SYLLABUSES FOR THE DEGREES OF
BACHELOR OF SCIENCE AND MASTER OF RESEARCH
(BSc&MRes)

A. Curriculum Structure

Each student must complete at least 240 credits in their Bachelor of Science (BSc) degree and 63 credits in the Master of Research (MRes) degree, with a total 303 credits for these 2 degrees.

The BSc Degree (240 credits):

To complete the BSc degree curriculum, you have to pass at least 240 credits, equivalent to 40 6-credit courses, which comprises:

(i) UG5:

- 2 English courses and 1 Chinese course for university language requirements (18 credits)
- 4 common core courses, including one course from each Area of Inquiry (24 credits)
- any other non-credit bearing courses as required (0 credit)

(ii) Intensive Science major:

- 24 - 25 courses for the intensive Science major including 2 Science Foundation courses, Disciplinary courses and capstone course(s) (144 - 150 credits)
- A choice of 8 - 9 courses as elective courses, or to fulfill the requirements of a minor (36-48 credits)

The intensive science majors available include the followings:

- Biological Sciences (Intensive)
- Chemistry (Intensive)
- Ecology & Biodiversity (Intensive)
- Geology (Intensive)
- Mathematics (Intensive)
- Molecular Biology & Biotechnology (Intensive)
- Physics (Intensive)

The syllabuses of the intensive science majors can be found at
https://webapp.science.hku.hk/sr4/servlet/enquiry

The MRes Degree (63 credits):

The MRes of the programme consists of course work and research project. Each student must complete at least 63 credits, including one compulsory course on research ethics (3 credits), 18 credits of Faculty-offered Research Postgraduate courses, and 42 credits of a research project. The project report of the research project will be in the form of a literature review paper and an original research paper in the relevant field. The below shows the current course list of the MRes component which is updated on a regular basis under the current quality assurance mechanism:

Core Course

INRE6033 Research Ethics for Graduate Students (Faculty of Science) (3 credits)

Elective Courses (6 credits each)

School of Biological Sciences

Course Code	Course Title
BIOL8021	Presentation Skills and Research Seminars in Cell and Molecular Biology
BIOL8022	Science Communication
BIOL8023	Topics in Ecology & Biodiversity
BIOL6004	Advanced Topics in Food Science
BIOL6005	Advanced Topics in Nutrition
BIOL6014	Guided Study in Endocrine/Microbial Research
BIOL6015	Advanced Experimental Techniques in Endocrinology/ Microbiology

Department of Chemistry

Course Code	Course Title
CHEM6101	Chemistry Seminars
CHEM6102	Research Techniques in Chemistry
CHEM6103	Special Topics in Chemistry
CHEM6108*	Introduction to Macromolecules *(CUHK)*

Department of Earth Sciences

Course Code	Course Title
EASC6001	Research Seminars and Presentation of Thesis Proposal
EASC6005	Advanced Regional Geology
EASC6006	Special Topics in Earth and Planetary Sciences
EASC6007	Mass Extinctions
EASC6009	Earth Systems Through Time
EASC6010	Nanogeoscience

Department of Mathematics

Course Code	Course Title
MATH6101	Intermediate Complex Analysis
MATH6201	Topics in Geometry
MATH6202	Complex Manifolds
MATH6217	Topics in Financial Mathematics
MATH6219	Topics in Applied Functional Analysis
MATH6224	Topics in Advanced Probability Theory
MATH6501	Topics in Algebra
MATH6502	Topics in Applied Discrete Mathematics
MATH6503	Topics in Mathematical Programming and Optimization
MATH6504	Geometric Topology
MATH6505	Real Analysis

Department of Physics

Course Code	Course Title
PHYS8351	Graduate Quantum Mechanics
PHYS8450	Graduate Electromagnetic Field Theory
PHYS8552	Physics of Quantum Liquids

PHYS8701	Physics Experimental Technique
PHYS8750	Nanophysics

Remarks: * Course offered by sister institutions under Joint Centre for Advanced Study (JCAS), subject to further confirmation

Capstone Project

INRE7999 Research Project (42 credits)

Course contents

For the BSc:

Course contents of the courses prescribed in the BSc curriculum can be found at https://webapp.science.hku.hk/sr4/servlet/enquiry

For the MRes:

INRE6033 Research Ethics for Graduate Students (Faculty of Science)
The aims of this course are to reinforce the importance that the University places on the preservation of the values and principles of research integrity in all research conducted at the university; and to provide opportunities to further examine and discuss responsible conduct of research in their own disciplines, thereby enabling them to apply the principles and practices in their research field.

Students complete this course by fulfilling the course requirements in
GRSC6101 Responsible Conduct of Research:
https://gradsch.hku.hk/gradsch/f/page/600/GRSC6101.pdf, and
GRSC6102 Stream-based Responsible Conduct of Research:
https://gradsch.hku.hk/gradsch/f/page/600/GRSC6102.pdf in the same semester.

Assessment: Course work (100%)

BIOL8021 Presentation Skills and Research Seminars in Cell and Molecular Biology
This course aims to equip students with the skills needed to critique, construct and deliver scientific presentations effectively. Students are encouraged to think critically about the important elements of a good scientific presentation. The course will not only coach the students through the delivery of their own seminar, but also involving students in the preparation, discussion and analysis of seminars delivered by others.
Assessment: Course work (100%)

BIOL8022 Science Communication
This course aims to train the Ecology & Biodiversity research postgraduate to use a modern toolkit to develop effective communication of science while exploring other transferable skills related to professional development in the sciences.
Assessment: Course work (100%)

BIOL8023 Topics in Ecology & Biodiversity
This course aims to elevate RPg conceptual understanding of classic ecological concepts through the reading and discussion of classic papers in ecology and evolution.
Assessment: Course work (100%). Students will be expected to lead and participate in discussions.

BIOL6004 Advanced Topics in Food Science
This course aims to introduce students to special food science topics which are of relevance to their research study. Students will be required to do further guided readings and/or attend extra tutorials and activities including exchange with food science related International programmes. Assessment will be based on critical and logical thinking in problem-based-learning models in food science.

Assessment: Written assignments (80%) and continuous assessment (20%)

BIOL6005 Advanced Topics in Nutrition
This course aims at providing in depth knowledge on special topics in human and animal nutrition. Students need to consult their supervisor and select three topics from the following: Nutritional Status Assessment, Body Weight Regulation and Obesity, Nutrient-Gene Interactions, Metabolic Programming, Nutrition & Immunity, Nutrition & Cancer, Laboratory Animal Handling and Surgical Techniques.
Assessment: Written assignments (50-80%) and continuous assessment (20-50%) for each topic

BIOL6014 Guided Study in Endocrine/Microbial Research
This course aims at providing the student a guided approach to his/her chosen area of research study in endocrinology or microbiology. The guided study is coordinated by the student's research supervisor. Students are required to consult their supervisors and select topics that are related to their research project(s).
Assessment: Written assignments (50-70%) and continuous assessment (30-50%)

BIOL6015 Advanced Experimental Techniques in Endocrinology/ Microbiology
This course focuses on advanced techniques in experimental animal and microbial sciences to assist the student's research studies. The learning is coordinated and taught by the student's research supervisor. Students are required to consult their supervisors and select topics related to their thesis studies from and not limited to the following: Advances in Growth Hormone Research, Signal Transduction within Animal Cells, Cell Culture and Biosensing Techniques and Design, Cytochemical and Cytometry Techniques, Gene Cloning and Related Techniques, Laboratory Animal Handling and Surgical Techniques, Protein and Peptide Analysis and Synthesis, Transgenic Biotechnology in Animals, Advanced Immunoassays and Immunotechniques, Clinical Laboratory Techniques.
Assessment: Written assignments (50-70%) and continuous assessment of laboratory performance (30-50%)

CHEM6101 Chemistry Seminars
This course aims to provide students with the essential communication skills to give scientific presentation in both written and oral formats. Students taking this course will also have the chance to expose to recent development in frontier research in different areas of chemistry.
Assessment: Course work (100%)

CHEM6102 Research Techniques in Chemistry
This course aims to provide the principles and practice of some important and widely used research techniques in chemistry. Topics selected on the advice of the supervisor from: nuclear magnetic resonance spectroscopy and electron spin resonance spectroscopy, x-ray diffraction, mass spectrometry, material characterization, molecular modeling techniques, vibrational spectroscopy, laser spectroscopy, separation techniques, combinatorial chemistry.
Assessment: One 3-hour written examination (100%)

CHEM6103 Special Topics in Chemistry
This course aims to provide more advanced treatment in topics in chemistry. A research topic selected on the advice of the supervisor from: selected advanced topics of current interest in analytical chemistry, inorganic chemistry, organometallic chemistry, organic chemistry, physical chemistry and theoretical chemistry, etc.

Assessment: A written report of no less than 2,500 words (100%) to be submitted at the end of the course.

CHEM6108 Introduction to Macromolecules *(CUHK)*
This is a postgraduate course offered by the Joint Centre for Advanced Study. Lectures will be delivered by faculty members from CUHK, HKUST, and HKU. Both introduction to macromolecular science and some frontier topics will be covered. The lectures will be held at the campus of these three institutions. Details will be announced at the beginning of the class.
Assessment: One 3-hour written examination (100%)

EASC6001 Research Seminars and Presentation of Thesis Proposal
This course enables students to present their research proposals and receive a broad and timely suggestions and critiques. Students are required to present their thesis proposals, and should attend the weekly seminar series held in the department. Students are required to enroll for this course of their first year of their degree programs and orally present the thesis proposal (20-30 minute talk) before submitting their biannual progress reports.
Assessment: Class participation in weekly seminars (50%) and presentation (50%); to be assessed by departmental staff members

EASC6005 Advanced Regional Geology
This course aims to provide an overview of the regional geology, including current major problem in regional geology (e.g., climate-erosion-tectonics interactions) and how multi-disciplinary approaches are used to solve regional geological questions (e.g., integration of thermochronology and tectonic reconstruction). Additional emphasis is placed on east Asian tectonics, as this our home region and a focal site of much regional geological discovery over the past ~ 40 years. A major project, each of which can be tailored to correspond with the research interests of the postgraduate student, will be the dominant graded element.
Assessment: Continuous assessment (100%)

EASC6006 Special Topics in Earth and Planetary Sciences
This course aims to provide in depth knowledge of selected special topics in earth and planetary sciences, including engineering and environmental geology, hydrogeology, engineering geophysics, quaternary geology, astrobiology and planetary sciences. Directed studies in a focused field of research recommended by the research group/supervisor, and writing of review reports and critiques.
Assessment: Continuous assessment (100%)

EASC6007 Mass Extinctions
This course aims to review five mass extinction events in earth history. The instructor will first explain the concepts of background extinction rate and major extinction events. Later students will learn the causes and effects for five mass extinction events. Additionally we will discuss if the 6th extinction event is coming.
Assessment: Continuous assessment (100%)

EASC6009 Earth Systems Through Time
Evaluate various integrative Earth systems in space and time. Course Contents & Topics: Biogeochemical and tectonic processes that influence Earth's surface environment. Each semester topics may cover: "Origin of the Continental Crust", "The Carbon Cycle", "Oxygenation of the Atmosphere", "Mountains and Climate", amongst others.
Assessment: Continuous assessment (100%)

EASC6010 Nanogeoscience
This course provides an overview of nanomaterial properties and nano-scale processes that take place in solids, fluids/droplets, vapors and across reacting interfaces with an emphasis on the Earth and environmental sciences.
Assessment: Continuous assessment (100%)

MATH6101 Intermediate Complex Analysis
The objective is to familiarize students with concepts and techniques in Complex Analysis beyond an introductory course in Functions of a Complex Variable. This course covers a choice of topics in Complex Analysis in one complex variable such as complex potential theory, meromorphic functions, open Riemann surfaces, compact Riemann surfaces, normal families, geometric theory of holomorphic mappings and complex dynamics.
Assessment: Coursework (50%); Written or oral examinations (50%)

MATH6201 Topics in Geometry
This course aims to introduce students to different research areas in geometry and their applications. This course covers a choice of topics in different areas of geometry such as Riemannian geometry, symplectic geometry, gauge theory and calculus of variations.
Assessment: Coursework (50%); Examination (50%)

MATH6202 Complex Manifolds
This course aims to introduce students to research on complex manifolds. This course contains an introductory part on basic notions such as holomorphic vector bundles, sheaves and sheaf cohomology, cohomology theories in terms of differential forms, and Hermitian and Kaehler manifolds, together with a choice of topics on analytic and geometric aspects of the theory of complex manifolds.
Assessment: Coursework (50%); Written or oral examinations (50%)

MATH6217 Topics in Financial Mathematics
This is a course intended for graduate students or ambitious undergraduate students who are interested in financial mathematics. Minimal knowledge in finance is needed as we shall introduce necessary backgrounds along our way. Starting from the basics, we shall describe fundamental results on optimization theory and its applications to optimal portfolio selection problems.
Assessment: Coursework (50%); Examination (50%)

MATH6219 Topics in Applied Functional Analysis
Topics will be chosen from the following list: 1. Generalized functions (also called distributions), delta function, generalized Fourier Transform. Applications to differential equations, Fundamental solution, Green's function. 2. Sobolev spaces, Sobolev Embedding Theorem, Trace. 3. Hilbert space linear operator theory (bounded operators, compact operators, closed unbounded operators), spectral theory. Applications on differential equations (infinitesimal generator, semigroup of linear operators). 4. Applications on optimization problems. Wherever needed, we shall also review techniques for Metric spaces (Catergory Theorem), Banach spaces (Hahn-Banach Theorem, Opening Mapping Theorem, Closed Graph Theorem and Uniform Boundedness Principle) and Hilbert spaces (Orthogonality and best approximation, Fourier isometry).
Assessment: Coursework (50%); Examination (50%)

MATH6224 Topics in Advanced Probability Theory

This is a course intended for students who are interested in probability theory and its applications. The course is a fundamental course for those students who will conduct advanced research in the field of probability theory and other related fields, such as stochastic analysis, information theory and so on. It also provides necessary tools and techniques that are needed for a wide-range of applications of probability theory, such as in financial engineering, electrical engineering and signal processing. The prospective students are expected to have basic knowledge of probability theory and analysis. We will cover the following topics: measure theory, law of large numbers, central limit theorems, random walks, martingales, Markov chains, ergodic theorems, Brownian motion. Upon request, other optional topics may be covered as well.
Assessment: Coursework (50%); Examination (50%)

MATH6501 Topics in Algebra
This course aims to provide students specializing in mathematics with the opportunity to study some topics in algebra in greater depth. This course covers a selection of topics in algebra, such as group theory, rings and modules, Galois theory, quadratic forms, multilinear algebra, algebraic number theory, group representation, introduction to commutative algebra, Groebner basis theory, introduction to algebraic geometry. The selected topics may vary from year to year.
Assessment: Coursework (50%); Examination (50%)

MATH6502 Topics in Applied Discrete Mathematics
This course aims to provide students with the opportunity to study some further topics in applied discrete mathematics. A selection of topics in discrete mathematics applied in combinatorics and optimization (such as algebraic coding theory, cryptography, discrete optimization, etc.) The selected topics may vary from year to year.
Assessment: Coursework (50%); Examination (50%)

MATH6503 Topics in Mathematical Programming and Optimization
A study in greater depth of some special topics in mathematical programming or optimization. It is mainly intended for students in Operations Research or related subject areas. This course covers a selection of topics which may include convex, quadratic, geometric, stochastic programming, or discrete combinatorial optimization. The selected topics may vary from year to year.
Assessment: Coursework (50%); Examination (50%)

MATH6504 Geometric Topology
This course gives a geometric introduction to some of the methods of algebraic topology. The emphasis throughout will be on the geometric motivations and applications of the theory. Continuity, compactness, connectedness, the fundamental group, triangulations and classification of surfaces, theory and applications of simplicial homology, theory of covering spaces.
Assessment: Coursework (50%); Examination (50%)

MATH6505 Real Analysis
The aim of the course is to introduce the basic ideas and techniques of measure theory and the Lebesgue integral.
Assessment: Coursework (50%); Examination (50%)

PHYS8351 Graduate Quantum Mechanics

This course introduces postgraduates to theory and advanced techniques in quantum mechanics, and their applications to select topics in condensed matter physics.
Assessment: Assignments (30%); Examination (70%)

PHYS8450 Graduate Electromagnetic Field Theory
The aim of this course is to provide students with the advanced level of comprehending on the theory of classic electromagnetic field, enabling them to master key analytical tools for solving real physics problems.
Assessment: Assignments (30%); Examination (70%)

PHYS8552 Physics of Quantum Liquids
The collective behavior of systems consisting of many particles (bosons or fermions) gives rise to new states of matter, which emerge at low temperatures where interactions are important. This course aims to introduce the students to those novel quantum states, emphasizing the general themes such as elementary excitations, broken symmetry, hydrodynamic description, and topological properties of condensed matter. Theoretical language useful in the interpretation of experiments, such as response functions, will be discussed. The emphasis will be on a selected few examples that illustrate the above concepts and techniques. The course is intended for both experimentalists and theorists.
Assessment: Continuous assessment including homework assignments and term paper (100%)

PHYS8701 Physics Experimental Technique
This course provides a detailed account of some common experimental techniques in physics research. It introduces the basic working principles, the operational knowhow, and the strength and limitations of the techniques.
Assessment: Attendance (20%); Presentation (40%); In class quizzes (40%)

PHYS8750 Nanophysics
This course is designed to let fresh postgraduate students know fundamental concepts and principles of nano physics, such as two-dimensional electron gas, quantum Hall effects, one-dimensional electron system, quantum wires and nanotubes, zero-dimensional electron systems, single electron effects and quantum dots.
Assessment: Assignments (10%); Essay (20%); Examination (70%)

INRE7999 Research Project
This course aims at providing students with an opportunity to pursue their own research interest under the supervision of a teacher. The period of the research project will last for the 1st semester, 2nd semester until the summer semester.
Assessment: Project report (80%); Oral examination (20%)