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:

For students admitted in 2025-26 and thereafter

- A non-credit bearing Academic Communication in English course
- 6 credits in an English in the Discipline course
- 6 credits in a Chinese language enhancement course
- 24 credits in the Common Core Curriculum, comprising courses from four of the five Areas of Inquiry with 6 credits from each selected Area of Inquiry
- 6 credits in artificial intelligence literacy
- A non-credit bearing course in national education and national security education

For students admitted in 2024-25 or before

- 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
BIOL6007	Biostatistics
BIOL6014	Guided Study in Molecular and Cell Biology
BIOL6015	Advanced Experimental Techniques in Molecular and Cell Biology
BIOL8017	Advanced Studies in Environmental Sciences
BIOL8018	'Omics' and Systems Biology
BIOL8021	Presentation Skills and Research Seminars in Cell and Molecular Biology
BIOL8022	Science Communication
BIOL8023	Topics in Ecology & Biodiversity

Department of Chemistry

Course Code	Course Title
CHEM6101	Chemistry Seminars
CHEM6102	Research Techniques in Chemistry
CHEM6103	Special Topics in Chemistry
CHEM6108	Advanced Functional Polymers
CHEM6109	Computational Chemistry
CHEM6111	Integrated Organic Synthesis
CHEM6112	Advanced Physical Chemistry
CHEM6113	Medicinal Chemistry
CHEM6114	Advanced Organic Chemistry
CHEM6115	Advanced Inorganic Chemistry
CHEM6116	Symmetry, Group Theory and Applications
CHEM6117	Modern Chemical Instrumentation and Applications
CHEM6118	Frontiers in Modern Chemical Science

Department of Earth and Planetary Sciences

Course Code	Course Title
EASC6009	Evolving Earth Systems
EASC6010	Nanogeoscience
EASC6011	The Art of Scientific Presentations
EASC6012	Seminar in Planetary Sciences

Department of Mathematics

Course Code	Course Title
MATH6014	Topics in Advanced Numerical Analysis
MATH6015	Topics in Artificial Intelligence and Machine Learning
MATH6101	Intermediate Complex Analysis
MATH6207	Topics in Applied Mathematics
MATH6216	Stochastic Processes
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 Advanced Optimization
MATH6505	Real Analysis
MATH7301	Lie Groups and Lie Algebras
MATH7302	Topics in Number Theory
MATH7304	High Dimensional Probability

Department of Physics

Course Code	Course Title
PHYS8351	Graduate Quantum Mechanics
PHYS8352	Quantum Information
PHYS8450	Graduate Electromagnetic Field Theory
PHYS8550	Graduate Statistical Mechanics
PHYS8552	Condensed Matter Physics
PHYS8653	Selected Topics in High Energy Astrophysics and Cosmology
PHYS8654	General Relativity
PHYS8656	Topics in Astrophysics
PHYS8701	Physics Experimental Techniques
PHYS8750	Physics of Nanoelectronics
PHYS8751	Device Physics
PHYS8852	Photonics and Metamaterials

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 for students 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/sites/default/files/content/4_current_students/coursework/course_information/graduate_school_courses/GRSC6101.pdf, and GRSC6102 Stream-based Responsible Conduct of Research: https://gradsch.hku.hk/sites/default/files/content/4_current_students/coursework/course_information/graduate_school_courses/GRSC6102.pdf in the same semester.

Assessment: Course work (100%)

BIOL6007 Biostatistics
This course aims to is to introduce students to the core ideas and concepts of statistical analysis with special attention to the modeling approaches used in biological sciences. The course will give students the skills and knowledge to understand how to apply these concepts using the R statistical programming language for data analysis. Although the course covers some basic concepts (experimental design, distributions, hypothesis testing), the main emphasis of the course is on model building and selection, linear models (regression and analysis of variance), basic random effects and mixed effects models.
Assessment: Assignments (40%) and Test (60%)

BIOL6014 Guided Study in Molecular and Cell Biology
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 Molecular and Cell Biology
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%)

BIOL8017 Advanced Studies in Environmental Sciences
This course aims to provide student centered learning opportunities which will be designed for each individual student. Students will be required to take parts of existing advanced courses from the BSc curriculum (Environmental Science major) which are considered necessary for their particular needs and which they have not previously taken.
Assessment: Examination (70-80%) and continuous assessment (20-30%) depending on the studies selected

BIOL8018 'Omics' and Systems Biology
Recent progress in high-throughput omics technology has revolutionized the biological research. Genome-wide profiling of various biomolecules simultaneously by omics technology generates huge amounts of data, providing the potential to obtain a global and holistic view of the system. This course aims to introduce the technologies of Omics and Systems Biology, and overview of various applications of omics technology.

Synthetic biology is set to be the heart of future economy, promising to create new drugs, industrial materials and energy sources similar to chemical synthesis. The significance of this field has been promoted by the worldwide synthetic biology competition organized by MIT, i.e., iGEM competition. In this course, we will introduce some innovative ideas in synthetic biology and practice the skills needed for iGEM competition.
Assessment: Examination (50%) and assignment (50%)

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.

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 Advanced Functional Polymers
This is a graduate course bridging polymer chemistry and materials, with emphasis on functional polymers spanning linear to two-dimensional architectures. It covers polymerization classifications (chain-growth and step-growth), living/controlled techniques, and advanced 2D polymer syntheses including solid-state photopolymerization, on-surface couplings, solution-phase dynamic covalent chemistry, and interface-assisted methods. Core principles link molecular structure (configuration, conformation, branching, crosslinking) to macroscopic properties such as crystallinity, glass transition, mechanical strength, viscoelasticity, and transport properties. Students are trained in key characterization tools (AFM, TEM, STM, XRD, FT-IR, Raman, XPS, UV-Vis) and explore applications ranging from electronics and energy to biomedicine and environmental sustainability. Learning outcomes include designing synthetic routes, interpreting characterization data, and predicting structure-property-performance relationships for advanced materials research.
Assessment: Mid-term oral presentation (30%); Final open book written examination (2 hours) (70%)

CHEM6109 Computational Chemistry
This course covers common topics in computational chemistry including molecular quantum chemistry and dynamics methods as well as the fundamental in machine learning. Topics include basic concepts, computational theories and practical problems in chemistry. It is offered to undergraduate and postgraduate students who are interested in advanced computational chemistry techniques.
Assessment: Laboratory reports (40%); Project reports (60%)

CHEM6111 Integrated Organic Synthesis
This course will present modern synthetic methods and synthetic planning. The course is organized into units based on target drug molecules. In each unit, the chemical biology of these compounds are briefly presented and the syntheses of these molecules are introduced, accompanied by in-depth discussions of the reactions involved with emphasis on their mechanisms, selectivity, stereochemistry, scope and limitations. Concept of synthetic design

including retrosynthetic analysis, stereoselectivity and enantioselective control elements will be emphasized. A laboratory section provides training in the practical skills of synthesis.
Assessment: Assignments (10%); Examination (50%); Laboratory reports (25%); Test (15%)

CHEM6112 Advanced Physical Chemistry
This course covers advanced topics in physical chemistry. It is offered for students majoring in physical chemistry and for students who are interested in postgraduate studies. The course contents & topics include time-resolved spectroscopy methods, excited states and reactive intermediates, photophysics and photochemical processes, chemical reaction mechanisms, advanced quantum mechanical methods, reaction pathways and surface crossings.
Assessment: Assignments (50%); Examination (50%)

CHEM6113 Medicinal Chemistry
This course covers the chemical principles of drug design and drug action and uses as an introduction to research in areas of bioorganic chemistry, bioinorganic chemistry, medicinal chemistry, pharmaceutical chemistry, and biotechnology. The course contents & topics include Drug discovery, design, and development: lead discovery, pharmacophore, structure-activity relationships (SAR), computer-aided drug design, combinatorial chemistry and high-throughput drug screening, Drug-receptor interactions, Proteins (and enzymes) and nucleic acids as drug targets, Metals in medicine, DNA-Drug interactions, Drug metabolism and prodrugs and drug delivery.
Assessment: Assignments (30%); Examination (50%); Test (20%)

CHEM6114 Advanced Organic Chemistry
This course aims to provide students with knowledge in organic chemistry reaction mechanism and organic compound structure determination. The course covers chemical bonding, advanced stereochemistry, conformational analysis, techniques for investigating reaction mechanisms, reactive intermediates, rearrangement reactions, and pericyclic reactions.
Assessment: Assignments (25%); Examination (50%); Test (25%)

CHEM6115 Advanced Inorganic Chemistry
This course is to give further and more detailed treatment to topics in Inorganic Chemistry and new areas of interest. Problem based learning on selected advance topics will be introduced in the later part of the course. Selected advanced topics of current interest. Examples include metal-metal bonds and metalligand multiple bonds, inorganic and supramolecular photochemistry, lanthanide chemistry, bio-inorganic and medicinal chemistry, and activation of small molecules by metal complexes.
Assessment: Assignments (25%); Examination (50%); Test (25%)

CHEM6116 Symmetry, Group Theory and Applications
This course aims to introduce the concepts of symmetry and group theory and to apply them in solving chemical problems. This course also provides an introductory treatment of bonding theories, inorganic electronic and vibrational spectroscopy. The course contents & topics includes Symmetry elements and symmetry operations; symmetry point groups; reducible and irreducible representations; character tables; direct products; symmetry-adapted linear combinations; projection operators; hybrid orbitals; molecular orbital theory for organic, inorganic and organometallic systems; selected applications in electronic and vibrational spectroscopy.
Assessment: Assignments (25%); Examination (50%); Test (25%)

CHEM6117 Modern Chemical Instrumentation and Applications

The aim of the course is to provide an understanding of modern instrumentation, covering both fundamental principles and practical aspects of instrument design. The course will be of particular benefit to those pursuing a higher research degree or a career in technical sales/service.
Assessment: Assignments (10%); Examination (50%); Laboratory reports (25%); Test (15%)

CHEM6118 Frontiers in Modern Chemical Science
This course aims to introduce students to the newest concepts and technological breakthroughs in chemical sciences. Throughout the course, students will be introduced to how the interplay among molecules, materials, and interfaces leads to unprecedented functionalities that contribute to innovations in biology and medicine, smart materials, and sustainable energy schemes.
Assessment: Assignments (30%); Essay (35%); Presentation (35%)

EASC6009 Evolving Earth Systems
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: Assignments (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: Assignments (100%)

EASC6011 The Art of Scientific Presentations
This course aims to help earth science students to improve their presentation skills by introducing practical tips for oral-poster presentations and providing constructive feedback to individual students' presentations on research topics in earth sciences.
Assessment: Assignments (100%)

EASC6012 Seminar in Planetary Sciences
The overall goal is to broaden the scope of graduate-level curricula, to include a series of focused-topic courses for students considering research in planetary sciences. By increasing exposure to cutting-edge science, we hope these courses will spark interest in doing research in these fields. We also want to help students build practical research skills, like coding, plotting one's results to optimize scientific communication, and how to get the most out of reading papers.
Assessment: Assignments (100%)

MATH6014 Topics in Advanced Numerical Analysis
This course delves into advanced topics in numerical analysis, providing students with a comprehensive understanding of key concepts and methods, as well as their cutting-edge developments in data-driven modeling and generative artificial intelligence (AI).
Assessment: Coursework (50%); Examination (50%)

MATH6015 Topics in Artificial Intelligence and Machine Learning

Selected topics in artificial intelligence that are of current interest will be discussed in this course.
Assessment: Coursework (50%); Examination (50%)

MATH6101 Intermediate Complex Analysis
The objective is to familiarize students with analytic, algebraic and geometric concepts and techniques in the study of Complex Analysis in a single variable beyond an introductory course on functions of a complex variable.
Assessment: Written midterm test and end-of-term assessment (100%)

MATH6207 Topics in Applied Mathematics
Selected topics in modeling, analysis, and numerical computation of mathematical models for collective dynamics.
Assessment: Assignment and test (50%); Examination (50%)

MATH6216 Stochastic Processes
Introduction to Brownian motion and related stochastic processes.
Assessment: Assignment and test (50%); Examination (50%)

MATH6219 Topics in Applied Functional Analysis
This is a graduate to advanced undergraduate university level course on applied functional analysis, which aims at introducing to students the basic knowledge of using functional analysis on various applied topics in mathematics. This course would lay a foundation for students in studying more advanced mathematical courses.
Assessment: Presentation (50%); Project reports (50%)

MATH6224 Topics in Advanced Probability Theory
Depending on the instructor, this course focuses on selected topics in probability theory.
Assessment: Project reports (50%); Test (50%)

MATH6501 Topics in Algebra
To provide students specializing in mathematics with the opportunity to study some topics in algebra in greater depth.
Assessment: Assignments + Project (50%); Oral Presentation (50%)

MATH6502 Topics in Applied Discrete Mathematics
This is a follow-up of the course MATH3600. It introduces students to some powerful linear algebra and probabilistic methods that have been used with striking success in discrete mathematics, and covers some of the most fundamental and beautiful results obtained by these methods.
Assessment: Coursework (50%); Examination (50%)

MATH6503 Topics in Advanced Optimization
To learn a selection of advanced and up-to-date topics in continuous optimization, including theory, numerical algorithms and applications.
Assessment: Assignment (10%); Essays (20%); Oral Presentation (20%); Research Project Report (30%); Written Midterm (20%)

MATH6505 Real Analysis
To introduce the basic ideas and techniques of measure theory and the Lebesgue integral.
Assessment: Test (40%); Examination (60%)

MATH7301 Lie Groups and Lie Algebras
This is an introductory course of Lie groups and Lie algebras and their representations. It covers basic concepts of Lie groups and Lie algebras, the Lie algebra of a Lie group, exponential map, the fundamental theorems of Lie theory, representations of compact Lie groups.
Assessment: Assignments + Project (40%); Oral Presentation (60%)

MATH7302 Topics in Number Theory
The course covers selected topics in graduate-level number theory that interplay with analysis, algebra or geometry, etc.
Assessment: Assignments + Quizzes (60%); Presentation/ Final Report (30%); Participation (10%)

MATH7304 High Dimensional Probability
This is an introductory course to a modern and active area of mathematical research, high dimensional probability. HDP is at the core of random matrix theory, random graph theory, and randomized algorithms, and has a very wide range of applications.
Assessment: Assignments + Tests (50%); Oral Presentation (50%)

PHYS8351 Graduate Quantum Mechanics
This course introduces postgraduates to theory and advanced techniques in quantum mechanics, and their applications to selected topics in condensed matter physics.
Assessment: Assignments (20%); Examination (50%); Test (30%)

PHYS8352 Quantum Information
This course covers the theory of quantum information and computation and its applications in physics and computer science.
Assessment: Assignments (20%); Examination (50%); Test (30%)

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 (40%); Examination (50%); Test (10%)

PHYS8550 Graduate Statistical Mechanics
This course covers advanced topics in equilibrium statistical physics.
Assessment: Assignments (50%); Examination (50%)

PHYS8552 Condensed Matter Physics
This course introduces many-body physics in quantum matter. Systems consisting of many particles (bosons or fermions) display novel collective phenomena that individual particles do not have, for example, ferromagnetism and superfluidity. It aims to introduce students the general principles behind these phenomena, such as elementary excitations, spontaneous symmetry breaking, adiabatic theorems, emergent topological phases of matter, etc. Theoretical language useful in the interpretation of experiments, such as linear response theory and response functions, will be discussed. This course is intended for both experimentalists and theorists. Students who would like to take this course are assumed to have sufficient knowledge on quantum mechanics and statistical mechanics.
Assessment: Assignments (40%); Essay (60%)

PHYS8653 Selected Topics in High Energy Astrophysics and Cosmology
The aim of the course is to offer an advanced introduction to cosmology as well as some current topics in high energy astrophysics. It may be taken as a self-contained course or as background to research work in astrophysics or cosmology.
Assessment: Assignments (30%); Examination (50%); Test (20%)

PHYS8654 General Relativity
This course serves as a graduate level introduction to general relativity. It provides conceptual skills and analytical tools necessary for astrophysical and cosmological applications of the theory.
Assessment: Assignments (10%); Examination (50%); Test (40%)

PHYS8656 Topics in Astrophysics
This course covers high energy processes, basic theory of stellar structure and evolution, and introduction to compact objects. It follows a vigorous mathematical treatment that stresses on the underlying physical processes.
Assessment: Assignments (10%); Examination (50%); Project reports (10%); Test (30%)

PHYS8701 Physics Experimental Techniques
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 Physics of Nanoelectronics
This course is designed to deliver fundamental concepts and principles of quantum transport phenomena in nanoelectronic systems to fresh postgraduate students.
Assessment: Assignments (24%); Examination (50%); Mid-term test (26%)

PHYS8751 Device Physics
This course aims at presenting a comprehensive introductory account of the physics and operational principles of some selected and yet classic semiconductor devices, microelectronic and optoelectronic. The text is primarily designed for postgraduates but can be of interest to senior undergraduates in physics, electrical and electronic engineering and materials science. Students are assumed to have acquired some basic knowledge of quantum mechanics, statistical mechanics, and solid state physics, though a review of the physics of semiconductors will be given in the beginning of the course.
Assessment: Assignments (20%); Examination (50%); Test (30%)

PHYS8852 Photonics and Metamaterials
This course aims at providing the fundamental understanding of the interaction of light with structured media whose unit cells are much smaller than the wavelength of light, and the design and functionalities of various metamaterial-based photonic devices. The course text is primarily designed for senior undergraduate students and postgraduate students and requires some knowledge on electromagnetism and optics. On the other hand, it will also be of interest to graduate students since it includes some most recent results in the field of metamaterials and nanophotonics.
Assessment: Assignments (50%); Examination (50%)

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%)