer-Verlag, 2004.
J.A. Pelesko and D.H. Bernstein, Modeling MEMS and NEMS, Boca Raton, Chapman &Hall/CRC, 2003.
V.K. Varadan, Microstereolithography and other fabrication techniques for 3D MEMS, Chichester, Wiley, 2001.

</td></tr>
</table>

	• H. Fujita, Micromachines as tools for nanotechnology, Berlin, Springer, 2003. • W.A. Goddard, Handbook of nanoscience, engineering, and technology, Baca Raton, CRC Press, 2003. • W. Menz, Microsytem technology, Weinheim, Wiley-VCH, 2001. • G.M. Rebeiz, RF MEMS: theory, design, and technology, Hoboken, Wiley, 2003. • V.K. Varadan, RF MEMS and their applications, Chichester, John Wiley, 2003. • M.J. Madou, Fundamentals of microfabrication : the science of miniaturization, Boca Raton, CRC Press, 2002.

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP619
Subject Title	Microfabrication Laboratory
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	To make the students familiar with the microfabrication concepts, materials and methods that are typically used in a cleanroom.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) understand the basic knowledge of a cleanroom, the working procedures, and the safety aspects; b) understand the principles behind the design and fabrication of semiconductor devices and the effect of processes on their performance; c) have a thorough understanding of the available fabrication technologies; and d) experimentally carry out a simple process recipe using the most common microfabrication techniques.
Subject Synopsis/ Indicative Syllabus	• Physical principles of IC fabrication processes; • Surface preparation; • Thermal processes; • Chemical and physical vapor depositions; • Resist coating and removal; • Mask fabrication and advanced lithography; • Etching techniques; • Process characterization;
Teaching/Learning Methodology	In order to stimulate and motivate the students' interest in the study of cleanroom microfabrication technologies, several cleanroom microfabrication experiments will be offered to the students for them to gain hands-on experience on the growth of SiO_2 thin film by thermal oxidation, CVD, PVD, lithography, patterning and etching. These proposed practical examples will demonstrate the importance of microfabrication in the forefront of modern microelectronics.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Written test	50	✓	✓	✓	✓
2. Continuous assessment	50	✓	✓	✓	
Total	100 %				

Students should a) have gained the basic knowledge of a cleanroom, the working procedures, and the safety aspects; b) have gained knowledge in the principles behind the design and fabrication of semiconductor devices and the effect of processes on their performance; c) have a thorough understanding of the available fabrication technologies; and d) be able to experimentally carry out a simple process recipe using the most common microfabrication techniques.

The continuous assessment includes the laboratory assignments, reports and presentation. Assignments will strengthen the students' basic knowledge and the analytical skill to solve the problems related to cleanroom microfabrication technologies as well as the cleanroom experimental skills on microfabrication. Tests will review their understanding of the course and examination will accelerate their knowledge understanding and improve their problem solving skills. Hence, the proposed assessment methods are necessary to assess the intended learning outcomes (i.e., items a, b, c, & d).

Student Study Effort Expected

Class contact:	
▪ Lectures	18 Hrs.
▪ Laboratory	21 Hrs.
Other student study effort:	
▪ Self-study	81 Hrs.
Total student study effort	120 Hrs.

Reading List and References

- S. Franssila, Introduction to Microfabrication, John Wiley & Sons, 2010.
- J. D. Plummer, M. D. Deal, and P. B. Griffin, Silicon VLSI Technology, Prentice Hall, 2000.
- S.Wolf & R.N.Tauber, Silicon Processing for the VLSI Era, vol.1, 2nd edition, Lattice, 2000.
- M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP620
Subject Title	Atomistic View of Matter: Modeling & Simulation
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This course will teach the physics that governs materials at the atomic scale and relate these processes to the macroscopic world.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) design, perform and analyze computer experiments using electronic and atomistic simulation techniques appropriate for the problem at hand; b) extract materials properties from the simulations; c) recognize the approximations and estimate the level of accuracy to be expected from each modeling technique, and d) critically read the current scientific literature on computational modeling and simulation of materials.
Subject Synopsis/ Indicative Syllabus	**The quantum mechanics of bonding**: Atoms, molecules, molecular orbital theory, linear combination of atomic orbitals, variational principle **Electronic structure calculations**: Hartree, Hartree-Fock, post-Hartree-Fock, density functional theory and beyond, Koopmans theorem, modeling crystals **Molecular dynamics simulations**: Numerical integrators, neighbor list, spatial decomposition, interatomic potentials, parameterization, mean square displacement, auto-correlation, nudged elastic band **Classical and statistical mechanics**: thermodynamical ensembles, Boltzmann equation, equipartition energy, fluctuations, normal modes analysis, phonons, harmonic oscillator, specific heat, thermostats, barostats **Advanced techniques**: coarse grain simulations, atomistic electrochemistry, multi-scale modeling
Teaching/Learning Methodology	The course will make extensive use of cloud computing to enhance the learning using nanoHUB.org as well as its features for collaboration and publishing. Students will perform *ab initio* calculations using density functional theory and other advanced techniques as well as molecular dynamics simulations. **Lecture**: The concepts will be presented in class including some illustrative

examples and live simulations. Homework assignments will be provided periodically for the students to apply the concepts developed in class and to solve problems of current research.

Computer laboratory: During laboratory sessions, students will perform atomistic simulations individually or in groups to gain a deeper understanding of topics related to the lectures. These sessions aim at developing the students' intuition and critical thinking upon discussion and exchange of ideas in order to engage in the proposed activities.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
(1) Homework	20	✓	✓	✓	
(2) Computer laboratory	20	✓	✓	✓	✓
(2) Final project	60	✓	✓	✓	✓
Total	100 %				

Continuous assessment includes participation in the computer laboratory sessions and homework assignments in order to check students' progress throughout the semester. Homework assignments will be graded as either complete or incomplete; in order to receive a passing grade students should not have more than one incomplete homework assignment. Computer labs will be graded.

The final project consists of a take-home exam and will be assigned during the second half of the semester. Students will utilize the knowledge gained in the class to design and perform atomistic simulations in order to tackle a problem of current research.

Student Study Effort Expected

Class contact:	
• Lecture	27 Hrs.
Other student study effort:	
• Self-study	81 Hrs.
• Computer Laboratory	12 Hrs.
Total student study effort	120 Hrs.

Reading List and References

- *"Modern Quantum Chemistry"* - Attila Szabo & Neil S. Ostlund
- *"Electronic Structure and the Properties of Solids"* - Walter A. Harrison
- *"Computational Physics"* - J. M. Thijssen

	• "From Atoms to Materials: Predictive Theory and Simulations" - Alejandro Strachan (2014), https://nanohub.org/courses/FATM

Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP621
Subject Title	Advanced Electron Microscopy: Theory and Practice
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	Nil.
Objectives	The aim of this subject is to introduce concepts of electron microscopy and develop the ability of students to use the electron microscopes for material characterizations.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) Understand the fundamental theory of electron optics b) Understand the working principles of transmission electron microscopy(TEM) and scanning electron microscopy(SEM) c) Identify the functions of analytical TEM d) Master the practical skills of TEM and SEM operations e) Select appropriate methods for particular purposes of real material characterizations
Subject Synopsis/ Indicative Syllabus	**Electron Optics:** Fresnel diffraction; Fraunhofer diffraction; Fourier transform; Phase Contrast; Resolution; Aberration; Kinematic diffraction; Dynamical diffraction; Electron wave in crystals **SEM:** Secondary electron; Contrast; Resolution; Backscattered electron; EBSD; LEEM **TEM:** TEM compositions; Diffraction; Imaging; Spectroscopy **Techniques for TEM and case study**: HRTEM; SAED; CBED; Diffraction contrast; STEM; Lorentz Microscopy; Holography; EDS; EELS; in situ TEMs
Teaching/Learning Methodology	**Lecture**: Basic theory and knowledge behind all experiments will be systematically introduced in lectures. Class work and assignments related to the content of lectures will be used to enhance students learning. **Laboratory session:** Experiments are essential for students to relate the concepts to practical applications and they are exposed to hand-on experience and proper use of equipment and also analytical skills on interpreting experimental results.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	
1. Continuous assessment	60		√	√	√	√	
2. Examination	40	√	√	√	√	√	
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Assignments will strengthen the students' basic knowledge and the analytical skills to solve the problems related to this subject. Practical Tests is useful to assess students' experimental skills and knowledge learned from the lectures and lab works. Examination will review their understanding of the course assess their ability to solve problems. Hence, the proposed assessment methods are necessary to assess the intended learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture/Seminar	27 Hrs.
Other student study effort:	
▪ Laboratory	12 Hrs.
▪ Self-study	81 Hrs.
Total student study effort	120 Hrs.

Reading List and References

(1) D.B. Williams, C.B. Carter, Transmission Electron Microscopy, (Plenum Publishing Corporation, 1996).
(2) J.C.H. Spence, High-Resolution Electron Microscopy (Oxford, 2013)
(3) J. Cowley, Diffraction Physics (North Holland 1995)
(4) J. Goldstein, et al, Scanning Electron Microscopy and X-ray Microanalysis (Springer 2003)

Attachment 3

The Hong Kong Polytechnic University

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AP6911</td></tr>
<tr><td>Subject Title</td><td>Guided Study in Physics of Low-Dimensional Materials</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>None</td></tr>
<tr><td>Objectives</td><td>• To broaden student’s research knowledge related to low-dimensional materials through literature searching in various fields
• To enhance student’s writing skill through their own research work or topics of their interest.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a) acquire knowledge and awareness of the latest advances in research development of low-dimensional materials from literature searching in their respective fields; and
b) improve skills in writing collective materials on current topics of interests.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>• Students must submit the completed guided study report to supervisor with adequate literature references.
• Students should consult supervisor regularly about the progress of the literature reviewing progress.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The students required to meet their supervisor(s) regularly, submit report with full list of related references.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Literature report</td><td>100%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
Explanation of the appropriateness of the assessment method in assessing the intended learning outcome:
1. Supervisor(s) will go through the literature report and check the references and give a final grade to the report.
</td></tr>
</table>

Student Study Effort Expected	Class contact:	
	▪ Lectures/Seminar	27 Hrs.
	Other student study effort:	
	▪ Literature search	51 Hrs.
	▪ Writing report	42 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	To be suggested by the corresponding supervisor(s).	

Attachment 3

The Hong Kong Polytechnic University

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AP6912</td></tr>
<tr><td>Subject Title</td><td>Guided Study in Polymer Electronics</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>None</td></tr>
<tr><td>Objectives</td><td>• To broaden student's research knowledge related to polymer electronics through literature searching in various fields
• To enhance student's writing skill through their own research work or topics of their interest.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a) acquire knowledge and awareness of the latest advances in research development of polymer electronics from literature searching in their respective fields; and
b) improve skills in writing collective materials on current topics of interests.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>• Students must submit the completed guided study report to supervisor with adequate literature references.
• Students should consult supervisor regularly about the progress of the literature reviewing progress.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The students required to meet their supervisor(s) regularly, submit report with full list of related references.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Literature report</td><td>100%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
Explanation of the appropriateness of the assessment method in assessing the intended learning outcome:
1. Supervisor(s) will go through the literature report and check the references and give a final grade to the report.
</td></tr>
</table>

Student Study Effort Expected	Class contact:	
	▪ Lectures/Seminar	27 Hrs.
	Other student study effort:	
	▪ Literature search	51 Hrs.
	▪ Writing report	42 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	To be suggested by the corresponding supervisor(s).	

Attachment 3

The Hong Kong Polytechnic University

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AP6913</td></tr>
<tr><td>Subject Title</td><td>Guided Study in Optical Properties of Luminescent Materials</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>None</td></tr>
<tr><td>Objectives</td><td>• To broaden student’s research knowledge related to luminescent materials through literature searching in various fields
• To enhance student’s writing skill through their own research work or topics of their interest.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a) acquire knowledge and awareness of the latest advances in research development of luminescent materials from literature searching in their respective fields; and
b) improve skills in writing collective materials on current topics of interests.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>• Students must submit the completed guided study report to supervisor with adequate literature references.
• Students should consult supervisor regularly about the progress of the literature reviewing progress.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The students required to meet their supervisor(s) regularly, submit report with full list of related references.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Literature report</td><td>100%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
Explanation of the appropriateness of the assessment method in assessing the intended learning outcome:
1. Supervisor(s) will go through the literature report and check the references and give a final grade to the report.
</td></tr>
</table>

Student Study Effort Expected	Class contact:	
	▪ Lectures/Seminar	27 Hrs.
	Other student study effort:	
	▪ Literature search	51 Hrs.
	▪ Writing report	42 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	To be suggested by the corresponding supervisor(s).	

Attachment 3

The Hong Kong Polytechnic University

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AP6914</td></tr>
<tr><td>Subject Title</td><td>Guided Study in Ferroelectric Materials</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>None</td></tr>
<tr><td>Objectives</td><td>• To broaden student’s research knowledge related to ferroelectric materials through literature searching in various fields
• To enhance student’s writing skill through their own research work or topics of their interest.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a) acquire knowledge and awareness of the latest advances in research development of ferroelectric materials from literature searching in their respective fields; and
b) improve skills in writing collective materials on current topics of interests.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>• Students must submit the completed guided study report to supervisor with adequate literature references.
• Students should consult supervisor regularly about the progress of the literature reviewing progress.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The students required to meet their supervisor(s) regularly, submit report with full list of related references.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
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<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Literature report</td><td>100%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
Explanation of the appropriateness of the assessment method in assessing the intended learning outcome:
1. Supervisor(s) will go through the literature report and check the references and give a final grade to the report.
</td></tr>
</table>

Student Study Effort Expected	Class contact:	
	▪ Lectures/Seminar	27 Hrs.
	Other student study effort:	
	▪ Literature search	51 Hrs.
	▪ Writing report	42 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	To be suggested by the corresponding supervisor(s).	

Attachment 3

The Hong Kong Polytechnic University

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AP6915</td></tr>
<tr><td>Subject Title</td><td>Guided Study on Research Topics in Applied Physics</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>6</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>None</td></tr>
<tr><td>Objectives</td><td>• To broaden student’s research knowledge related to applied physics through literature searching in various fields
• To enhance student’s writing skill through their own research work or topics of their interest.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
a) acquire knowledge and awareness of the latest advances in research development in applied physics from literature searching in their respective fields; and
b) improve skills in writing collective materials on current topics of interests.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>• Students must submit the completed guided study report to supervisor with adequate literature references.
• Students should consult supervisor regularly about the progress of the literature reviewing progress.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The students required to meet their supervisor(s) regularly, submit report with full list of related references.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Literature report</td><td>100%</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
Explanation of the appropriateness of the assessment method in assessing the intended learning outcome:
1. Supervisor(s) will go through the literature report and check the references and give a final grade to the report.
</td></tr>
</table>

Student Study Effort Expected	Class contact:	
	▪ Lectures/Seminar	27 Hrs.
	Other student study effort:	
	▪ Literature search	51 Hrs.
	▪ Writing report	42 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	To be suggested by the corresponding supervisor(s).	

Subject title: Presentation Skills for Research Students

Subject code: ELC6001

Credit value: Nil

Pre-requisites: Nil

Contact hours: 28

Objective

This subject aims to develop the spoken English language and communication skills required by research students to present their research projects effectively in academic contexts.

Learning outcomes

By the end of the subject, students should be able to present their research to academic audiences in research-related contexts such as conferences and vivas through

1. planning, organising and delivering effective oral presentations, and
2. reporting and defending their research.

To achieve the above outcomes, students are expected to use language and organisational structure appropriate to the context, select information critically, justify various aspects of the research, present and support stance and opinion, and analyse the impact and significance of the research.

Content

The content is indicative. The balance of the components, and the corresponding weighting, will be based on the specific needs of the students.

1. **Planning and organising presentations**
   Identifying purposes and audiences; selecting and organising information and ideas; using appropriate organisational patterns.

2. **Using visual aids in presentations**
   Analysing the characteristics of different types of commonly-used visual aids; selecting visual aids; planning and preparing visual aids; describing graphics; practising the techniques of using different visual aids.

3. **Delivering presentations**
   Using transitions; signposting the presentation; selecting appropriate register; employing non-verbal interactive strategies; handling questions.

Teaching and learning approach

The study method is primarily seminar-based. Activities include teacher input as well as individual and group work. Students will be provided with opportunities to practise giving oral presentations related to their research. Through practice supported by video-recording, students will learn to evaluate their presentations and obtain advice on presentations related to their research. Students will be referred to information on the Internet and the ELC's Centre for Independent Language Learning.

Learning materials developed by the English Language Centre are used throughout this course. Additional reference materials will be recommended as required.

Assessment

Continuous assessment: 100%

Students' oral skills are evaluated through assessment tasks related to the learning outcomes. Students are assessed on the fluency, accuracy and appropriacy of the language used in fulfilling the assessment tasks, as well as the selection and organisation of ideas.

Indicative references

Cauldwell, R. (2002). *Streaming speech: Listening and pronunciation for advanced learners of English* (2nd ed.). Birmingham: Speechinaction.

Hancock, M. (2003). *English pronunciation in use*. Cambridge: Cambridge University Press.

Jay, A. and Jay, R. (2000). *Effective presentation*. London: Prentice Hall.

Madden, C. G. & Rohlck, T. N. (1997). *Discussion and interaction in the academic community.* Ann Arbor, MI: University of Michigan Press.

Reinhart, S. (2002). *Giving academic presentations.* Ann Arbor, MI: University of Michigan Press.

Subject title: Thesis Writing for Research Students

Subject code: ELC6002

Credit value: Nil

Pre-requisites: Nil

Contact hours: 42

Objective

This subject aims to improve students' ability to analyse and apply generic structures and linguistic features in postgraduate degree theses.

Learning outcomes

By the end of the subject, students should be able to present their research effectively in a thesis through
1. summarising the study in the Abstract,
2. introducing the background, rationale and objectives of the study in the Introduction,
3. reviewing the literature,
4. describing the method used in the study,
5. describing and discussing the findings of the study, and
6. summarising and assessing the significance of the study in the Conclusion.

To achieve the above outcomes, students are expected to use language and text structure appropriate to the context, select information critically, cite and review sources appropriately and critically, present and support stance and opinion, and analyse the impact and significance of the research.

Content

This syllabus is indicative. The balance of the components, and the corresponding weighting, will be based on the specific needs of the students.

With regard to the organisational structures and linguistic features appropriate to different sections of the research thesis, the course will focus on the following:

Planning and organising the thesis; summarising, evaluating and citing sources; describing quantitative and qualitative data; presenting interpretations of data; using appropriate grammatical structures, vocabulary and register; achieving coherence and cohesion; maintaining clarity; using appropriate academic style; and revising and proofreading.

Teaching and learning approach

The course is designed to introduce students to the language and skills they will need to write their research thesis effectively.

The study method is primarily seminar-based. Activities include teacher input as well as individual and group work involving writing practice, evaluation of texts, mini-presentations and discussions. Practical work will involve analysing texts such as journal articles and theses that are relevant to students' research areas. Students will be provided with opportunities to apply the language skills acquired to the preparation of their own thesis. Students will be referred to information on the Internet and the ELC's Centre for Independent Language Learning.

Learning materials developed by the English Language Centre are used throughout this course. Additional reference materials will be recommended as required.

Assessment

Continuous assessment: 100%

Students will be assessed on their cohesion and coherence, linguistic accuracy and language appropriateness in fulfilling the task requirements of assignments and activities related to the learning outcomes.

Indicative references

Calabrese, R. L. (2006). *The elements of an effective dissertation and thesis: A step-by-step guide to getting it right the first time.* Lanham, MD: Rowman & Littlefield.

Cooley, L. and Lewkowicz, J. (2003). *Dissertation writing in practice: Turning ideas into text*. Hong Kong: Hong Kong University Press.

Dunleavy, P. (2003). *Authoring a PhD: How to plan, draft, write, and finish a doctoral dissertation.* Basingstoke; New York: Palgrave Macmillan.

Foss, S. K. & Waters, W. (2007). *Destination dissertation: A traveler's guide to a done dissertation.* Lanham, MD: Rowman & Littlefield Publishers.

Golden-Biddle, K. & Locke, K. (2007). *Composing qualitative research.* Thousand Oaks, CA: Sage.

Luey, B. (Ed.). (2008). *Revising your dissertation: Advice from leading editors* (2nd ed.). Berkeley, CA: University of California Press.

Lunenburg, F. C. & Irby, B. J. (2008). *Writing a successful thesis or dissertation: Tips and strategies in the social and behavioural sciences.* Thousand Oaks, CA: Corwin Press.

Potter, S. (Ed.). (2006). *Doing postgraduate research* (2nd ed.). Milton Keynes: Open University; London: Sage.

Swales, J. M. & Feak, C. B. (2000). *English in today's research world: A writing guide.* Ann Arbor: University of Michigan Press.

Swales, J. M. & Feak, C. B. (2004). *Academic writing for graduate students: Essential tasks and skills* (2nd ed.). Ann Arbor, MI: University of Michigan Press.

Weissberg, R. and Buker, S. (1990). *Writing up research: Experimental research report writing for students of English*. Englewood Cliffs, NJ: Prentice Hall Regents.