

## **REGULATIONS FOR THE DEGREES OF MASTER OF SCIENCE (MSc) AND MASTER OF SCIENCE IN ENVIRONMENTAL MANAGEMENT (MSc[EnvMan])**

*For students admitted in 2021-22 and thereafter.*

*(See also General Regulations and Regulations for Taught Postgraduate Curricula)*

Any publication based on work approved for a higher degree should contain a reference to the effect that the work was submitted to the University of Hong Kong for the award of the degree.

The degree of Master of Science is a postgraduate degree awarded for the satisfactory completion of a prescribed course of study in one of the following five fields: Applied Geosciences, Food Industry: Management and Marketing, Food Safety and Toxicology, Physics and Space Science.

The degree of Master of Science in Environmental Management is a postgraduate degree awarded for the satisfactory completion of a prescribed course of study in Environmental Management.

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### **Admission requirements**

#### **Sc21**

- (a) To be eligible for admission to the courses leading to the degree of Master of Science or Master of Science in Environmental Management, a candidate
    - (i) shall comply with the General Regulations and the Regulations for Taught Postgraduate Curricula;
    - (ii) shall hold a Bachelor's degree with honours of this University; or another qualification of equivalent standard of this University or another University or comparable institution accepted for this purpose;
    - (iii) in respect of the courses of study leading to the degree of Master of Science in the field of Space Science, shall hold a Bachelor's degree in a relevant science or engineering discipline, and prior knowledge expected in basic college-level physics, mathematics, statistics, and computer programming;
    - (iv) in respect of the courses of study leading to the degree of Master of Science in the field of Physics, a Bachelor's degree with honours in a relevant science (e.g. physics, astronomy, earth science, mathematics) or engineering, and prior knowledge expected in university-level electromagnetism, quantum mechanics and thermodynamics, university-level linear algebra and multi-variable calculus, basic statistics, and some computer programming experience (e.g. coding in C++, Mathematica, Matlab or Python); and
    - (v) shall satisfy the examiners in a qualifying examination if required.
  - (b) A candidate who does not hold a Bachelor's degree with honours of this University or another qualification of equivalent standard may in exceptional circumstances be permitted to register if the candidate demonstrates adequate preparation for studies at this level and satisfies the examiners in a qualifying examination.
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### **Qualifying examination**

#### **Sc22**

- (a) A qualifying examination may be set to test the candidate's academic ability to follow the course of study prescribed. It shall consist of one or more written papers or equivalent and may include a project proposal.

- (b) A candidate who is required to satisfy the examiners in a qualifying examination shall not be permitted to register until he/she has satisfied the examiners in the examination.
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### **Award of degree**

**Sc23** To be eligible for the award of the degree of Master of Science or Master of Science in Environmental Management, a candidate

- (i) shall comply with the General Regulations and the Regulations for Taught Postgraduate Curricula; and
  - (ii) shall complete the curriculum and satisfy the examiners in accordance with these regulations and syllabuses.
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### **Advanced standing**

**Sc24** In recognition of studies completed successfully before admission to the Master of Science in Environmental Management, Master of Science in the field of Applied Geosciences and Master of Science in the field of Space Science, advanced standing of up to 12 credits may be granted to a candidate with appropriate qualification and professional experiences, on production of appropriate certification, subject to the approval of the Board of the Faculty. Credits gained for advanced standing shall not be included in the calculation of the GPA but will be recorded on the transcript of the candidate. The candidate should apply before commencement of first year of study via the Department and provide all the supporting documents.

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### **Period of study**

**Sc25** The curriculum of the Master of Science or the Master of Science in Environmental Management shall normally extend over one academic year of full-time study or two academic years of part-time study. Candidates in either degree shall not be permitted to extend their studies beyond the maximum period of registration of two academic years of full-time study or three academic years of part-time study, unless otherwise permitted or required by the Board of the Faculty.

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### **Completion of curriculum**

**Sc26** To complete the curriculum of the Master of Science or Master of Science in Environmental Management, a candidate

- (a) shall satisfy the requirements prescribed in TPG 6 of the Regulations for Taught Postgraduate Curricula;
  - (b) shall follow courses of instruction and complete satisfactorily all prescribed written, practical and field work;
  - (c) shall complete and present a satisfactory dissertation or project on an approved subject or complete courses with equivalent credits as a replacement; and
  - (d) shall satisfy the examiners in all courses prescribed in the respective syllabuses.
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### **Dissertation or Project**

**Sc27** The title of the dissertation or project shall

- (a) for the full-time mode of Master of Science (except MSc in Environmental Management), be submitted for approval by October 15 and the dissertation or project report shall be

- submitted not later than August 15 in the subsequent year;
- (b) for the full-time curriculum of MSc in Environmental Management, be submitted by October 30 and the dissertation or project report shall be submitted not later than the last Friday in June of the first year of study, unless otherwise permitted or required by the course coordinator(s);
  - (c) for the part-time curriculum (except Master of Science in the field of Applied Geosciences, Master of Science in the field of Physics and MSc in Environmental Management), be submitted for approval by March 15 of the first year of study and the dissertation or project report shall be submitted not later than July 1 of the second year of study;
  - (d) for the part-time curriculum of MSc in Environmental Management, be submitted by June 30 of the first academic year, unless otherwise permitted or required by the course coordinator(s). The dissertation shall be submitted not later than the last Friday in May of the second year of study and the project report shall be submitted not later than the last Friday in June of the second year of study, unless otherwise permitted or required by the course coordinator(s);
  - (e) for the full-time curriculum of Master of Science in the field of Physics, be submitted by October 15 and the dissertation or project report shall be submitted not later than the last Friday in May of the first year of study;
  - (f) for the part-time curriculum of Master of Science in the field of Physics, be submitted by October 15 of the first academic year and the dissertation or project report shall be submitted not later than the last Friday in May of the second year of study.

**Sc 28** A candidate shall submit a statement that the dissertation or project represents his/her own work (or in the case of co-joint work, a statement countersigned by his/her worker, which shows his/her share of the work) undertaken after registration as a candidate for either degree.

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## **Assessments**

**Sc29** The assessment in any course shall consist of elements prescribed by the course teachers, and will normally comprise either written coursework alone, or coursework combined with formal examinations; in either case participation in field work or practical work may form part of the assessment.

**Sc30** A candidate who has failed to satisfy the examiners

- (a) at his/her first attempt in any course in the examination held during any of the academic years of study may be permitted to present himself/herself for re-examination in the course or courses at a specified subsequent examination, with or without repeating any part of the curriculum;
- (b) at his/her first submission of dissertation or project report may be permitted to submit a new or revised dissertation or project report within a specified period;
- (c) in any prescribed fieldwork or practical work may be permitted to present himself/herself for re-examination in fieldwork or practical work within a specified period.

**Sc31** Failure to take the examination as scheduled, normally results in automatic course failure. A candidate who is unable because of illness to be present at any examination of a course, may apply for permission to be present at some other time. Any such application shall be made on the form prescribed within two weeks of the examination.

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## Discontinuation

- Sc32** A candidate who
- (a) has failed to satisfy the examiners in more than half the number of credits of courses during any of the academic years or in any course at a repeated attempt, or
  - (b) is not permitted or fails to submit a new or revised dissertation or project report, or
  - (c) has failed to satisfy the examiners in their dissertation or project report at a second attempt, may be recommended for discontinuation of studies.
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## Assessment results

**Sc33** On successful completion of the curriculum, candidates who have shown exceptional merit may be awarded a mark of distinction, and this mark shall be recorded in the candidates' degree diploma.

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## Grading systems

**Sc34** Individual courses shall be graded according to one of the following grading systems as determined by the Board of Examiners:

- (a) Letter grades, their standard and the grade points for assessments as follows:

Grade	Standard	Grade Point
A+	Excellent	4.3
A		4.0
A-		3.7
B+	Good	3.3
B		3.0
B-		2.7
C+	Satisfactory	2.3
C		2.0
C-		1.7
D+	Pass	1.3
D		1.0
F	Fail	0

or

- \*(b) 'Pass' or 'Fail'

Courses which are graded according to (b) above will not be included in the calculation of the GPA.

\*Only applies to certain courses in MSc in the field of Applied Geosciences and MSc in the field of Physics

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# SYLLABUSES FOR THE DEGREE OF MASTER OF SCIENCE IN THE FIELD OF APPLIED GEOSCIENCES

*For students admitted in 2021-22 and thereafter.*

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## A. COURSE STRUCTURE

To be eligible for the award of the MSc in the field of Applied Geosciences a student shall complete all core courses and total credits prescribed in a selected theme and elective courses, if any, totalling 66 or 69 credits.

### ***ENGINEERING GEOLOGY THEME (66 credits)***

#### Core Courses

GEOS7010	^Geology principles and practice (6 credits)
GEOS7011 OR GEOS7033	*Advanced geology of Hong Kong (6 credits) OR ^Geology of Hong Kong (6 credits)
GEOS7012	Site investigation and engineering geological techniques (6 credits)
GEOS7015	Rock mechanics (3 credits)
GEOS7016	Soil mechanics (3 credits)
GEOS7020	Project Part I (6 credits)
GEOS7021 OR GEOS8021	^ Geological fieldwork I (3 credits) OR *Geological fieldwork II (3 credits)
GEOS8001	Hydrogeology (3 credits)
GEOS8002	Professional practice in applied geosciences (3 credits)
GEOS8003	Seminars on unforeseen ground conditions, geotechnical and environmental failures (3 credits)
GEOS8020	Project Part II (12 credits)
GEOS8101	Engineering geology and geotechnical design (6 credits)
GEOS8102	Rock engineering and geomaterials (6 credits)
GEOS8104	*Natural hillside landslide and hazard studies (3 credits)
GEOS8204	+^Basic structural mechanics and behaviour (3 credits)

#### Other courses

GEOS7022	#Course of directed studies (3 credits)
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\* For students with a first degree in Geology or a related subject

^ For students whose first degree is not in Geology or a related subject

△ Not a core course for students taking course GEOS7022 and students whose first degree is not in Geology or a related subject

+ Students with a first degree in Civil Engineering cannot take this course for credits

# As directed by the programme director

Core courses for students with a first degree in Geology or a related subject:

GEOS7011, 7012, 7015, 7016, 7020, 8001, 8002, 8003, 8020, 8021, 8101, 8102, 8104, 8204 – 66 credits.

Course GEOS7022 may be substituted for course GEOS8204.

Core courses for students whose first degree is not in Geology or a related subject:

GEOS7010, 7012, 7015, 7016, 7020, 7021, 7033, 8001, 8002, 8003, 8020, 8101, 8102 – 66 credits.

## ***ENGINEERING GEOLOGY WITH HKIE APPROVED COURSES THEME (69 credits)***

### Core Courses

GEOS7012	Site investigation and engineering geological techniques (6 credits)
GEOS7015	Rock mechanics (3 credits)
GEOS7016	Soil mechanics (3 credits)
GEOS7020	Project Part I (6 credits)
GEOS7024	Management (3 credits)
GEOS8001	Hydrogeology (3 credits)
GEOS8002	Professional practice in applied geosciences (3 credits)
GEOS8003	Seminars on unforeseen ground conditions, geotechnical and environmental failures (3 credits)
GEOS8020	Project Part II (12 credits)
GEOS8101	Engineering geology and geotechnical design (6 credits)
GEOS8102	Rock engineering and geomaterials (6 credits)
GEOS8204	Basic structural mechanics and behaviour (3 credits)
GEOS8205	Mathematics I (6 credits)
GEOS8206	Mathematics II (6 credits)

Certain courses not included above may be accepted as electives at the discretion of the programme director.

Teaching will take place mainly on weekday evenings but students are expected to undertake field and laboratory work during weekends. Normally there are two evening classes each week but in some semesters there are three. Full-time students attend the same evening classes as part-time students, most of whom have day-time employment. Concentrated teaching may be held at weekends.

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## **B. COURSE CONTENTS**

### **GEOS7010 Geology principles and practice (6 credits)**

A review of fundamental concepts in geoscience, including earth and geological processes, surface processes, minerals and rocks, geological structures and geological map interpretation. The course also introduces the rocks and geological formations of Hong Kong.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS7011 Advanced geology of Hong Kong (6 credits)**

This advanced course examines specialist aspects of the rocks and geological formations and structures of Hong Kong and their significance in the context of geotechnical engineering, environmental management and resource development. Topics include volcanic and granitic rocks, sedimentary and metamorphic rocks, weathering processes, superficial deposits, geology and geological aspects of landslides.

Assessment: Course work (50%) and written examination (50%)

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### **GEOS7012 Site investigation and engineering geological techniques (6 credits)**

A professional course on the concepts and skills used in geotechnical site investigation. Topics include the design of site investigations, desk study and walkover survey, aerial photographic interpretation, soil and rock description and classification, ground investigation technology and soil and rock laboratory testing.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS7015 Rock mechanics (3 credits)**

The course introduces the basic concepts of rock mechanics used in geotechnical practice. Topics include index properties, strength and deformability of intact rock; distribution and measurement of in-situ stresses; and shear strength of discontinuities in rock masses.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS7016 Soil mechanics (3 credits)**

An examination of the basic soil mechanics theory used in geotechnical practice. The course reviews phase relationships, soil classification, compaction, fluid flow and effective stress concepts; and provides a more detailed analysis of elasticity, shear strength and consolidation.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS7020 Project Part I (6 credits)**

The first phase of an independent study of a problem in applied geosciences. It involves literature review, data collection and data analysis. Students are required to write an inception report and give a presentation on their proposed study. Work is required on the project during the summer following the second semester. Professional geologists are expected to undertake a field mapping task as part of their project. This course provides a capstone experience.

Assessment: Course work (100%)

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### **GEOS7021 Geological fieldwork I (3 credits)**

Self-directed study in the field over a 6-month period leading to the production of maps, field sheets, narrative accounts and other geological records for assessment. The fieldwork may be undertaken in association with the excursions of the Department of Earth Sciences, the local learned societies or independently. (Marked on a pass/fail basis.)

Assessment: Course work (100%)

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### **GEOS7022 Course of directed studies (3 credits)**

Studies to assist learning in the core courses, involving some of the following activities: professional activities, field work, laboratory work, internship, class exercises, tutorials and reading.

Assessment: Course work (80%) and oral examination (20%)

### **GEOS7024 Management (3 credits)**

This subject provides the graduate with basic knowledge of project management practice. It will cover most of the following: engineering processes, programming and procurement strategies; contract management; construction site safety, health and environmental aspects; quality control and quality assurance.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS7033 Geology of Hong Kong (6 credits)**

To provide an understanding of the principal components of the geology of Hong Kong and its regional setting, including the distribution and interpretation of the main rock types, age relationships; and superficial deposits; and the locations and orientations of the main regional and local structures.

Pre-requisite course: Pass in GEOS7010

Assessment: Course work (50%) and written examination (50%)

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### **GEOS8001 Hydrogeology (3 credits)**

To study the role of sub-surface water in engineering and environmental applications. Topics include the hydrologic cycle, properties of aquifers controlling the transmissivity storage and quality of groundwater, quantification of groundwater flow, the field investigation of groundwater and assessment of field parameters and applications of hydrogeology in engineering and environmental studies.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS8002 Professional practice in applied geosciences (3 credits)**

An examination of issues in professional practice in applied geoscience, including regulation of practice, professional ethics and law, contracts and risk management.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS8003 Seminars on unforeseen ground conditions, geotechnical and environmental failures (3 credits)**

A series of student-led seminars on case histories of landslides, collapses of engineering structures, excessive ground settlement and environmental disasters. Presentations of facts and opinions are given by students based on suggested reading material. This course provides a capstone experience.

Pre-requisite course: Pass in GEOS8002

Assessment: Course work (100%)

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### **GEOS8020 Project Part II (12 credits)**

The second phase of an independent study of a problem in applied geosciences culminating in the preparation of a project report of about 10,000 words. Students will be required to make a presentation of



their preliminary results. This course provides a capstone experience.

Assessment: Course work (100%)

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### **GEOS8021 Geological fieldwork II (3 credits)**

Self-directed study in the field over a 6-month period leading to the production of maps, field sheets, narrative accounts and other geological records for assessment. The fieldwork may be undertaken in association with the excursions of the Department of Earth Sciences, the local learned societies or independently. (Marked on pass/fail basis.)

Assessment: Course work (100%)

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### **GEOS8101 Engineering geology and geotechnical design (6 credits)**

An examination of civil engineering design methodology and the application of soil mechanics theory and empiricism in geotechnical design. Emphasis is given to soil slopes and embankments, earth pressure and retaining structures and shallow and deep foundations.

Pre-requisite course: Pass in GEOS7016

Assessment: Course work (30%) and written examination (70%)

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### **GEOS8102 Rock engineering and geomaterials (6 credits)**

This course starts with a brief introduction to the design methodology and the systems approach in rock engineering, and is mainly focused on the collection and analyses of engineering geological data for the design of rock structures. Uses of rock mechanics input and empirical classifications in analysis and design of rock slopes, tunnel excavation and support systems, and rock foundations are demonstrated through case histories.

Pre-requisite course: Pass in GEOS7015

Assessment: Course work (30%) and written examination (70%)

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### **GEOS8104 Natural hillside landslide and hazard studies (3 credits)**

The contents of this course will include most of the following topics: classification of landslides; Hong Kong terminology, examples of natural terrain landslides and documentary sources of information; hillslope evolution, geomorphological principles (including the evolutionary landform models of Dalrymple and Hansen) and Quaternary geology of Hong Kong; hillslope hydrology, modes of groundwater flow, runoff and infiltration, piping; hydrological and morphological conditions for initiation of shallow landslides in regolith; engineering geological and geomorphological mapping; landform processes; regolith mapping, boulder identification; landslide hazard assessment; landslide susceptibility assessment for risk quantification; design event approach; landslide mobility modelling.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS8204 Basic structural mechanics and behaviour (3 credits)**

The subject will cover most of the following:

Behaviour of structural members subjected to tension, compression, bending, shear and torsion. Buckling of compression members. Statically determinate and indeterminate structures; including the concept of redundancy of structural members. Load transfer mechanisms of structural systems including foundations and shoring systems. General behaviour and basic concepts in design of reinforced concrete members. Structural design of foundations and retaining walls.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS8205 Mathematics I (6 credits)**

This course (together with GEOS8206 Mathematics II) strives to provide a comprehensive introduction to the fundamental mathematics that all earth scientists need. Topics include the language of sets, the concept of matrices and its applications, functions, limits, first order differentiation, applications of derivatives, first order Taylor's expansion, properties of exponential and logarithmic functions, the notation of integration, integration techniques, volume of revolution, higher order differentiation and Taylor's expansion, Hessian test for functions of two variables, the concept of multiple integration, and volume using triple integration.

Assessment: Course work (30%) and written examination (70%)

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### **GEOS8206 Mathematics II (6 credits)**

This course is a continuation of GEOS8205 (Mathematics I). The first part of the course aims to teach students different solution methods to first order differential equations (separable, linear, Bernoulli, exact/non-exact types), second order linear differential equations with constant coefficients using characteristic equation, method of variation of parameters, method of educated guess. The second part introduces the concept of probability and statistics, topics include counting, probability (using the language of sets), random variables (including Binomial, Poisson, Exponential, Normal), probability density/distribution functions, cumulative distribution functions, joint distributions, independence, mean, variance, covariance, moment generating functions, sampling and confidence intervals (using Normal/t- distributions).

Assessment: Course work (30%) and written examination (70%)

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## **C. PROGRAMME LEARNING OUTCOMES**

1. Can apply geological and related engineering knowledge and skills in the solution of problems in the student's discipline.
2. Can explain, use and critically assess the use of science related to the student's discipline.
3. Insists on knowing the facts before making a judgement; exhibits judicial habits of mind.
4. Effective in defining and solving problems from first principles, without reliance on solutions from memory; can satisfactorily complete a self-directed study.
5. Effective in oral, written and graphical communication.
6. Works well in a team.
7. Knows the standards of conduct required by law, by the student's professional qualifying body and by the university and why it is important to uphold a high standard of professional ethics. Knows the specific malpractices that may be encountered in the student's profession and how to guard against malpractice.

8. Able to recognise, articulate and advocate the societal benefits of the application of best practice in engineering geology in the construction industry, in the use of earth resources and in the mitigation of geological risk.<sup>1</sup>

<sup>1</sup> for those taking the Engineering Geology Theme or the Engineering Geology with HKIE Approved Courses Theme of the MSc in Applied Geosciences

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## **D. ACADEMIC ASSESSMENT**

The following Grade Descriptors will be used in academic assessment:

Grade A	Is very good or excellent in using basic principles and essential skills in practice. Requires very limited supervision. Is creative, work is virtually error free and writes well. Can apply learning in unfamiliar situations.
Grade B	Is good in using the basic principles and the essential skills in practice but requires some supervision.
Grade C	Is able to state most of the basic principles but is poor at using them, and the essential skills, in practice without direction.
Grade D	Marginal Pass and any Pass in a supplementary examination.
Fail	Does not know most of the basic principles and has not mastered the essential skills used in practice.

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# SYLLABUSES FOR THE DEGREE OF MASTER OF SCIENCE IN THE FIELD OF FOOD INDUSTRY: MANAGEMENT AND MARKETING

*For students admitted in 2021-2022 and thereafter.*

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## A. COURSE STRUCTURE

All courses in this programme are compulsory. A candidate shall be examined shortly after the completion of each course.

The list of courses, and their contents set out thereafter, may be changed from time to time.

### First Year

FOOD7001	Quality assurance and management I (6 credits)
FOOD7002	Quality assurance and management II (6 credits)
FOOD7003	Advance food technology (6 credits)
FOOD7005	Food product development & marketing (9 credits)
FOOD7006	Future food (9 credits)

### Second Year

FOOD8006	Marketing management (6 credits)
FOOD8007	Financial control (6 credits)
FOOD8008	Organisational behaviour (6 credits)
FOOD8009	Project (12 credits) [ <i>Capstone experience</i> ]

Total: 66 credits

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## B. COURSE CONTENTS

### FOOD7001 Quality assurance and management I (6 credits)

This course includes an overview on the practical aspects of quality management not only from consumer's, but also on all stakeholders' perspectives in managing a cost effective quality department. The management of food laboratory as well as lab accreditation requirements will be introduced in this course. Students will learn the different phases of crisis management supplemented with case studies for discussion and practice. Issue management, crisis handling, product recall, post-crisis recovery will be discussed. Students will learn the skills in risk management. Troubleshooting techniques for root cause analysis during product failure including microbiological troubleshooting will be discussed. Quality / process improvement tools will be introduced.

Assessment: Course work (70%); Examination (30%)

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### FOOD7002 Quality assurance and management II (6 credits)

This course includes an overview on quality management focused on safety and risk management. Students will learn food quality and safety management, and crisis and management in food industry. Core components in GMP and other safety standards and religious related standards (GSFI, ISO, BRC, Halal, Kosher) will be introduced in this course. Through these foundations and exercises of problem solving, students will be able to apply the knowledge in decision making of crisis and the use of modern communications for intervention.

Assessment: Course work (60%); Examination (40%)

### **FOOD7003 Advance food technology (6 credits)**

The effects of processing and packaging on the shelf lives and changes in physical and chemical characteristics of food products will be discussed. Emphasis will be placed on the food preservation methods to extend product shelf lives as applicable to the popular local food products. Methods for sensitive nutrients and techniques to preserve the characteristic aroma and taste of a product in processing modification will be reviewed. Issues related to nutrient enrichment and fortification will be discussed. Case studies will be used to dispel the many misplaced information on food preservations and alternatives to extending shelf life of foods without the use of the traditional food preservatives. In addition, understanding of various newly world-visionic food ingredients for health is will be introduced; reformulation to reduce sugar and fat as well as reinforcement of fibres to foods are to be discussed.

Assessment: Course work (70%); Examination (30%)

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### **FOOD7005 Food product development and marketing (9 credits)**

The role of research from the management perspective, the R & D process and the impact of technological innovation on the development of new products will be discussed. Interrelationship between product recipes, processing and food packaging in the food product development process will be discussed together with the effects of product formulations on food safety, sustainability, fair trade and business ethics will be highlighted.

Cultural and religious aspects will be emphasized as an important consideration in developing new market frontiers. The strengths and weaknesses of major “Chinese food” manufacturers will be analyzed. Areas of potentials business opportunities will be identified and explored. The difference in the product development process among local food companies as compared to more established FMCG global food companies will also be discussed.

Basic concepts of intellectual property rights will also be described in this course: copyright, trademarks, trade secrets, patents. Patent strategy for research-intensive technology companies. Practical aspects and international considerations in filing for patent protection are highlighted. The application of information technology in food manufacturing and catering, and the concepts of logistics in supply chain and new regulations in cold chain and food delivery will be discussed.

Assessment: Course work (60%); Examination (40%)

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### **FOOD7006 Future food (9 credits)**

Due to social and consumer’s demands, practical modifications in food industries are inevitable. Notwithstanding, the use of advanced technology, AI and urban farming has become essential in the current generation. Students will learn up-to-date approaches in sustaining food retail such as resources, digital business and the use of big data, and the application of modern farming in the city. Guest lectures from local and international experts will be invited to exchange real-life experience in the current food industry.

Assessment: Course work (100%)

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### **FOOD8006 Marketing management (6 credits)**

The course is designed to provide an understanding of the role of marketing in the business organization and its contribution to business success. Students will be introduced to different marketing concepts, marketing programs, planning and execution of marketing strategies. On completion of the course, students will be able to analyze customer requirements, competitive environment and to formulate effective marketing program. Sharing sessions with industry practitioners will be arranged to deliver

the topics on marketing in food industry (F&B operations & marketing, food labelling tracking system, food safety management and accreditation of ISO 22000 standard to create/deliver customer value) and field work will be arranged to visit food industry settings in Hong Kong. In addition, field work will be arranged for the students to visit the real-life food industry settings (e.g. Chinese restaurant, hotel steak house, shared kitchen, food factory + online delivery) and they are required to apply the marketing concepts to formulate a marketing plan for these companies as part of their assessment in the course.

Assessment: Course work (60%); Examination (40%)

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### **FOOD8007 Financial control (6 credits)**

The course aims to equip non-accounting professionals with the skills required to analyse and interpret the major financial reports prepared by businesses. The focus of the course is on providing a user perspective of the financial statements and aim as how to use financial information in daily business life. In addition, the course addresses principles of basic financial management and explains the need for internal control procedures. Particular emphasis is given to develop an understanding of the balance sheet, profit and loss statement, and cash flow statement. The relationship between the statements will be explained and illustrated in detail. Study detail on different types of costing and how they impact business decision will be taught. A framework for making business decisions by analysing a set of financial statements using simple techniques will also be developed.

Assessment: Course work (60%); Examination (40%)

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### **FOOD8008 Organisational behaviour (6 credits)**

The course aims to equip students with a better understanding of the complex array of behaviours in organisational life. It will analyse the determinants of human behaviour in an organisation at the individual, group and organisational levels. Topics covered will include motivation, performance management, group dynamics, leadership, organisational culture, management of conflict, management of ethics, and the leading change.

Assessment: Course work (70%); Examination (30%)

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### **FOOD8009 Project (12 credits) [Capstone experience]**

This is an individual or group research project to be carried out under the supervision of one or more faculty members. Students may propose their own topics and approach potential supervisors, or they may consider those suggested by the faculty members. The proposed project title must be submitted for approval before starting the study. The candidate shall make a formal presentation on the subject of his/her project during the final semester of the teaching programme.

Assessment: Course work (100%)

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# SYLLABUSES FOR THE DEGREE OF MASTER OF SCIENCE IN THE FIELD OF FOOD SAFETY AND TOXICOLOGY

*For students admitted in 2021-2022 and thereafter.*

All courses in this programme are compulsory. A candidate shall be examined shortly after the completion of each course.

## A. Course Structure

<b>Programme Structure of the <u>Full-time</u> Mode:</b>		
<b>Year 1 (69 credits)</b>		
FSTX7001	Principles of toxicology I	(9 credits)
FSTX7002	Principles of toxicology II	(9 credits)
FSTX7003	Toxicity tests and hazards evaluation methods	(9 credits)
FSTX7004	Regulatory toxicology: risk assessment, risk management and communication	(12 credits)
FSTX8005	Chemical and microbial hazards in food	(9 credits)
FSTX8006	Food safety management	(9 credits)
FSTX8007	Project [ <i>Capstone experience</i> ]	(12 credits)

<b>Programme Structure of the <u>Part-time</u> Mode:</b>		
<b>Year 1 (39 credits)</b>		
FSTX7001	Principles of toxicology I	(9 credits)
FSTX7002	Principles of toxicology II	(9 credits)
FSTX7003	Toxicity tests and hazards evaluation methods	(9 credits)
FSTX7004	Regulatory toxicology: risk assessment, risk management and communication	(12 credits)
<b>Year 2 (30 credits)</b>		
FSTX8005	Chemical and microbial hazards in food	(9 credits)
FSTX8006	Food safety management	(9 credits)
FSTX8007	Project [ <i>Capstone experience</i> ]	(12 credits)

## B. Course Content

### **FSTX7001 Principles of toxicology I (9 credits)**

This module introduces students to the general principles and practice of toxicology. The major focus of the course is on basic principles, mechanisms and common methods underpinning the science of toxicology. Selected target organ systems (e.g. respiratory, nervous and immune systems) are studied with respect to understanding how representative chemicals damage and impair their ability to function. Students will develop a fundamental understanding of how chemicals may exert toxic effects and gain insight into the importance of organ-specific toxicity.

Assessment: Course work (25%); Examination (75%)

### **FSTX7002 Principles of toxicology II (9 credits)**

This module continues to introduce students to the general principles and practice of toxicology. The course continues to focus on basic principles, mechanisms and common methods underpinning the science of toxicology. Selected toxicants are studied with respect to their source of exposure and mechanisms of effects. Selected disease processes (e.g., mutagenesis, carcinogenesis, reproductive toxicity, teratogenesis and developmental toxicity) are studied with respect to understanding their basic pathways and common mechanisms. Selected fields are presented to give students insight into the applications of toxicology and its relationship with other fields.

Assessment: Examination (100%)

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### **FSTX7003 Toxicity tests and hazards evaluation methods (9 credits)**

This module will provide students with the current state-of-the-art methodology employed to investigate the effect of chemical and microbial toxins and environmental pollutants on living systems. Topics include exposure estimate, animal tests for acute toxicity, short-term and long-term toxicity, for mutagenicity, genotoxicity and carcinogenicity, for reproductive toxicity, teratogenicity, developmental toxicity and delayed neurotoxicity. Major focus is on the basic principles underpinning each test method including the test rationale, protocol design, limitations and data interpretation. Students will also be introduced to the basic concepts of toxicological evaluation and criteria for setting guidance values for dietary and non-dietary exposure to chemicals. The role of biochemical, metabolic and toxicokinetic studies in toxicological evaluation is also considered.

Assessment: Course work (20%); Examination (80%)

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### **FSTX7004 Regulatory toxicology: risk assessment, risk management and communication (12 credits)**

In order to fully appreciate risks that arise from human exposure to chemicals in our living environment, it is essential to quantify levels of chemical contamination in environmental media and foods, and estimate total chemical exposure from dietary and non-dietary sources. This module will provide students with intensive training to develop the necessary practical skills to measure and model the extent to which human populations come into contact with toxic agents in the environment and foods, to conduct qualitative and quantitative risk assessments, to set safe levels of chemical exposure in foods (based on local food consumption patterns), and to implement effective risk management in protecting human health and the environment. The roles of international food safety authorities such as WHO, FAO, Codex Alimentarius Commission, JECFA, IARC and OECD will be described. Introduction to local and international food laws will be provided.

Assessment: Course work (20%); Examination (80%)

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### **FSTX8005 Chemical and microbial hazards in food (9 credits)**

This module will introduce students to the chemical and microbial hazards in food and their effects on human health. Special reference is made to heavy metals, pesticides, food additives, persistent organic pollutants and natural food contaminants of current public concern. An emphasis will also be placed on developing the understanding of the actual impact of food and waterborne pathogens, their epidemiology and factors contributing to the increase in their incidence. Determination of exposure pathways and linking food hazards to human health is the primary focus. Topics include: contamination



monitoring, quantification of exposure at the individual level, interactive effects of exposure to multiple risk factors, perceptions of risk and integration of laboratory science with population-based studies.

Assessment: Course work (20%); Examination (80%)

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### **FSTX8006 Food safety management (9 credits)**

Good manufacturing practice has a significant impact on the daily operation of a food processing facility. Quality products and a safe work place are important components of a good company. This course will focus on issues arising from GMP and aspects of the physical design of a food processing facility which impact the safety of workers and products. In food supply chain, traceability is the ability to follow the movement of a food product through the stages of production, processing, and distribution, and is an important component of the food safety management system. As a core quality management tool in the food industry, the relevance, impact and use of ISO 22000 and HACCP in manufacturing and catering will be discussed. Topics covered will include the international/national HACCP standards, and designing safety into food products and processes as well as the practical development and implementation of a HACCP Plan using local and Asian case studies.

Assessment: Course work (20%); Examination (80%)

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### **FSTX8007 Project (12 credits) [Capstone experience]**

All students are required to undertake to attend training (up to maximum 6 months) in one of the following areas:

- Academic institutions, to carry out basic research project using the most advanced techniques in molecular biology, analytical chemistry and biomedical sciences.
- Food, chemical and pharmaceutical industries, to overlook industry procedures on ensuring that the emerging/newly developed food and chemical products meet regulatory standards and requirements and are safe for consumers; their potential health implications, and
- Government agencies, to gain knowledge on the procedures implemented by the local/national authorities in formulating science-based policies, laws and regulations to ensure the safe production and use of food and chemicals.

The candidate shall make a formal presentation on the subject of his training during the final semester of the teaching programme.

Assessment: Course work (100%)

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**SYLLABUSES FOR THE DEGREE OF  
MASTER OF SCIENCE IN ENVIRONMENTAL MANAGEMENT  
MSc(EnvMan)**

For students admitted in 2021-2022 and thereafter

A candidate shall follow and be examined in at least 60 credits of courses including core courses (42 - 51 credits) and elective courses (9 -18 credits). For Part-time candidates, they will normally take 30 credits in their first year of study and 30 credits in their second year of study. A 3-credit course will normally consist of 18-24 hours of lectures, seminars, workshops and/or field trips.

**A. COURSE STRUCTURE**

The list of courses, and their contents set out thereafter, will be changed from time to time.

<b>Programme Structure of the <u>Part-time</u> Mode (from 2021-2022 onwards):</b>	
The list of courses and their contents may be changed from time to time.	
<b><u>Year 1:</u></b>	
<b>Core courses (30 – 33 credits):</b>	
ENVM7003	Introduction to ecology (3 credits)
ENVM7012	Environmental economics and analysis (3 credits)
ENVM7013	Sustainability, society and environmental management (3 credits)
ENVM7014	Environmental quality management (6 credits)
ENVM7015	Research methods and report writing in environmental management (6 credits)
ENVM7016	Environmental policy (3 credits)
ENVM7017	Environmental law in Hong Kong (3 credits)
<b>Select at least one field study course:</b>	
ENVM7018	Environmental field studies (3 credits)
ENVM7019	Ecological field studies (3 credits)
<b><u>Year 2:</u></b>	
<b>Core courses (12 – 18 credits):</b>	
ENVM8006	Environmental impact assessment (3 credits)
<i>Select either one of the two capstone experience courses, i.e. ENVM8004 or ENVM8021</i>	

ENVM8004 #	Dissertation (15 credits) [ <i>Capstone experience</i> ]
ENVM8021	Project (9 credits) [ <i>Capstone experience</i> ]
<p><b>Elective courses (9 – 18 credits):</b>  <b>(Depending on the core courses taken):</b></p> <p>[Indicative only: courses' availability will vary from year to year]</p>	
ENVM8003	Conservation biology and management (3 credits)
ENVM8011	Environmental auditing and reporting (3 credits)
ENVM8012	Environmental health and risk assessment (3 credits) (May be taken in Year 1 summer semester)
ENVM8013	Air and noise pollution control and management (3 credits)
ENVM8014	Special topics in environmental management (3 credits)
ENVM8015	Directed studies in environmental management (6 credits)
ENVM8016	Conservation and management of freshwater resources (3 credits)
ENVM8017	Conservation and management of marine resources (3 credits)
ENVM8018	Urban planning and environmental management (3 credits)
ENVM8019	Corporate sustainability (3 credits)
ENVM8020	Green buildings and energy management (3 credits)
<p><b><i>Notes:</i></b> Alternative courses from all other taught Masters' programmes at HKU might be accepted at the discretion of the Programme Director.</p> <p><b><i>#</i></b> If a part-time student wishes to take ENVM8004 Dissertation, he/she must obtain a Grade B+ or above in ENVM7015 Research methods and report writing in environmental management by May of the first study year. Students must have submitted their dissertation titles and supervisor's names to the School of Biological Sciences by June 30 and are expected to commence work on their dissertation during the summer vacation between their first and second years of study. Students are also required to attend a dissertation research colloquium in their first and second years of study. They have to deliver presentations based on their dissertation project. The presentations will be assessed and this will contribute to the final grade awarded for the dissertation. Part-time students must submit their dissertation to the School of Biological Sciences on or before the last Friday in May in the second academic year of study, unless otherwise permitted or required by the course coordinator(s). On the successful completion of the degree, a copy of the outstanding dissertation may be lodged in the University Library for public access.</p>	

**Programme Structure of the Full-time Mode (from 2021-2022 onwards):**

The list of courses and their contents may be changed from time to time.

<b>Core Courses (42 – 51 credits):</b>	
ENVM7003	Introduction to ecology (3 credits)
ENVM7012	Environmental economics and analysis (3 credits)
ENVM7013	Sustainability, society and environmental management (3 credits)
ENVM7014	Environmental quality management (6 credits)
ENVM7015	Research methods and report writing in environmental management (6 credits)
ENVM7016	Environmental policy (3 credits)
ENVM7017	Environmental law in Hong Kong (3 credits)
ENVM8006	Environmental impact assessment (3 credits)
<b>Select at least one field study course:</b>	
ENVM7018	Environmental field studies (3 credits)
ENVM7019	Ecological field studies (3 credits)
<b>Select either one of the two capstone experience courses, i.e. ENVM8004 or ENVM8021</b>	
ENVM8004 #	Dissertation (15 credits) <i>[Capstone experience]</i>
ENVM8021	Project (9 credits) <i>[Capstone experience]</i>
<b>Elective courses (9 – 18 credits): (Depending on the core courses taken):</b>	
[Indicative only: courses' availability will vary from year to year]	
ENVM8003	Conservation biology and management (3 credits)
ENVM8011	Environmental auditing and reporting (3 credits)
ENVM8012	Environmental health and risk assessment (3 credits)
ENVM8013	Air and noise pollution control and management (3 credits)
ENVM8014	Special topics in environmental management (3 credits)
ENVM8015	Directed studies in environmental management (6 credits)
ENVM8016	Conservation and management of freshwater resources (3 credits)
ENVM8017	Conservation and management of marine resources (3 credits)

ENVM8018	Urban planning and environmental management (3 credits)
ENVM8019	Corporate sustainability (3 credits)
ENVM8020	Green buildings and energy management (3 credits)
ENVM8022	Environmental management internship (6 credits)

**Notes:** *Alternative courses from all other taught Masters' programmes at HKU might be accepted at the discretion of the Programme Director.*

**#** *If a full-time student wishes to take ENVM8004 Dissertation, he/she must pass a qualification assessment in September / October of the first study year. Students must have submitted their dissertation titles and supervisor's names to the School of Biological Sciences by October 30. Students are also required to attend a research colloquium at which presentations are made by students based on their dissertation project. The presentations will be assessed and this will contribute to the final grade awarded for the dissertation. Full-time students must submit their dissertation to the School of Biological Sciences on or before the last Friday in June in the first academic year of their study, unless otherwise permitted or required by the course coordinator(s). On the successful completion of the degree, a copy of the outstanding dissertation may be lodged in the University Library for public access.*

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## B. COURSE CONTENTS

### Core Courses

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#### **ENVM7003 Introduction to ecology (3 credits)**

This course deals with the ecological processes determining the distribution and abundance of organisms, and which in turn govern the structure and function of communities and ecosystems. The focus of the course is on how an understanding of ecology is important for environmental management. Together with lectures and student-centered learning, this course also incorporates a practical fieldwork component.

Assessment: Written examination (100%)

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#### **ENVM7012 Environmental economics and analysis (3 credits)**

The aim of this course is to equip students with the ability to undertake economic analyses of the environment. The course provides an introduction to economic concepts and principles and applies them to the analysis and management of environmental problems. The course covers the economic understanding of environmental problems (e.g. external costs and benefits, public goods, resource scarcity), economic instruments for environmental management (e.g. taxes, subsidies, tradable permits), methods for valuing environmental goods and services (market and non-market approaches), and economic tools for supporting decision-making (e.g. cost-benefit analysis). All topics will be illustrated with current environmental and policy issues to emphasize their relevance and applicability.

Assessment: Course work (60%) and written examination (40%)

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### **ENVM7013 Sustainability, society and environmental management (3 credits)**

This course begins with intellectual debates on the definitions, conceptions and different interpretations of the notion of sustainable development. The course then moves on to explore and analyse the implementation of the sustainability concept at the macro- and the micro- levels, covering a wide range of issues from international agreements and campaigns to local projects and practice. This will be followed by a number of implementation tools and techniques including community engagement and sustainability assessment. The course concludes with a series of real-life case investigations on innovative models to achieve sustainability in different contexts.

Assessment: Course work (100%)

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### **ENVM7014 Environmental quality management (6 credits)**

This course introduces students to the types, sources and effects of environmental pollution and some of the key principles and strategies used in combating pollution and managing environmental quality. Topics include water and air quality management, solid waste management and noise pollution control, with an emphasis on the situation in Hong Kong.

Assessment: Course work (30%) and written examination (70%)

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### **ENVM7015 Research methods and report writing in environmental management (6 credits)**

This course is intended both as preparation for the dissertation or project course and as a general introduction to writing reports on environmental issues. Subjects covered include: research design, research methodology (quantitative and qualitative methods; basic data processing and analysis) and report writing. Other research skills such as avoiding plagiarism, literature search and review and giving oral presentations may also be taught.

Assessment: Course work (100%)

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### **ENVM7016 Environmental policy (3 credits)**

This course focuses on key aspects of environmental policy-making and policy-implementation processes, such as how policy agendas emerge and evolve, how environmental discourse shapes policy outputs; and how institutions affect the trajectories and outcomes of environmental policy measures. Making references to local, national and international cases of successful and not-so-successful policies that pertain to the sustainable development agenda, the course also examines the theories and praxis of policy transfer and policy convergence, as well as the perennial problematics of policy integration, policy learning and policy failure.

Assessment: Course work (100%)

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### **ENVM7017 Environmental law in Hong Kong (3 credits)**

This course focuses on the statutory interpretation of the four principal Ordinances and subsidiary legislation dealing with pollution and environmental protection in Hong Kong; namely the Water Pollution Control Ordinance, the Air Pollution Control Ordinance, the Noise Control Ordinance and the Wild Animal Protection Ordinance. Some consideration will also be given to the Environmental Impact Assessment Ordinance, the Protection of Endangered Species of Animals and Plants Ordinance and

international conventions effecting the law. Students will study the nature of environmental offences, including the requirement for proving “mens rea” (intent) in order for certain offences to be successfully prosecuted. Students will also be introduced to the principles of judge made law (the Common Law) and will learn to read and interpret relevant case law in order to better understand the current sentencing policies towards environmental offenders, both locally and in other Common Law jurisdictions.

Assessment: Course work (100%)

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### **ENVM7018 Environmental field studies (3 credits)**

This is an experiential learning course. This course aims to broaden students' horizon and knowledge base on key aspects of environmental management and nature conservation through a series of field studies and visits to local and/or overseas organizations. Topics include, but not limited to, conservation and biodiversity management, waste and wastewater treatment processes, water treatment processes, and corporate environmental management in practices. Field studies will be conducted in form of guided visits, field work, service learning and invited lectures or forums according to the topics involved. Study trips outside Hong Kong such as Macau, Mainland China and Taiwan may be considered. Students are required to attend at least 6 sessions organized over the study period and may need to pay the participation fee of some local and/or non-local activities.

Assessment: Course work (100%)

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### **ENVM7019 Ecological field studies (3 credits)**

This is an experiential learning course. This course aims to teach students with the field survey and study skills in biodiversity assessment through an intensive residential field course and some optional field trips. Rapid biodiversity assessment methods and report writing skills will be taught. Students taking this course have to conduct hands on field surveys of common plant and animal groups in Hong Kong such as vascular plants, mammals, birds, amphibians, reptiles and butterflies. Students completing this course shall be able to take part in ecological assessments.

Assessment: Course work (100%)

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### **ENVM8004 Dissertation (15 credits) [Capstone experience]**

The dissertation is an individual, independent research project carried out under the supervision of one or more faculty members. Students may propose their own topics and approach possible supervisors, or they may consider those topics suggested by faculty members. Normally, the student develops the research outline in collaboration with his or her Faculty advisor(s) and then collects data, carries out analysis and writes the report prior to the research colloquium where the student will present his/her work. The candidate shall make a formal presentation on the subject of his/her during the second semester of the teaching programme. Substantial work, in particular, data collection and analysis, is required in this course.

Assessment: Individual presentation (10%), and a dissertation report of at least 15,000 words, excluding reference list and appendices (90%)

Prerequisite: Part-time students must obtain a Grade B+ or above in ENVM7015 Research methods and report writing in environmental management by May of the first study year. Full-time students must pass a qualification assessment in September / October of the first study year.

### **ENVM8006 Environmental impact assessment (3 credits)**

Environmental Impact Assessment (EIA) is one of the most important contemporary instruments of environmental management. Used widely around the world to identify the environment impacts of development projects as well as strategic plans and policies. EIA plays a key role in many regulatory systems for the environment. This course reviews the development of different approaches to EIA, basic analytical principles, administrative and legal systems for EIA, assessments at the project and strategic levels (SEA), and case study applications in Hong Kong.

Assessment: Course work (50%) and written examination (50%)

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### **ENVM8021 Project (9 credits) [Capstone experience]**

This is a group project (2-3 students per group) to be carried out under the supervision of one or more teachers. The topic and content of the project will be agreed individually between students and the supervisor(s) which have to be endorsed by the respective course coordinators. Students may propose their own topics and approach potential supervisors, or they may consider those suggested by teachers. Apart from research projects, creative projects such as the production of field guides, books, websites, videos, apps about the environment, and action projects such as waste upcycling; biodiversity conservation, environmental education and public campaigns are encouraged.

Assessment: Individual project report (50%) and group presentation (50%)

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### **Elective Courses**

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### **ENVM8003 Conservation biology and management (3 credits)**

Conservation biology is the essential scientific element in biodiversity conservation. The course will cover the basic principles and methods of conservation biology from a management perspective. In reality, successful biodiversity conservation projects often require an integration of the welfare of local communities. As such, practical examples from Hong Kong and elsewhere will be used as case studies to illustrate the importance of different elements in conserving the world's biodiversity.

Assessment: Course work (50%) and written examination (50%)

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### **ENVM8011 Environmental auditing and reporting (3 credits)**

This course provides an introduction on the concepts of environmental management, auditing and reporting. Detailed explanation of the development, implementation and continuous improvement of an environmental management system (EMS) based on ISO14001:2015 standards will be covered. With the understanding on the key elements of an EMS, audit methodology and skills based on ISO19011:2011 would be introduced with focus on environmental audit. Process of carbon audit which is becoming important in environmental management by acting as a useful greenhouse gases measuring tool will also be explained. The function and importance of environmental reporting will be explained along with the contents of Global Reporting Initiative which is a guide for sustainability reporting.

Assessment: Course work (100%)

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### **ENVM8012 Environmental health and risk assessment (3 credits)**

Environmental Risk Assessments (ERAs) are a tool to determine the likelihood that contaminant releases, either past, current, or future, pose an unacceptable risk to human health or the environment. Currently, ERAs are required under various regulations in many developed countries so as to support decision-makers in risk characterization or the selection of cost-effective remedial clean-up. This course introduces the theory and practice of human and ecological risk assessments. Students completing the course will gain a sound knowledge of the concepts and principles of ERAs, risk management and risk communication as applied in practice; understand the basic risk assessment tools (i.e. prospective, retrospective and tiered approaches) to environmental risk management; be able to select and apply the simpler tools to tackle risk issues; and appreciate the interpretations of risk and its role in environmental policy formulation and decision making.

Assessment: Course work (100%)

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### **ENVM8013 Air and noise pollution control and management (3 credits)**

This advanced course focuses on various technical aspects related to air and noise pollution control and their management issues. The topics include micrometeorology; air dispersion modelling; advanced air pollution control (e.g. process modification, energy audit and emission trading); case studies on control of emissions from stationary and mobile source; concept of sound propagation; basic principles of noise control; noise impact assessment and technical mitigation measures for construction, industrial, road traffic, railway and aircraft noise.

Assessment: Course work (30%) and written examination (70%)

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### **ENVM8014 Special topics in environmental management (3 credits)**

The contents of this course will vary from year to year, depending on the availability of teachers and topics, and will be announced before course selection each year. Hot topics in Hong Kong or overseas that are related to environmental management will be selected. Examples of such topics could include urban tree management; slope greening; nature conservation versus development in rural Hong Kong and China, sustainable development movements. With careful consideration of different needs of various stakeholders, various management options are reviewed and evaluated.

Assessment: Course work (100%)

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### **ENVM8015 Directed studies in Environmental Management (6 credits)**

This course provides an opportunity for students to study a topic of particular interest under the supervision of a teacher or an experienced environmental practitioner. The contents of this course will be agreed individually between the student and the supervisor, which has to be endorsed by the course coordinator. Directed studies may include traditional research projects generating scientific paper or other study projects with creative outputs in environmental management such as audit reports; booklets; pamphlets; field guides; manuals; teaching modules and so on. The course was designed to allow a flexible approach in fixing the content and output of the directed studies.

Assessment: A written report or other form of output to be agreed by the supervisor (50%); Supervisor's assessment (20%); Oral presentation (30%)

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### **ENVM8016 Conservation and management of freshwater resources (3 credits)**

The overall aim of this course is to introduce the global importance of freshwater resources to sustainable development of mankind. This course offers an introduction to the problems associated with human use of water and current patterns of water resource management, and explains how the characteristics of natural systems constrain sustainable use of water. Emphasis will be placed on examples of river and lake management that can indicate the reasons for success and failure of sustainable water resource use, with particular emphasis placed on regional examples. Students taking this course will gain an appreciation of the trade-offs inherent in water resource management, and the practices that can be adopted to conserve freshwater biodiversity in the complex context of maintaining human livelihoods.

Assessment: Course work (40%) and written examination (60%)

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### **ENVM8017 Conservation and management of marine resources (3 credits)**

The marine environment has been an important source of its fortunes but today suffers from a range of perturbations, from pollution and habitat destruction, to community loss and over-exploitation. This course primarily deals with pressing issues of marine resource conservation and management in Hong Kong. An overview of the current global situation of marine resources will be presented with an emphasis on the local situation. The past and present exploitation of marine resources and human impacts on the marine ecosystem are addressed with a view to identifying problems and providing practical solutions. Real cases are taken from Hong Kong as example to illustrate the crisis and its management options. Various management options are reviewed and evaluated with careful consideration of different needs of various stakeholders. The key topics of this course include marine pollution, habitat destruction, biological invasion, biodiversity conservation, fisheries, mariculture and harmful algal bloom.

Assessment: Course work (50%) and written examination (50%)

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### **ENVM8018 Urban planning and environmental management (3 credits)**

This course lays down the challenges of achieving sustainability in cities. It highlights the important role of urban planning and its related tools and instruments in managing development pressure, mitigating environmental impacts, conserving ecological sensitive areas and achieving the society's overall resilience. The course begins with an introduction to the fundamental functions and processes of planning. Illustrated with real-life case studies, the course then critically reviews the effectiveness of a series of planning tools, such as land use zonings, conservation trusts, partnership schemes, in resolving climate change and sustainability conflicts in both urban and rural contexts. The course adopts the Problem-based Learning (PBL) approach where students will take lead and debate on selected current environmental affairs such as planning and development on private land with high conservation value, planning for facilities with environmental nuisances, design and planning for inclusive open space and rural revitalisation for sustainable communities.

Assessment: Course work (100%)

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### **ENVM8019 Corporate sustainability (3 credits)**

Corporate sustainability focuses on the business sector's role and contribution to achieving sustainability. In recent years, the expectations of business to act sustainably have increased. The scope has extended from contributing to the social welfare of society through philanthropic contributions or avoiding environmental degradation to a new business approach that creates long term value for both

the business and society as a whole, by their managing of risks deriving from economic, environmental and social developments, and through the creation of opportunities. The course examines the commonly used tools in corporate sustainability and corporate social responsibility (CSR), including reporting, environmental, health & safety, corporate community investment and clean production. It reviews the business relationships with the environment and society expressed in the concepts of sustainable production and consumption. The course also emphasizes the importance of learning about current practice in the business sector, and therefore case studies will be used.

Assessment: Course work (100%)

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### **ENVM8020 Green buildings and energy management (3 credits)**

One of the ways to tackle global climate change is to significantly enhance energy efficiency especially in buildings. This course will introduce the global trends in the green building movement with focuses on current energy management in new and existing buildings in Hong Kong e.g. BEAM Plus. The course will introduce various aspects of energy efficiency including laws and codes; assessment tools; methods to analyse energy uses in different types of buildings and practical energy conservation measures. This course stresses on practical knowledge and experiences in energy management in buildings. Thus, experienced practitioners in the field are engaged to deliver some of the course content. The course is accredited by Hong Kong Green Building Council Limited and BEAM Society Limited. Starting from the Academic Year 2020-21, the students upon passing the examination of the course and completing the MSc(EnvMan) programme will be able to register as BEAM Affiliate by the Hong Kong Green Building Council Limited.

Assessment: Course work (50%) and examination (50%)

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### **ENVM8022 Environmental management internship (6 credits)**

This course provides an opportunity for students to undertake an internship in environmental management in universities, NGOs or commercial companies under the supervision of an experienced Environmental Practitioner or Faculty member. The student needs to work for at least 160 hours for the internship employer on either the first, second or summer semester. During the internship, the student needs to conduct a desktop study on a topic related to the internship job duties, which should be endorsed by the course coordinator. The written report for the internship shall contain a fully referenced report for the desk top study and some sharing and reflection of the internship experiences.

Assessment: Written report (60%); Supervisor's assessment (20%); Oral presentation (20%)

Prerequisite: For Full-time students only

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# SYLLABUSES FOR THE DEGREE OF MASTER OF SCIENCE IN THE FIELD OF SPACE SCIENCE

*For students admitted in 2021-22 and thereafter.*

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## A. COURSE STRUCTURE

Each student must complete at least 60 credits of courses, split into 36 credits of core courses, 18 credits of electives, and 6 credits of a capstone project.

### Core Courses

SPSC7002	Introduction to space weather (6 credits)
SPSC7003	Remote sensing in space science (6 credits)
SPSC7004	Radiation detection and measurement (6 credits)
SPSC7005	Space science entrepreneurship (6 credits)
SPSC7007	Data analysis in space science (6 credits)
SPSC7015	Introduction to planetary science (6 credits)

### Elective Courses\*

SPSC7006	Small satellite design (6 credits)
SPSC7011	Introduction to space plasma physics (6 credits)
SPSC7014	Big data, AI and machine learning in space science (6 credits)
SPSC7016	Overview of space astrophysics (6 credits)
STAT6016	Spatial data analysis (6 credits)
STAT7102	Advanced statistical modelling (6 credits)
ELEC6008	Pattern recognition and machine learning (6 credits)
ELEC6026	Digital signal processing (6 credits)
ELEC6065	Data compression (6 credits)
ELEC6100	Digital communications (6 credits)

### Capstone Project

SPSC7031	Space science final project (6 credits)
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*\* Timetabling of courses may limit availability of some electives. The actual offering of such electives will be based on student demand.*

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## B. COURSE CONTENTS

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### Core Courses

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#### **SPSC7002 Introduction to space weather (6 credits)**

Our modern lifestyles rely on satellite technology which can be severely affected by the Earth's local particle environment. Much of this is due to the influence of the Sun, which emits large quantities of radiation and charged particles that interact with the Earth's magnetic field. This course covers the fundamentals of space weather, from its origins, to its effects, and forecasting.

Assessment: coursework (50%); written examination (50%)

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**SPSC7003 Remote sensing in space science (6 credits)**

This course introduces the theory behind, and the many practical applications of remote sensing, focusing on applications of satellite-based detectors to monitor the Earth's environment. The course covers the physical principles of remote sensing, including the various spectral signatures in the different parts of the electromagnetic spectrum. Students will learn about the different sensor technologies, and how to characterize and quantify their performance.

Assessment: coursework (50%); written examination (50%)

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**SPSC7004 Radiation detection and measurement (6 credits)**

This course provides an overview of various ways we detect radiation to make physical measurements in space science. It covers the fundamentals of radiation interactions and properties of radiation detectors, including some of the most commonly used ones in contemporary science missions.

Assessment: coursework (50%); written examination (50%)

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**SPSC7005 Space science entrepreneurship (6 credits)**

No longer driven entirely by governmental institutions, developments in frontier space science in modern times also receive boosts from academia, corporations and entrepreneurs alike. Businesses like SpaceX, Blue Origin, or Virgin Galactic are not only capturing people's imagination, but also proving that space provides big business opportunities. This course will cover the basics of designing, launching, and running a business, with a special emphasis on how ventures can be started for the burgeoning space industry.

Assessment: coursework (60%); final case study and presentation (40%)

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**SPSC7007 Data analysis in space science (6 credits)**

This course introduces concepts of data analysis in space science. Techniques ranging from traditional statistical methods to recent machine learning algorithms will be introduced. Applications of these techniques in space science will be the focus in this course for students to understand how they are actually deployed in solving practical problems in space science.

Assessment: coursework (50%); written examination (50%)

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**SPSC7015 Introduction to planetary science (6 credits)**

We live in a golden age of planetary science, with new missions being proposed at an unprecedented rate by all the major space agencies. This course provides a modern understanding of the properties of our Solar System and planetary systems around other stars and of the physical, chemical, and geological processes that govern their motion and properties. Special attention will be paid to how our knowledge has been enriched by recent discoveries from space missions such as Cassini and Kepler.

Assessment: coursework (50%); written examination (50%)

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Elective Courses

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**SPSC7006      Small satellite design (6 credits)**

Small satellites (sometimes referred to as microsattellites, CubeSats, etc.) are becoming increasingly popular. Once proposed mainly for educational purposes, due to their low cost and shorter development time scales, these days many such satellites are being proposed and launched with a range of cutting-edge scientific goals. Microsatellites make full use of the latest achievements in basic technologies such as modern microelectronics, micro mechanics, and advanced materials. This course covers the practical aspects of designing a small satellite, based on the principle of purchasing “off-the-shelf” components, and benefitting from “open source” solutions to many of the technical challenges. Topics include: science instruments and payloads, satellite subsystems, ground networks, space science data and software, ground networks, launchers, and operations.

Assessment: coursework (50%); written examination (50%)

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**SPSC7011      Introduction to space plasma physics (6 credits)**

Most of space is filled with plasma, the fourth state of matter where freely moving charges from ionized gas interact with (and generate) electric and magnetic fields, leading to a complicated set of phenomena. This course will provide an introduction to the field, covering such topics as plasma characteristics, electromagnetic waves in cold plasmas, collision theory, magnetohydrodynamics (MHD), force-free magnetic-field configurations, stochastic processes, and interaction of particles and waves. The course will emphasize some of the applications of plasma physics in the fields of geophysics and astrophysics.

Assessment: coursework (50%); written examination (50%)

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**SPSC7014      Big data, AI and machine learning in space science (6 credits)**

Artificial Intelligence (AI), Machine Learning and Big Data analytics are interdependent disciplines that are increasingly influential in the real world under the broad umbrella of data science. They have found widespread applications in all branches of science and technology and have direct application in space and satellite technologies. This course introduces the basics of all these areas. Data analytics is the science of analyzing raw data to make conclusions, a particular challenge in the Big data era, while machine learning (ML) is a technique enabling computers to learn without being explicitly programmed and is part of the broader concept of Artificial Intelligence (AI). Key concepts across these fields will be explored including practical processes, techniques and algorithms. There will be a focus on real-world examples with specific emphasis on applications in space and planetary sciences. The course will also cover some ML software packages in Python and R. Examples in all areas will be drawn from contemporary research in fields such as astrophysics, particle physics and complex systems, including rare source identification from vast data, training sets, smart classification, time series, imaging and spectral analyses.

Assessment: coursework (50%); written examination (50%)

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**SPSC7016      Overview of space astrophysics (6 credits)**

While astrophysics from space was historically proposed to cover those parts of the electromagnetic spectrum not visible from earth such as X-rays and gamma rays, almost every part of the spectrum can

benefit from space observations, removing the obstacles posed by our atmosphere. Some of the most iconic astrophysical images have been produced by the Hubble Space telescope, a relatively modest (in size) instrument which has made some stunning discoveries over the course of its 30-year lifetime. This course provides an overview of past, present, and future astrophysical space missions, including their major science goals and achievements, and the technologies that made them possible.

Assessment: coursework (50%); written examination (50%)

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### **STAT6016      Spatial data analysis (6 credits)**

This course covers statistical concepts and tools involved in modelling data which are correlated in space. Applications can be found in many fields including epidemiology and public health, environmental sciences and ecology, economics and others. Covered topics include: (1) Outline of three types of spatial data: point-level (geostatistical), areal (lattice), and spatial point process. (2) Model-based geostatistics: covariance functions and the variogram; spatial trends and directional effects; intrinsic models; estimation by curve fitting or by maximum likelihood; spatial prediction by least squares, by simple and ordinary kriging, by trans-Gaussian kriging. (3) Areal data models: introduction to Markov random fields; conditional, intrinsic, and simultaneous autoregressive (CAR, IAR, and SAR) models. (4) Hierarchical modelling for univariate spatial response data, including Bayesian kriging and lattice modelling. (5) Introduction to simple spatial point processes and spatio-temporal models. Real data analysis examples will be provided with dedicated R packages such as geoR.

Assessment: coursework (50%); written examination (50%)

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### **STAT7102      Advanced statistical modelling (6 credits)**

This course introduces modern methods for constructing and evaluating statistical models and their implementation using popular computing software, such as R or Python. It will cover both the underlying principles of each modelling approach and the model estimation procedures. Topics from: (i) Linear regression models; (ii) Generalized linear models; (iii) Model selection and regularization; (iv) Kernel and local polynomial regression; selection of smoothing parameters; (v) Generalized additive models; (vi) Hidden Markov models and Bayesian networks.

Assessment: coursework (50%); written examination (50%)

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### **ELEC6008      Pattern recognition and machine learning (6 credits)**

This course aims at providing fundamental knowledge on the principles and techniques of pattern recognition and machine learning.

Specifically, the course covers the following topics: Bayes decision theory; parametric and non-parametric methods; linear discriminant functions; unsupervised learning and clustering; feature extraction; neural networks; context-dependent classification; case studies.

Pre-requisite: A good background in linear algebra, programming experience.

Mutually exclusive with: COMP7504 Pattern recognition and applications

Assessment: coursework (25%); written examination (75%)

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**ELEC6026    Digital signal processing (6 credits)**

This course provides an introduction to the fundamental concepts of digital signal processing (DSP) including a wide variety of topics such as discrete-time linear time invariant systems, sampling theorem, z-transform, discrete-time/discrete Fourier transform, and digital filter design. Furthermore, the course will also discuss in detail about other advanced topics in digital signal processing such as multidimensional signals and systems, random processes and applications, and adaptive signal processing.

Assessment: coursework (30%); written examination (70%)

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**ELEC6065    Data compression (6 credits)**

This course provides an introduction to the state-of-the-art compression techniques for typical media including files, digital images, videos and audios. Specifically, the course will discuss in detail about the coding and quantization techniques commonly used for images, videos and audios. Finally, the course will cover basic concept and terminologies of common image, video and audio standards.

Assessment: coursework (30%); written examination (70%)

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**ELEC6100    Digital communications (6 credits)**

This course aims at enabling the fundamental understanding of the digital communication systems. After an overview on basic probability and random processes, the course will cover the modulation and demodulation. Then, performance analyses under additive white Gaussian noise channel and fading channel are examined. This is followed by topics on spatial diversity and channel equalization.

Mutually exclusive with: ELEC6014 and ELEC6045

Assessment: coursework (40%); written examination (60%)

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Capstone Project

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**SPSC7031    Space science final project (6 credits)**

Students must carry out a research project in any aspect of space science under the guidance of a faculty member from the MSc in Space Science program. Students are encouraged to approach faculty members in their areas of interest as soon as possible, in order to choose an appropriate project. Students may either propose a topic of interest, participate in any existing projects of the faculty member, or else they will be assigned a project after consultation with the course coordinator. An oral presentation is required and a written report must be submitted.

Assessment: oral presentation (25%); written report (75%)

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# SYLLABUSES FOR THE DEGREE OF MASTER OF SCIENCE IN THE FIELD OF PHYSICS

*For students admitted in 2021-22 and thereafter.*

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## A. COURSE STRUCTURE

To be eligible for the award of the MSc in the field of Physics a student shall complete at least 60 credits of courses. Courses with 3 or 6 credits are offered in the first and/or second semesters while courses with 9 credits are year-long courses spanning both the first and second semesters. If a student selects a course whose contents are similar to a course (or courses) which he/she has taken in his/her previous study, the Department may not approve the selection in question.

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## CURRICULUM

(applicable for both full-time and part-time modes)

<b>Compulsory Courses (9 credits)</b>	
PHYS8201	Basic Research Methods In Physical Science (6 credits)
PHYS8970	Physics Seminar (3 credits)
<b>Disciplinary Electives (42 credits)</b>	
<i>Take at least 42 credits from Lists A and B with at least 18 credits must be chosen from List A:</i>	
<i>List A:</i>	
PHYS8150	Computational Physics and its Contemporary Applications (6 credits)
PHYS8351	Graduate Quantum Mechanics (6 credits)
PHYS8450	Graduate Electromagnetism (6 credits)
PHYS8550	Graduate Statistical Mechanics (6 credits)
PHYS8701	Physics Experimental Techniques (6 credits)
<i>List B:</i>	
PHYS8352	Quantum Information (6 credits)
PHYS8551	Topics in Solid State Physics (6 credits)
PHYS8552	Condensed Matter Physics (6 credits)
PHYS8654	General Relativity (6 credits)
PHYS8656	Topics in Astrophysics (6 credits)
PHYS8750	Nanophysics (6 credits)
PHYS8751	Device Physics (6 credits)
PHYS8850	Topics in Particle Physics (6 credits)
PHYS8852	Photonics (6 credits)
<b>Capstone requirement (9 credits)</b>	
PHYS8971	Capstone Project (9 credits)

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## B. COURSE CONTENTS

### **PHYS8150 Computational Physics and its Contemporary Applications (6 credits)**

This course shows the power of computational approach to solving physics and related problems, which is complimentary to the traditional experimental and theoretical approaches. Students are expected to spend a significant fraction of time in actual programming. Topics include: introduction to computational physics, introduction to data analysis, ordinary differential equation for classical physical problems, partial differential equation for classical and quantum problems, matrix method and exactly

diagonalization for classical and quantum problems, Monte Carlo methods for statistical physics and quantum many-body physics, AI and machine learning related topics such as regression (multivariate linear and logistic), feature extraction (principal component analysis, recommender systems, clustering) and neural networks (biological neural networks, mathematical representation, feed-forward neural networks, convolutional neural networks).

Assessment: coursework (60%) and examination (40%)

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### **PHYS8201 Basic Research Methods in Physical Science (6 credits)**

This course introduces basic research methods commonly used in various sub-fields in physics. It comprises of four modules, each introduces commonly used research methods in physics. Students are required to take two out of the four modules. They are

1. Astrophysical techniques: Commonly used techniques and packages in astrophysical data gathering and data analysis are introduced.
2. Computational physics and modelling techniques: Commonly used computational physics and physical modelling methods are introduced.
3. Experimental physics techniques: Commonly used experimental physics apparatus and techniques are introduced.
4. Theoretical physics: Commonly used techniques in mathematical and theoretical physics are introduced.

Assessment: coursework (100%)

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### **PHYS8351 Graduate Quantum Mechanics (6 credits)**

This course covers the theory and advanced techniques in quantum mechanics, and their applications to select topics in condensed matter physics. Topics include: Dirac notation; quantum dynamics; the second quantization; symmetry and conservation laws; permutation symmetry and identical particles; perturbation and scattering theory; introduction of relativistic quantum mechanics.

Assessment: coursework (40%) and examination (60%)

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### **PHYS8352 Quantum Information (6 credits)**

This course covers the theory of quantum information and computation and its applications in physics and computer science. Topics include: quantum computer, quantum algorithms, quantum error correction, quantum information processing, quantum entanglement and quantum cryptography.

Assessment: coursework (30%) and examination (70%)

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### **PHYS8450 Graduate Electromagnetism (6 credits)**

This course covers advanced topics in equilibrium statistical physics. Topics include: boundary-value problems in electrostatics and Green Function method; electrostatics of media; magnetostatics; Maxwell's equations and conservation laws; gauge transformations; electromagnetic waves and wave guides.

Assessment: coursework (40%) and examination (60%)

**PHYS8550 Graduate Statistical Mechanics (6 credits)**

This course covers the theory of classical electromagnetic field, enabling them to master key analytical tools for solving real physics problems. Topics include: ensemble theory—the micro-canonical ensemble, the canonical ensemble, and the grand canonical ensemble; quantum mechanical ensemble theory; theory of simple gases, ideal Bose systems, ideal Fermi systems; statistical mechanics of interacting systems; some topics in the theory of phase transition may be selected.

Assessment: coursework (40%) and examination (60%)

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**PHYS8551 Topics in Solid State Physics (6 credits)**

This course covers a broad introduction to modern theory of the solid state physics. Topics include: crystal structures and symmetry; the reciprocal lattice and X-ray diffraction; lattice vibration and thermal properties; free electron of metals; band structures and Bloch theory; nearly free electrons and tight binding model; electronic and optical properties; semi-classical model of electron dynamics; if time permits, topics of semiconductor physics, quantum Hall effect, superconductivity, two-dimensional materials will also be covered.

Assessment: coursework (40%) and examination (60%)

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**PHYS8552 Condensed Matter Physics (6 credits)**

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. This course is intended for both experimentalists and theorists. It will concentrate on the phenomena of emergent many-body states that require not only the effects of quantum mechanics, but also that of quantum statistics to its proper explanation. Examples include: Fermi liquid, superfluidity, superconductivity, and the quantum Hall states. We will emphasize on the interaction effects and discuss the primary feature brought about by the interaction. Some general themes related to these quantum states, such as elementary excitation, Ginzburg-Landau description and symmetry breaking will be discussed.

Assessment: coursework (40%) and examination (60%)

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**PHYS8654 General Relativity (6 credits)**

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. Topics include: the principle of equivalence; inertial observers in a curved space-time; vectors and tensors; parallel transport and covariant differentiation; the Riemann tensor; the matter tensor; the Einstein gravitational field equations; the Schwarzschild solution; black holes; gravitational waves detected by LIGO; special topics such as bending of light calculation and Kerr black holes and their causal structures will be discussed if time permits.

Assessment: coursework (40%) and examination (60%)

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### **PHYS8656 Topics in Astrophysics (6 credits)**

This course covers radiation mechanism and 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. Topics include: radiation mechanisms; stellar structure equations; polytropic model; elementary stellar radiation processes; simple stellar nuclear processes; stellar formation; late stage of stellar evolution; supernova explosion; compact stellar; if time permits, additional selected topics in high-energy and particle astrophysics will be covered.

Assessment: coursework (40%) and examination (60%)

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### **PHYS8701 Physics Experimental Techniques (6 credits)**

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. It will discuss and train students of the following techniques:

1. Noise, Data Analysis, and Computer Grid
2. Vacuum technology and deposition techniques
3. Raman spectroscopy and photoluminescence (PL)
4. Electrical Characterizations
5. Scanning Probe Microscopy (STM and AFM)
6. Electron and X-Ray Diffraction (LEED/RHEED/XRD)
7. Photoemission Spectroscopy (PES)
8. Scanning Electron Microscopy (SEM)
9. Transmission Electron Microscopy (TEM)
10. Low-temperature electrical measurements
11. Radiation Detection and Measurements in Nuclear Physics
12. Particle Detection in Space and Microwave Measurement with Superconducting Detector.

Assessment: coursework (100%)

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### **PHYS8750 Nanophysics (6 credits)**

This course is designed to deliver fundamental concepts and principles of nano physics to fresh postgraduate students, mostly focusing on the transport properties of the low-dimensional electronic systems under external electric and/or magnetic fields. The course will cover various topics in nano physics, such as zero-, one-, and two-dimensional electronic gas systems, quantum dots, graphene and 2D materials, semiconductor heterostructures, quantum Hall effects, Coulomb blockade effects, single electron effects, field effect transistors, and phase-coherent interference effects. While the most discussions will be made based on experimental findings, the basics of the relevant theories will also be covered using the tight-binding model, basic quantum mechanics, and Landauer-Büttiker formula. The principles and applications of nano fabrication and low-temperature measurement techniques will be discussed if the time allows.

Assessment: coursework (40%) and examination (60%)

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**PHYS8751 Device Physics (6 credits)**

This course introduces the working principle and the processing technology of microelectronic and photonic devices. Topics include: introductory semiconductor physics, fundamental and practical aspects of semiconductor devices, including rectifying diodes, photodiodes, photodetector and laser, bipolar and field-effect transistors, integrated circuits.

Assessment: coursework (30%) and examination (70%)

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**PHYS8850 Topics in Particle Physics (6 credits)**

This course covers selected topics in both theoretical and experimental aspects of particle physics. Topics include: fundamental particles, symmetry and conservation law, Feynman diagrams, electromagnetic interaction, weak interaction, strong interaction, gauge theory, particle accelerator and detector.

Assessment: coursework (50%) and examination (50%)

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**PHYS8852 Photonics (6 credits)**

The discovery of the quantum nature of light and the invention of laser has deeply impacted our fundamental understanding of both light and matter, and led to the birth and rapid development of whole new branches of physics, such as quantum optics, laser physics and nonlinear optics etc. This course aims at providing a fundamental but coherent text starting from the physical nature of light, and then giving a self-contained and straightforward access to the quantum nature of light. In particular, this course deals with the coherence properties of light, its seemingly conflicting wave and particle aspects and its interaction with matter. The course text is primarily designed for senior undergraduate students and requires no much knowledge of quantum mechanics. On the other hand, it will also be of interest to graduate students and even research workers since it includes some most recent results in quantum optics such as Rabi oscillations. This course will begin at the physical nature of light, emphasizing quantization and coherence of light. Then it handles the interaction between light and matter. The interaction topics include the interaction representation, the dipole approximation, spontaneous and stimulated emission and absorption. In addition, damping and linewidth broadening will be also discussed. In the final part of this course, quantum coherence and quantum beats of light will be treated, including examples of the evaluation of quantum mechanical coherence functions and Rabi oscillations.

Assessment: coursework (30%) and examination (70%)

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**PHYS8970 Physics Seminar (3 credits)**

This course aims to initiate students into research culture and to develop a capacity for communication with an audience of varied background. Students are required to attend and take part in a specified number of seminars organized by Department of Physics to expose themselves to various topics of contemporary physics research and to learn the technique of professional physics presentation. Students are also required to submit a written paper, to give an oral presentation of about 15 minutes normally on the background materials related to their Capstone Project and to orally answer questions related to the oral presentation.

Assessment: seminar participation (20%), written paper (30%), oral presentation (50%) including the ability to answer questions related to the presentation

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## **PHYS8971 Capstone Project (9 credits)**

This capstone course provides students with the opportunity to study a specific research-type problem by themselves, either theoretical, experimental or numerical, under the supervision of an academic staff using the knowledge the student gained in their entire MSc study.

For theoretical and numerical projects: Students will receive training in research literature reading and reviewing, and make investigation which is close to research work in nature, under the supervision of a staff member. The student may need to perform some original calculations, to fill in mathematical gaps of some sophisticated derivations, or a combination of both. For numerical projects, students also need to use computers to find numerical or simulation results.

For experimental projects: Students will carry out experiments in research labs under the supervision of a staff member. The student will receive a comprehensive training in advanced experimental techniques, including preparation of samples, determination of physical properties, measurement of small signals obscured by noise, laser, high-vacuum and low-temperature techniques and so on. Wide reading of the relevant scientific literature and originality in experimental design are expected.

It is expected that most of the projects would involve team work.

Pre-requisites: Pass or already enrolled in PHYS8201 Basic Research Methods in Physical Science and PHYS8970 Physics Seminar

Assessment: coursework (100%)

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