Master of Science in the field of Applied Geosciences
Faculty of Science Department of Earth Sciences University of Hong Kong

Course GEOS7010 Geology principles and practice

Textbook: A. Essentials of Geology by Lutgens and Tarbuck;
B. Geological Structures and Maps: A Practical Guide
C. https://hkss.cedd.gov.hk/hkss/eng/education/gs/eng/hkg/indexe.htm

The course is designed for students with no or limited background in Geology. It covers fundamental geological concepts and principles, including basics of earth materials (minerals and rocks) and processes that operate within the earth's interior and surface.

Contents

- Geologic Time and Earth's Evolution
- Matter and Minerals *(Lab 1: Mineral Lab)*
- Igneous Rocks (*Lab 2: Igneous Rock Lab)*
- Sedimentary Rocks *(Lab 3: Sedimentary Rock Lab)*
- Metamorphic Rocks *(Lab 4: Metamorphic Rock Lab)*
- *Rock Identification Test*
- Origin and Evolution of Ocean Floor
- Crustal Deformation and Mountain Building
- Geological Maps and Field Geology *(Lab 5: Geological Maps)*
- Overview of Geomorphology
- Overview of Hong Kong Geology

Teaching and learning methods:

The course is designed for students with no or limited background in Geology. The course is taught mainly through class lectures and laboratory practical sessions. It covers fundamental geological concepts and principles, including the basics of earth materials (minerals and rocks) and processes that operate within the earth's interior and surface.

Assessment:

Five laboratory assignments (25%)
Rock identification test (5%)
Three-hour examination (70%)

Grade Descriptors:

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 to 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.

Learning Outcomes:

1. Know Earth's structures and composition and understand the principles of plate tectonics.
2. Have a general knowledge of mineralogy and petrology, and common methods to identify rock-forming minerals and major igneous, sedimentary, and metamorphic rocks on hand specimens.
3. Have general knowledge about Earth's resources and major geological processes that led to their formation.
4. Know major features of folds and faults, including their classification and geological significance.
5. Understand major geohazards and their environmental effects (e.g., earthquakes and tsunamis).
6. Demonstrate an understanding of early Earth and supercontinents in the Earth's history.

Master of Science in the field of Applied Geosciences
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Course GEOS7011 Advanced Geology of Hong Kong

Objective
Provide geologists with the opportunity to gain in-depth knowledge of the geology of Hong Kong.

Course schedule
Lectures/classroom sessions (3 hours)
Geology of Hong Kong - Geological Background and Units (JRA)
Igneous rocks of Hong Kong – plutonic suites and volcanic stratigraphy of Hong Kong, recognition and classification of volcanic rocks and formations (RJS)
Metamorphic rocks of Hong Kong – history of metamorphism, metamorphic structures and mineralogy, major metamorphic rocks of Hong Kong (RJS)
Hong Kong's young and surficial geology (JRA)
Hong Kong's key structural geology features (JRA)
Unresolved problems/new insights into the geology of Hong Kong (RJS)
Revision/consultation class (JRA)

Fieldtrips (each ~8 hours)
Magmatic rocks on southern Hong Kong Island (RJS with JRA)
NW New Territories (RJS with JRA)
Tolo Channel/western Mirs Bay (JRA)

Practicals and discussion
1. Petrographic study of Hong Kong's igneous and metamorphic rocks (two sessions linked to the relevant classroom sessions).
2. Examination of the Hong Kong geological map in the class on HK structures.

Teaching and learning methods
The course uses a combined lecture-directed study approach. The students will also write two field reports related to two of the field sessions plus a ~2500-word essay on a topic related to the geology of the New Territories.

Assessment Methods
Field report related to trip #1. (12.5% of the course mark.)
Field report related to trip #2. (12.5% of the course mark.)
Essay on either a specific element of broader view of the geology of the New Territories (25% of the course mark.) The third fieldtrip is linked to this.
The 3-hour final examination accounts for 50% of the course mark.

Grade Descriptors

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.

Course Text
The main recommended references are Hong Kong Geological Survey memoirs 'The Quaternary Geology of Hong' and 'The Pre-Quaternary Geology of Hong Kong', both published by Geotechnical Engineering Office, Civil Engineering & Development Department.

Learning objectives

1 Acquire a thorough understanding of the main 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.
2 Able to identify and describe the main rock types (volcanic, intrusive, sedimentary and metamorphic) that occur in Hong Kong, and to understand the principles of their formation classification, and interpretation.
3 Able to explain the important geological structures in Hong Kong and the adjacent parts of southern China and how they might have been generated.
4 Able to describe the origin, environment of deposition, description, and classification of the superficial deposits in Hong Kong.
5 Able to explain some of the problematic areas in our understanding of Hong Kong's geology as well as the areas where major revisions are being made to the knowledge base.

Pre-requisites
At least a BSc major/full degree in Earth Sciences/Geology or a closely allied subject.

JRA/AWM 28.11.14

Master of Science in the field of Applied Geosciences
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Site Investigation & Engineering Geological Techniques (GEOS7012)

Site Investigation (SI) for Civil Engineering Projects	3 hrs
Formulating SI Questions, SI Stages, Desk Study	3 hrs
Walkover Survey, Field Mapping, Planning the GI, Ground Models	3 hrs
Half day field class on engineering geological plans (9:30am at Po Shan Mansions, 10-16 Po Shan Road)	3 hrs
Assignment #1	
Assignment #2	
Aerial Photo Interpretation	3 hrs
Ground Investigation: Drilling, Probing, Pitting, Sampling	3 hrs
Ground Investigation: Field Testing, Supervision, Reporting	3 hrs
Laboratory Testing	6 hrs
Half day field class at GI works site or contractor's Depot	3 hrs
Half-day laboratory practical (Public Works Central Laboratory, Cheung yip Street, Kowloon Bay)	3 hrs
Assignment #3	
Assignment #4	
Description and Classification of Soil and Rock for Engineering Purposes	3 hrs
Case Studies and Other Topics:	3 hrs
Geotechnical Uncertainty, SI Ethics and Quality issues, Work of the Engineering Geologist	

Teaching and learning methods

The course is taught mainly through class lectures and uses problem-based learning with students in small work groups. Air photo interpretation is taught through a class lecture and stereoscope practical work. The sessions on walkover survey and field mapping, ground investigation, soil and rock description, and laboratory testing are taught in class lectures supplemented by field classes and a laboratory practical. Learning is reinforced by regular assignments.

Assessment Methods

Achievement will be assessed by examination (70%) and coursework (30%). A 3-hour written examination will be held at the end of the semester. There will be a choice of five questions out of six. During the course there will be four homework assignments.

Grade Descriptors:

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 to 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.

Reference books for the course

The course textbook is: 'Site Investigation', Clayton, Matthews & Simons, published by Blackwell, 1995. Available free at www.geotechnique.info

The book "A Basic Guide to Air Photo Interpretation in Hong Kong' by Ho, King and Wallace (2006) is also recommended: available to download free for 30 days at www.scribd.com/document/270167562/Book-A-Basic-Guide-to-Air-Photo-Interpretation-in-HK-OCR-pdf

Learning outcomes

1. Know how civil engineering projects are accomplished, and how civil engineering design is carried out.
2. Understand when and how geological knowledge is best applied in civil engineering projects in the interests of safety, economy and the environment.
3. Demonstrate the ability to formulate appropriate questions for geotechnical site investigation.
4. Can create simple engineering geological models; can carry out basic soil and rock description and characterisation, and simple air photo interpretation tasks.
5. Can critically evaluate the quality of ground investigation operations and the reliability of the associated data.
6. Can determine some basic soil parameters and evaluate soil properties from laboratory test results.
7. Demonstrate an understanding of the significance of uncertainty in geotechnical prediction and for site investigation.

PC 13.01.2022

Master of Science in the field of Applied Geosciences
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Course Outline and Timetable
Soil Mechanics (GEOS7016)

Phase relationships, Analysis of plane stress and strain, Elasticity and Plasticity in geomechanics, Mohr's circles	3 hrs
Principle of effective stresses, Compaction of soils	3 hrs
Assignment #1	
Darcy's law, seepage analysis and flow nets	3 hrs
Consolidation of soils	3 hrs
Assignment #2	
Lateral earth pressures	3 hrs
Shear strength of soils	3 hrs
Assignment #3	

Teaching and learning methods
The course is mainly taught by class lectures. Learning is reinforced and monitored by short Quiz, Q-A sessions, small group discussions and home assignments.

Assessment Methods
Achievement will be assessed by examination (70%) and coursework (30%). A 2-hr written examination will be held at the end of the semester. The coursework includes three homework assignments.

Grade Descriptors:

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 to 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.

Reference books for the course

Knappett, J.A. and Craig, R.F. (2012). Craig's Soil Mechanics, 8th edition. Spon Press.552p

Barnes, G. (2010). Soil Mechanics: Principles and Practice, 3rd edition. Palgrave Macmillan. 549p

Holtz, R.D., Kovacs, W.D., Sheahan, T.C. (2010). An Introduction to Geotechnical Engineering, 2nd edition. Prentice Hall PTR. 864p

Learning outcomes

1. Can carry out simple calculations on the state of a soil sample.
2. Can use Darcy's Law and flow nets to calculate pore pressures and quantity of flow in the ground.
3. Can assess the quality of fill compaction by means of relative compaction and understand the crucial factors affecting compaction.
4. Can determine the theoretical earth pressure acting on a soil retaining wall using Rankine's and Coulomb's Methods.
5. Can use Terzaghi's 1D consolidation theory to evaluate the time-dependent settlement of the ground.
6. Can use the Mohr Circle construction to determine stresses acting on planes within the soil and the Mohr-Coulomb failure criterion to evaluate the frictional and apparent cohesion components of shear strength from the results of direct shear and triaxial tests.

THE UNIVERSITY OF HONG KONG

MASTER OF SCIENCE IN APPLIED GEOSCIENCES

Course Outline GEOS7020 Project Part I (6 credits)

Objective
To learn and practice knowledge development and project management skills by carrying out a self-directed scientific study.

Course Summary
Instead of being taught directly, the student is to develop personal knowledge of an applied geoscience problem through technical reading, data acquisition and data analysis. The student is to plan and execute the actions needed for the study. Planning starts with sufficient technical reading to appreciate the nature of the applied geoscience problem and define the precise parts to learn on. The student then identifies the scientific principles to read up on, the data to help answer or illustrate the problem, potential difficulties, and the actions to take to bring the study to fruition within the timeframe of the MSc programme. Project Course Part I focuses on planning of the study, and execution to the extent possible.

For students enrolled to finish the Programme **within one year**, this phase is to be completed in the first semester. Work is to continue into the winter break.

For students enrolled to finish the Programme **within two years**, this phase is to be completed in the second semester. Work is to continue into the summer break after the second semester.

Applied Geoscience Problem
The applied geoscience problem to study on should be one agreed by the adviser.

Adviser
The adviser shall be a member of the academic staff of the Department of Earth Sciences or a practitioner from the outside nominated by the Programme Director. The adviser will review and comment on written submissions from the student and provide advice when asked. The adviser will not direct and monitor the student's work.

Data
The data may be that obtained from the student's field or laboratory observations, or provided by the adviser, or acquired from publications, or retrieved from an archive, or obtained by numerical modelling.

The Project Statement
The student is to prepare, for agreement of the adviser, a project statement to include

i) The adviser name
ii) The project title
iii) A broad description of the applied geoscience problem to be studied, in about 50 words

The Project Plan
Each student is to prepare and present a Project Plan, both in writing and an oral presentation to an invited audience. The 10-minute oral presentation should cover the following topics.

i) The question(s) to be answered
ii) The scientific principles and investigation skills needed to tackle the questions
iii) The data needed and how it will be acquired

iv) The way the data help answer the questions
v) Possible roadblocks
vi) Strategy for effective use of limited time

The 500-word written version of the Project Plan should contain the same topics. In addition, it should include a section each on "technical literature read" and "resources needed", and as appendices a simple bar-chart programme and a list of key publications read or to be read. It may also include up to four tables/ graphs/ drawings and the like for illustration.

The presentation may be supported by up to ten PowerPoint slides. Each slide is to be prepared using a font not less than 20-pt.

A Q & A session follows each presentation. The student is responsible for recording the questions and answers and may get a classmate to assist. The Q & A record should be sent to the adviser and the Course Coordinator within 7 days of the presentation.

At the end of the course, the student is to update and resubmit the written version of the Project Plan to include inspirations from the Q&A and knowledge gained on the subject since the presentation. A new section "Insights and Inspirations since the Oral Presentation" may be added to the Project Plan to highlight the improvements. A new Appendix should be added to include the Q&A record and feedback on it.

Assessment
Students will be assessed in three parts as follows, using the templates attached.

(i) Approach and involvement with the adviser
(ii) Oral presentation of the project plan
(iii) The updated written Project Plan

The three parts carry the relative weight of 20%, 30% & 50% respectively.

Grade Descriptors
See the templates attached.

Key Dates
For students enrolled to finish the Programme **within one year**:

4 September 2023: briefing to students on the objectives and requirements of the dissertation project, project planning and literature review skills

22 September: each student to submit to the Course Coordinator the project statement for record

1 December: each student to present orally the Project Plan to an invited audience and submit a written version; attendance of the oral presentation session is mandatory for students

15 December: each student to submit an updated Project Plan to the adviser with a copy to the Course Coordinator

22 December: advisers report the 6-credit grade for course GEOS7020 to Course Coordinator

For students enrolled to finish the Programme **within two years**:

4 September 2023: briefing to students on the objectives and requirements of the dissertation project, project planning and literature review skills.

31 October: each student to submit to the Course Coordinator the project statement for record

5 and 6 March 2024: each student to present orally the Project Plan to an invited audience and submit a written version; attendance of the oral presentation session is mandatory for students

31 May: each student to submit an updated Project Plan to the adviser with a copy to the Course Coordinator

20 August: advisers report the 6-credit Grade for course GEOS7020 to the Course Coordinator

Learning Outcomes

LO1 can source and read technical publications to identify key issues and scientific principles relating to the study problem, and learn to judge the strength of individual publications from the quality of the factual basis, application of established principles and the logic of arguments

LO2 can define precisely the knowledge to be developed to shed light on the study problem by asking a limited set of questions

LO3 can identify key actions to develop the knowledge and programme them to make the best use of the limited time available

LO4 can document the project planning as the platform for effective execution of the project including continual reviews for adjustments needed

LO5 be conscious of personal limitations and ready to seek help when needed

August 2023

(i) Approach and involvement with adviser

Percentage marks and letter grades

MSc Grade	Percentage marks
A+	
	90
A	
	80
A-	
	70
B+	
	67.5
B	
	62.5
B-	
	60
C+	
	57.5
C	
	52.5
C-	
D	50
F	

Grade Descriptors

A to A+: the student keeps the advisor well informed of thoughts and concerns, and shows a good grasp of the approach and path for developing the knowledge sought

A-: the student leaves an impression of a reasonable grasp of the approach and path for developing the knowledge sought, either truly so or the result of the student being a bit detached from the advisor

B- to B+: the student keeps the advisor informed of thoughts and concerns, to which the advisor could contribute when needed on the approach and path for developing the knowledge sought

C- to C+: the student makes little use of the advisor but at least programmes for and makes use of review sessions, and responds when prompted.

D: Marginal pass

F: the student has no meaningful contact with the adviser and problems surface too late to be solved

(ii) Oral Presentation of Project Plan

THE UNIVERSITY OF HONG KONG

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Scorecard for Project Plan Presentation

Date of presentation:	Course: GEOS7020		
Title of presentation:			Score
Presenter's name:	Start time:	End time:	
1. Slides: Follow the good practice of ≤ 10 slides, ≤ 60 word per slide, font ≥ 20 pt, ≥ half of the slides with illustration			/10
2. Delivery Speaks slowly and clearly, facing the audience			/10
Makes good use of time			/10
Wins audience's confidence in the project			/30
3. Content – Audience gains clear understanding of questions to be answered			/5
scientific principles and investigation skills to tackle the questions			/5
data needed and sources			/5
how the data help answer the questions			/5
potential roadblocks			/5
strategies for effective use of limited time			/5
4. Questions Response promptly by answering questions or appreciating implications			/10
Total score			/100

Overall Comments: where relevant, comment on whether the student demonstrated an insistence on knowing the facts and context before passing judgement, or a capacity to think fairly and dispassionately about controversial matters

_____

_____

Marker's Name: _____

Date of Marking: _____

Marks:	/100

YCC/20.0701

(iii) Quality of Documentation of Project Plan

Percentage marks and letter grades

MSc Grade	Percentage marks
A+	
	90
A	
	80
A-	
	70
B+	
	67.5
B	
	62.5
B-	
	60
C+	
	57.5
C	
	52.5
C-	
D	50
F	

Grade Descriptors

A to A+: a succinct document that reflects clear understanding of the context of the knowledge to be developed and an insightful action plan that addresses project uncertainties and permits focused use of semester breaks and timely advice from advisers

A-: a document that reflects reasonable understanding of the context of the knowledge to be developed, and describes a thoughtful action plan for delivery, with signs of having benefited from comments at the oral presentation

B- to B+: a document that describes the knowledge to be developed and a reasonably thoughtful action plan, with signs of having benefited from the comments at the presentation

C- to C+: a collection of points that describes the knowledge to be developed and an action plan that appears to be workable

D: Marginal pass

F: an incoherent collection of points that casts doubts on the student's understanding of the knowledge to be developed and ability to deliver.

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Geological Fieldwork I GEOS7021 3 credits

Objectives
To introduce non-geologists to the procedures used for making geological observations in the field.

Course schedule

Lecture: Basic geological field skills & Geological map reading	3 hrs
Lecture: Geology of Hong Kong	3 hrs
Day trip: Igneous rocks	8 hrs
Day trip: Sedimentary rocks	8 hrs
Day trip: Geological history and structural features	8 hrs

Reading material

Sedimentary Rocks in the Field: A Practical Guide, 4th Edition by *Maurice Edwin Tucker*, 2011. ISBN: 978-0-470-68916-5

The Field Description of Igneous Rocks, 2nd Edition by *Douglas Jerram and Nick Petford*, 2011. ISBN: 978-0-470-02236-8

Geological Structures and Maps: A Practical Guide by *Lisle, Richard J,* 2003.

The Geology of Hong Kong (Interactive Online) by the *Civil Engineering and Development Department*: https://www.cedd.gov.hk/eng/about-us/organisation/geo/pub_info/memoirs/geology/index.html

Teaching and learning methods The course involves 2 lecture (3 hours each) and 3 guided field trips (each of 7-8 hours). Students have to do self-directed study in the field leading to the production of field sheets, narrative accounts and other geological records for assessment. The fieldwork should comprise no less than three full days in the field and may be undertaken in association with the excursions of the Department of Earth Sciences, the local learned societies or independently. For each day in the field, students will need to spend at least 3 hours in completing geological records. They have to summarize the field features, account for the observation and interpret the unsolved problems in a field report. Learning is monitored by the course coordinators each Semester.

Assessment Methods
Achievement will be assessed by coursework (100%), marked on a Pass/Fail basis.

Grade Descriptors

Pass Can apply the basic principles and essential skills in practice, with or without supervision.
Fail Does not know most of the basic principles and has not mastered the essential skills used in practice.

Learning Outcomes

Students are expected to:

CLO1 Plan a route for efficient acquisition of geological information and to navigate and position fix.

CLO2 Know the field safety code.

CLO3 Document geological information in the field.

CLO4 Interpret a geological map and make a cross-section.

TT 31.8.20

Master of Science in the field of Applied Geosciences
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Tentative Timetable for the course on Project Management
GEOS7024

Subject	
General overview; Organisation of firms and sites	3 hrs
Procurement methods; Contractual arrangement	3 hrs
Construction programming; cost estimation	3 hrs
Dispute resolution; professional ethics	3 hrs
Introduction of building information modelling (BIM); Environmental management	3 hrs
Health and safety in construction; Quality management	3 hrs

Venue and time: JL314A, Fridays 7:00pm-9.45pm, with a 10-minute break

Teaching and Learning Methods: The course is taught by class lectures and problem-based learning sessions with students in small work groups. Learning is reinforced and monitored by home assignments.

Assessment: Academic performance is assessed by coursework (30%) and examination (70%). There will be a 2-hour written examination at the end of the semester. There will be a choice of three questions out of four. Two home assignments will be set.

Grade Descriptors:

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 to 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.

Course Text and recommended reading

Civil Engineering Project Management by A.C. Twort & J.G. Rees, 4th edition, Butterworth-Heinemann (2003)

Civil Engineering Procedure, 8th edition, Institution of Civil Engineers (2020)

Learning objectives

1. Can distinguish various project stages; recognise the roles and responsibilities of engineering professionals; understand organisational structures for an engineering project.
2. Know about different procurement methods, contractual arrangement approaches and tendering process; recognise the components of tender documents; appraise received tender.
3. Can evaluate the financial feasibility of a project; measure the quantities; employ the fundamental principle of estimation to derive unit rates; appraise the applications of digital informatics in construction.
4. Understand the stages involved in planning, organising and controlling the time of a project; can employ critical path method to prepare a construction programme; can apply scheduling software to create a Gantt chart and level the resources.
5. Recognise the rights and responsibilities of different parties in a contract; recognise the pros and cons of different dispute resolution approaches; can judge what is regarded as ethical behaviour of engineering professionals.
6. Understand environmental impacts, regulations and mitigation measures; understand concepts of quality management; recognise the importance of safety management; identify potential health hazards.

PLN 30.8.23

Master of Science in the field of Applied Geosciences
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Draft Course outline GEOS7022 Course of Directed Studies (3 credits)

Objective
To assist learning in the core courses of the programme.

Learning activities
The course may include lectures, field classes, field work, laboratory work, internship, class exercises, professional body activities, tutorials and reading.

Supervisor
Learning progress will be monitored by a supervisor who will contribute to assessment of academic achievement.

Target learning outcomes for full-time Engineering Geology themes students taking the internship/associate activities option

LO1 can describe the roles of the different types of companies in the construction industry, the purposes of the regulatory and professional bodies and the job functions of the team members in a construction project
LO2 can explain how a business is administered
LO3 understands what the geologist does in the construction industry and why they do it
LO4 recognizes gaps in own knowledge and can relate these to the courses of the MSc
LO5 can use the English language as required in local practice in the construction industry

Optional internship schedule
Typically three days per week for 4 weeks in a company in the local construction industry.

Optional associate schedule
30 hours with associates who are practising professionals, including tutorials, site visits, field trips, learned society and professional body functions, discussions and Q & A sessions.

Reading for full-time Engineering Geology themes students taking the internship/associate activities option
Chapters 1 and 2 Hencher SR 2012 *Practical Engineering Geology* CRC Press

Assessment
Assessed 80% on course work 20% oral examination
Assessment where the student is taking the internship/associate activities option:
1. Academic achievement will be assessed on the employer's report (20%), the student's diary (20%), the assignment paper (40%) and the course coordinator's oral examination (20%).
2. The assignment is to write an essay of 800 words minimum on a topic related to one of the course learning outcomes.

Assessment where the student is not taking the internship/associate activities option:
Course work will comprise one to three written assignments with a total of 3000 or more words.

AWM 23.5.19

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GEOS7033 Geology of Hong Kong

Objective
The course gives an introduction to the geology of Hong Kong for non-geologists who have passed the prerequisite course GEOS7010.

Course Schedule
Lecture/classroom sessions (3 hours each)
Course Overview and Summary of the Geology of Hong Kong
Igneous Rocks
Sedimentary Rocks
Metamorphic Rocks and Ore Mining in Hong Kong
Geological Structures and Geological Evolution in Hong Kong
Quaternary Geology and Surficial Processes
Hong Kong Geopark

Field classes (8 hours each):
Field trip to observe igneous rocks in the southern part of Hong Kong
Field trip to look at sedimentary rocks and geological structure in Northeast New Territories
Field trip to Hong Kong's mining history in different mining sites of Hong Kong

Practicals and discussion:
Hand specimen study of Hong Kong's igneous, sedimentary and metamorphic rocks, linked to the relevant classroom sessions
Examination of maps, readings and discussion to study Hong Kong's geological history

Teaching and learning methods
The course uses lectures, field classes and practical sessions to study Hong Kong geology in the classroom and the field. The students are required to write two reports related to two of the field trips plus an essay (about 2500 words) on a theme related to Hong Kong geological history.

Assessment
Field report related to trip #1 (12.5% of the course mark)
Field report related to trip #2 (12.5% of the course mark)
Essay on Hong Kong geological history, with some content from trip #3 (25% of the course mark)
The 3-hour final examination (50% of the course mark)

Grade Descriptors

Grade A	Is good, 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 generally competent 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.

Course Texts
'The Quaternary Geology of Hong Kong' and 'The Pre-Quaternary Geology of Hong Kong', published by the Geotechnical Engineering Office, Civil Engineering & Development Department.

Learning outcomes:
1. Can explain the principal components of the geology of Hong Kong in their historical and regional context, including the distribution of the main rock types and the nature of the main regional and local geological structures.
2. Has a basic understanding of the main rock types that occur in Hong Kong and how they formed.
3. Has a basic understanding of the superficial deposits in Hong Kong and the development of the present landform.
4. Has a basic understanding of the Hong Kong's various-scale geological maps and can use the embedded cross-sections to help in their interpretation.
5. Has a basic understanding of the geological features/phenomena that may pose problems for construction/development, such as karstification, weathering, shear zones and jointing, and post-glacial marine deposits.

Pre-requisites
Course GEOS7010 Geology Principles and Practice

JW 13.01.2021

Master of Science in the field of Applied Geosciences
Faculty of Science
Department of Earth Sciences
University of Hong Kong

Hydrogeology GEOS8001

Objective
To study the role of sub-surface water in engineering and environmental applications

Course schedule:
1.Introduction to Hydrogeology/Aquifer Properties/Water In Unsaturated Zone, 3 hours
2.Hydraulic Head And Flow Net/Water Level In Slopes, 3 hours
3.Basic Equations Of Groundwater Flow/Groundwater Flow To Wells, 3 hours
4.Aquifer Tests, 3 hours
5.Groundwater Contamination & Tracer test, 3 hours
6.Introduction To Groundwater Flow Modelling, 3 hours
7.Field aquifer testing (slug test, Guelph test, Double ring test), Half day (Saturday morning)

Classes are held in three-hour sessions in the evenings. Field testing is carried out on one of the Saturday mornings.

Teaching and Learning Methods
The course is taught mainly through class lectures. Learning is monitored by three home assignments and one field report. .

Assessment Methods
Achievement will be assessed by examination (70%) and coursework (30%). A 3-hour written examination is held. There will be a choice of four questions out of five.

Grade Descriptors

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.

Course Text
The course textbook is: ‘Applied Hydrogeology’, Fetter, 2001

Learning Outcomes

1) Understands the importance of hydrogeology in geotechnical and environmental engineering and the main hydrogeological problems in Hong Kong
2) Understands that groundwater flow usually occurs in a regional flow system and that there is a close relationship between such a system and topography and geology. Be able to think hydrogeologically.
3) Knows the basic principles of groundwater flow and the main aquifer properties
4) Knows how to use basic field aquifer tests to estimate some important aquifer parameters.
5) Knows the important steps in setting up a numerical groundwater model

AWM 26.6.14

Master of Science in the field of Applied Geosciences
Faculty of Science Department of Earth Sciences University of Hong Kong

Tentative Timetable for the course on Professional Practice in Applied Geosciences GEO8002

Learning from failures, using the Kwun Lung Lau disaster for example. Assignment No. 1	3 hrs
The risk management process and examples of its use Assignment No. 2	3 hrs
Assuring quality of professional practice	3 hrs
Sources of law in Hong Kong	3 hrs
Law of Tort: negligence	3 hrs
Introduction to contracts Assignment No. 3	3 hrs

Venue and time: Thursdays 7:00pm-9.45pm, with a 10-minute break. The first three classes will be taught on line. The teaching mode of the other three classes will be decided later.

Teaching and Learning Methods: The course is taught by class lectures and problem-based learning sessions with students in small work groups. Learning is reinforced and monitored by home assignments.

Assessment: Academic performance is assessed by coursework (30%) and examination (70%). There will be a 2.5-hour written examination at the end of the semester. There will be a choice of three questions out of four. Three home assignments will be set.

Grade Descriptors:

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 to 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.

Textbook

Peter Wesley-Smith, *An Introduction to the Hong Kong Legal System*, Oxford University Press, 1998

Pre-requisites

No pre-requisite courses are prescribed but students unfamiliar with Law should prepare themselves for the course by reading chapters of the recommended textbook.

Learning Outcomes

1. Can analyse case histories of failures using the James Reason model to examine the human and organizational factors which contributed to the cause of the failure. In doing so, insists on knowing the facts before making a judgement and exhibits judicial habits of mind (the ability to find an impartial solution, form an opinion for oneself, identify and question assumptions).
2. Understands the constitution of the Hong Kong SAR, the sources of law in Hong Kong and, at an introductory level, the Law of Tort with respect to professional negligence. Can formulate an elementary defence to a professional negligence claim.
3. Understands the function of a contract and the formation of a valid contract. Capable of analysing a contract and recognising its elements and understands the significance of the arrangements for the allocation of risk between the parties in the various forms of civil engineering contract.
4. Capable of using the risk management process in professional work.
5. Can explain the contributions of trade associations, learned societies, professional qualifying bodies, professional licensing systems and NGOs to the well-being of professions
6. 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.

YCC/ 20.0805

Master of Science in the field of Applied Geosciences
Department of Earth Sciences University of Hong Kong

Course of Seminars on Failures
GEOS8003

March 12	The Abbeystead tunnel explosion UK 23 May 1984
March 19	The Ching Cheung Road landslide 3 August 1997
March 26	The Lamma Ferry disaster 1 October 2012
April 2	The Sau Mau Ping landslide disaster 18 June 1976
April 9	Unusual settlement at Tseung Kwan O due to tunnelling 1999
April 16	The Stonehaven rail accident 12 August 2020

Venue: James Lee Building JL104
Time: Tuesdays 7:00pm to 9.45pm
Teaching assistant: To be advised

The objective of this course is to expose students to failure case histories and give them the opportunity to learn from the cases. The study of failures, examining non-technical as well as technical factors, may partly compensate for lack of personal working experience.

This is a course of six students-led seminars - read these instructions very carefully.

The required reading materials are listed below. Each student must study this material and prepare an individual PowerPoint presentation, present for 10 minutes and answer questions from the audience. Presenters will each use 15 PowerPoint slides (not including any title slide, contents slide), 8 of which must have relevant technical diagrams. Each presenter must ensure a teammate writes down the questions and answers for their presentation, and submit these to the instructor within 7 days of the seminar.

Spend 30 hours in reading and analysis and 5 hours in preparing the PowerPoint slides and rehearsing the presentation.

In presentation 1, Student 1 will state salient facts relating to the failure/accident as given in the required reading material and report factual errors in any Wikipedia article(s) on the case.

In presentation 2, student 2 will analyse the case using the James Reason model to examine some of the factors which contributed to the cause of the failure. Identify a) the initiating event, and b) 3 or 4 ‘barriers’ which might have prevented the failure/accident. The initiating event must pre-date the earliest barrier.

In presentation 3, student 3 will a) identify the defects in each barrier which allowed the failure/accident to occur, b) say what could or should have been done by the parties to avoid these defects, c) suggest what actions could have been taken by civil society and government bodies or others to prevent such failures/accidents.

In presentation 4, Student 4 will give analysis and opinion on whether the damage caused by the failure/accident was reasonably foreseeable by the parties closely involved in the case. Refer to Appendix A for advice on foreseeability.

In presentation 5, if any, student 5 will describe the most important lessons to be learnt from the case and give a written account of teamwork activities, including notes of discussion at each team meeting, recording differences of opinion between team members and how they were resolved.

Note that the standard of care required of a professional person is that of a reasonably competent specialist applying the standards appropriate at the time of design, construction or operation.

Presenters must collaborate with teammates in preparing their presentations. PowerPoint files must be exchanged between teammates **14 days before the seminar (Student 1**) and **7 days before the seminar (Students 2, 3, 4 & 5)**. Teammates must agree each other's presentations. They must ensure there are no errors or omissions in the factual content presented by teammates and no disagreements on the opinions expressed. PowerPoint presentation files **must be sent to the instructor at least 3 days before the seminar.**

During the presentations, other student groups will make an active contribution. For example, a Group 1 may be asked to formulate and present the defence case to a charge of negligence, for one of the parties involved in the failure/accident. And a Group 2 may be asked to provide constructive criticism of the presentations. Each group will appoint a coordinator. The instructor will facilitate the proceedings by assigning students to groups, selecting the party to be represented by Group 1 and generally giving guidance to facilitate attainment of the learning outcomes.

Assessment

Oral presentation (60%); in-class assessment by quizzes, etc. (10%). First assignment paper (10%); second assignment paper (20%). The oral presentation is marked using the Oral Presentation Scorecard (Appendix B).

First assignment paper: presenters will individually prepare an essay of 700-800 words about their case describing *causative factors in the failure/accident (technical and non-technical factors)*. The assignment submission must be emailed to the instructor and erica25@hku.hk within 7 days of their presentation; late submissions will not be accepted.

The second assignment requires each student to generalise the findings of the six cases and write an essay of 900-1000 words on the topic: *Causative factors that occurred in more than one of the six failures*. To be submitted to erica25@hku.hk before 26 April; late submissions will not be accepted. For this assignment you need to invent a classification of causative factors, with three or four classes, where each class is justified by at least two examples from the six cases.

Your presentation and assignment submissions must be original work by you. Generative Artificial Intelligence must not be used. **Do not 'cut and paste' text.** State all sources of information on **every** PowerPoint slide and in the text of the assignment papers. A list of references must be given at the end of the presentation and assignment papers.

Attendance at all seminars is compulsory and the attendance rules for written examinations will apply to absentees. Late-comers will be required to submit an additional assignment paper.

Grade Descriptors

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.

Learning Outcomes

1. Can analyse case histories of failures using the James Reason model to examine the non-technical factors which contributed to the cause of the failure.
2. Can generalise the findings from a series of failure case histories, and draw conclusions.
3. Insists on knowing the facts before making a judgement and thinks fairly and dispassionately about controversial matters, such as engineering failures. Is objective in judging professional conduct.
4. Effective in oral, written and graphical communication.
5. Works well in a team; collaborates well in completing tasks and negotiates with others in coming to a decision.

Reading Materials
(Don't waste your time reading other materials. Online sites like Wikipedia may have errors, omissions and misunderstandings and may mislead you).

Abbeystead
Orr et al 1991. The Abbeystead outfall works: background to repairs and modifications and the lessons learned. *J Inst Water Environmental Management*, v5, 7-20. **Study pages 7-13.**
Health & Safety Executive 1985. *The Abbeystead explosion*. London: HMSO. **Study the extract provided.**
Eckersley v Binnie 1988 *18 Construction Law Reports 1.* Study the judgement by Bingham LJ **up to the end of the section entitled 'A. The design stage'.**

Ching Cheung Road landslide
Halcrow Asia Partnership Ltd, 1998. *Report on the Ching Cheung Road landslide of 3 August 1997*. Geotechnical Engineering Office.
Geotechnical Control Office, 1989. *Cut slopes 11NW-A/C55 & C56, Ching Cheung Road*. Geotechnical Control Office, Hong Kong, Stage 3 Study Report No. S3R 11/89.
Geotechnical Control Office, 1989. *Engineering geology study of slopes 11NW-A/C55 & C56, Ching Cheung Road*. Geotechnical Control Office, Hong Kong, Planning Division Advisory Report ADR 1/89.
Maunsell Consultants Asia 1973. *Report on landslides on Ching Cheung Road*. Report to Public Works Department, Hong Kong Government.

The Lamma Ferry disaster
Lunn M.V. & Tang B.K.B. 2013 *Report of the Commission of Inquiry into the Collision of Vessels near Lamma Island on 1 October 2012*

Sau Mau Ping landslide disaster 1976
Knill, J.L., Lumb, P., Mackey, S., de Mello, V.F.B., Morgenstern, N.R. & Richards, B.G. 1999 *Report of the Independent Panel on Fill Slopes (GEO Report No. 86).*

Tseung Kwan O Town Centre settlement
Endicott LJ 2013 Spatial variations in groundwater response during deep tunnelling. *Proc 18th South-East Asian Geotechnical Conference Singapore* eds Leung Goh & Shen
Endicott LJ 2013a Engineering Experience of the TKO Unusual Ground Settlement Project Implementation & Observations ICE Evening Seminar 9 April 2013
Maunsell Consultants 2000. *Unusual settlement in Tseung Kwan O Town Centre,* Final Report to Territory Development Department, Hong Kong Government.
Maxwell & Kite *Settlement due to under-drainage* Maxwell Geosystems company website articles
Territory Development Department 1999 paper for Legislative Council joint meeting panel on planning, lands and works panel on housing 6 December 1999
Troughton *et al*, 1991. Prediction and control of groundwater, vibration and noise for construction of Hongkong Bank seawater tunnel. *Proc 6th Int. Symp. Tunnelling. (Tunnelling '91).* London. 411-423.

Stonehaven train derailment
Rail Accident Investigation Branch March 2022 *Derailment of a passenger train at Carmont, Aberdeenshire, 12 August 2020 (full report).*
Rail Accident Investigation Branch March 2021 *Resilience of rail infrastructure – update report to the Secretary of State for Transport following the derailment at Carmont, near Stonehaven.*

THE UNIVERSITY OF HONG KONG

MASTER OF SCIENCE IN APPLIED GEOSCIENCES

Course Outline GEOS8020 Project Part II (12 credits)

Objective

To learn and practice knowledge development and project management skills by carrying out a self-directed scientific study.

Course Summary

Instead of being taught directly, the student is to develop personal knowledge of an applied geoscience problem through technical reading, data acquisition and data analysis. In Project Course Part II, the student carries out the actions planned in Project Course Part I, monitor progress, resolve difficulties, and revise the plan regularly to bring the study to fruition within the timeframe of the MSc programme despite the difficulties encountered. It cumulates in the production of a dissertation to practice technical writing, and to document the knowledge developed and the development process.

For students enrolled to finish the Programme **within one year**, this phase starts in the winter break before the second semester.

For students enrolled to finish the Programme **within two years**, this phase starts in the summer break before the third semester

Adviser

The adviser will review and comment on written submissions from the student and provide advice when asked. The adviser will not direct and monitor the student's work.

Data

The data may be that obtained from the student's field or laboratory observations, or provided by the adviser, or acquired from publications, or retrieved from an archive, or obtained by numerical modelling.

Preliminary Results

Students are to present their preliminary results, with a one-page handout, to an invited audience. The 10-minute oral presentation should cover the following.

1. Objective: what the student set out to achieve
2. Methodology: what the student did and the outcomes
3. Results: what the student achieved with respect to the objective

The presentation may be supported by up to eight PowerPoint slides. All slides should be prepared using a font not less than 20-pt.

A Q & A session follows each presentation. The student is responsible for recording the questions and answers and may get a classmate to assist. The Q & A record should be sent to the adviser and Course Coordinator within 7 days of the presentation.

The one-page handout should give a concise summary of the presentation. It may also include up to four tables/ graphs/ figures and the like as an Appendix for illustration.

Dissertation

The student documents the work carried out and the knowledge developed in a dissertation following the HKU Thesis format. It is to be not less than 10,000 words amply illustrated with tables, graphs, diagrams and the like, and supported by appendices as appropriate.

The student submits the draft dissertation to the adviser for comments specifying further work, amendments and additions needed.

A model dissertation format will be provided. The Main Library and the DES General Office hold a collection of past MSc dissertations which may be consulted for guidance on the standards required.

Assessment

Students will be assessed in three parts as follows, using the templates attached.

(i) Approach and involvement with the adviser
(ii) Oral presentation of the preliminary results
(iii) Quality of the final dissertation

The three parts carry the relative weight of 20%, 20%, 60% respectively.

Grade Descriptors

See the templates attached

Key Dates

For students enrolled to finish the Programme **within one year**

12 January 2024: briefing to students on project documentation and revision of good practises of self-directed study projects

9 and 10 July: each student to make an oral presentation of preliminary results to an invited audience, with a one-page handout; attendance of the oral presentation session is mandatory for students

22 July: each student to submit a draft dissertation in standard format to the adviser, with a copy of the Q&A record from the preliminary results presentation; copy both to the Course Coordinator

12 August: each student to submit the final dissertation to the adviser

20 August: advisers report Grade for GEOS8020 to Course Coordinator

31 August: each student to submit to DES Office a softcopy of the dissertation on a CD and the HKU Library consent form; a bound copy is to be submitted unless the adviser decides otherwise

For students enrolled to finish the Programme **within two years**

12 January 2024: briefing to students on project documentation and revision of good practises of self-directed study projects

4 and 5 June: each student to make an oral presentation of preliminary results to an invited audience, with a one-page handout; attendance of the oral presentation session is mandatory for students

30 June: each student to submit a draft dissertation in standard format to the adviser, with a copy of the Q&A record from the preliminary results presentation; copy both to the Course Coordinator

31 July: each student to submit the final dissertation to the adviser

20 August: advisers report Grade for GEOS8020 to Course Coordinator

31 August: each student to submit to DES Office a softcopy of the dissertation on a CD and the HKU Library consent form; a bound copy is to be submitted unless the adviser decides otherwise.

Learning Outcomes

LO1 can conceive and plan a study by asking the right questions and working out actions to answer them, and execute the plan including continual reviews for adjustments needed

LO2 can develop knowledge by learning scientific principles and investigation techniques, and applying them to acquire and analyse data to gain insights

LO3 insists on knowing the facts before making a judgement

LO4 can document and present succinctly and precisely the work done and the knowledge developed, both in writing and oral presentation

LO5 be conscious of personal limitations and ready to seek help when needed

August 2023

(i) Approach and involvement with adviser

Percentage marks and letter grades

MSc Grade	Percentage marks
A+	
	90
A	
	80
A-	
	70
B+	
	67.5
B	
	62.5
B-	
	60
C+	
	57.5
C	
	52.5
C-	
D	50
F	

Grade Descriptors

A to A+: the student keeps the advisor informed of thoughts and concerns, and shows a good grasp of the approach and path for developing the knowledge sought

A-: the student leaves an impression of a reasonable grasp of the approach and path for developing the knowledge sought, either truly so or the result of the student being a bit detached from the advisor

B- to B+: the student keeps the advisor informed of thoughts and concerns, with which the advisor could contribute when needed on the approach and path for developing the knowledge sought.

C- to C+: the student makes little use of the advisor but at least programmes for and makes use of review sessions, and responds when prompted.

D: marginal pass

F: the student has no meaningful contact with the adviser and problems surface too late to be solved

(ii) Oral Presentation of Preliminary Results

THE UNIVERSITY OF HONG KONG

Master of Science in Applied Geosciences

Scorecard for Preliminary Results Presentation

Date of presentation:	Course: GEOS8020		
Title of presentation:			Score
Presenter's name:	Start time:	End time:	
1. Slides: Follow the good practice of ≤ 6 slides, ≤ 60 word per slide, font ≥ 20 pt, all slides with illustration and plain background			/10
2. Delivery			
Speaks slowly and clearly, facing the audience			/10
Makes good use of slides			/10
Persuaded audience that the student had developed solid personal knowledge of the problem			/30
3. Content – Helps audience gain clear understanding of			
Questions to answer			/5
Methodology (e.g., what data collected and how analysed)			/20
Answers to the questions			/5
4. Questions Respond promptly by answering questions or appreciating implications			/10
Total score			/100

Overall Comments: where relevant, comment on whether the student demonstrated an insistence on knowing the facts and context before passing judgement, or a capacity to think fairly and dispassionately about controversial matters

_____

_____

Marker's Name: _____

Date of Marking: _____

Marks:	/100

YCC/21.0802

(iii) Quality of the Dissertation

Percentage marks and letter grades

MSc Grade	Percentage marks
A+	
	90
A	
	80
A-	
	70
B+	
	67.5
B	
	62.5
B-	
	60
C+	
	57.5
C	
	52.5
C-	
D	50
F	

Grade Descriptors

A- to A+: Is good, very good or excellent in using basic principles and essential skills in practice. Is creative, work is virtually error free and writes well. Can apply what has been learnt to new situations.

B- to B+: Is generally competent in using the basic principles and the essential skills in practice

C- to C+: Is able to state most of the basic principles but makes limited use of them and the essential skills in practice

D: marginal pass

F: Does not know most of the basic principles and has not mastered the essential skills used in practice

Master of Science in the field of Applied Geosciences
Department of Earth Sciences, Faculty of Science, University of Hong Kong
Geological Fieldwork II GEOS8021 (3 credits)

Objectives

This course aims to further the field geology skills of graduate geologists by experiential learning over 3 x 1 day practical field excursions.

Schedule

2 Lectures
3 Field Trips will take place in Kat O

Teaching and Learning Methods

Experiential learning in the field under the guidance of an instructor.

Assessment Methods

Achievement will be assessed by coursework (100%), marked on a Pass/Fail basis.

Materials Required for Assessment

1 x Final Field Map
Field Sheets
Field Book
Synthesis Report

Learning Outcomes

1. Can produce a geological map and field sheets
2. Can systematically record lithological and structural data and produce a brief geological synthesis of the mapped area

Grade Descriptors

Pass - Can apply the basic principles and essential skills in practice, with or without supervision.
Fail - Does not know most of the basic principles and has not mastered the essential skills used in practice.

15.12.2022

Master of Science in the field of Applied Geosciences
Faculty of Science Department of Earth Sciences University of Hong Kong

Timetable - Engineering Geology and Geotechnical Design (GEOS8101)

Objective
To strengthen understanding of soil mechanics theory and gain an appreciation of how theory is applied in geotechnical design. To recognize the role of empiricism in geotechnical design and the shortcomings of theory.

Earth Pressures and Design of Retaining Walls	4.5 hrs
Bearing Capacity and Design of Shallow Foundations	4.5 hrs
Design of Piled Foundations	6 hrs
Practice in design of retaining walls	3 hrs
Practice in calculating stresses in the ground	3 hrs
Limit Equilibrium Methods and introduction to stability of geotechnical structures	6 hrs
Stability of Slopes and design of soil nailed slopes	6 hrs
Burland's Triangle; mechanics, observed behavior geological models & empiricism in geotechnical design	3 hrs

Full-time students start the course in class 7 and take classes 1-6 in the second semester.

Teaching and learning methods
The course is taught by class lectures and practice sessions. Some classes use problem-based learning with students in small groups. Learning is reinforced and monitored by home assignments and practice in calculations.

Assessment Methods
Achievement will be assessed by examination (70%) and coursework (30%). A 3-hr written examination will be held at the end of the semester. There will be a choice of five questions out of six. The coursework includes three homework assignments.

Grade Descriptors:

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 to 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.

Course Text

The recommended textbook is 'An introduction to the mechanics of soils and foundations', by John Atkinson, published by McGraw-Hill, 1993. Chapters 18 to 23. Or the second edition 2007 published by Taylor & Francis. Chapters 19 to 24.

Learning outcomes

1. Understands the fundamentals of applied mechanics at an introductory level. (Atkinson 1993/2006 Chapter One). Knows basic soil mechanics theory and how it is applied in geotechnical design. This includes the Principle of Effective Stress, Mohr-Coulomb failure criterion, Bound Methods, Limit Equilibrium Method, Earth Pressure theories, Bearing Capacity theories.
2. Understands the limitations of and approximations in the theory.
3. Is able to calculate quickly and accurately theoretical soil stresses in the ground under various seepage conditions. Is able to evaluate changes in soil stresses in the ground due to changes in surface loading and water table.
4. Knows how the geotechnical engineer designs piles, retaining walls, shallow foundations and slopes with soil nails.
5. Understands the place of soil mechanics theory, observation of behaviour, geological models and empiricism in geotechnical design, as expressed in Burland's soil mechanics triangle. Can recognise theory, empiricism and reality in a geotechnical case history.

Pre-requisites

Course GEOS7016 Soil Mechanics except for graduates in Civil Engineering

Master of Science in the field of Applied Geosciences
Department of Earth Sciences, Faculty of Science, The University of Hong Kong

Course on GEOS8102 Rock Engineering and Applications

Objective

This course introduces the principles of modern rock engineering theory and practice, and allows students to gain an appreciation of how rock mechanics theory and empiricism is applied in geotechnical design. The design methodology in rock engineering is introduced. The collection and analysis of engineering geological data for the design of rock structures is the main focus. 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.

Course schedule

No.	Topic (3 hours each)
1	Stereographic projection methods & rock slope stability
2	Intact rock/rock mass failure criteria
3	Rock mass and discontinuity surveys
4	Discontinuity shear strength criteria
5	Engineering use of rock materials
6	Rock mass classifications
7	Underground excavation in hard rock – failure mechanism
8	Underground excavation in hard rock – design of rock support
9	Underground excavation in hard rock – control of groundwater inflow
10	Underground excavation in hard rock – drill-and-blast construction
11	Foundations and piling on/in rock
12	Reliability and back analysis in rock engineering

Teaching and learning methods

The course is mainly taught by class lectures. The structural instability mechanisms are studied with reference to an actual rock mass outcrop and discontinuity survey carried out by small teams in the field. Learning is monitored by a quiz and home assignments.

Assessment methods

One 3-hr written examination (70%) and coursework (30%); the written examination will require answering a choice of four questions out of six; the coursework includes one quiz and multiple assignments.

Grade Descriptors

Grade A	Is good, 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 generally competent 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.

Course Text

Pariseau, W.G. (2007). *Design Analysis in Rock Mechanics*, Taylor & Francis

Hoek's corner (https://www.rocscience.com/learning/hoek-s-corner/books)

Hudson, J. A., & Harrison, J. P. (2000). *Engineering rock mechanics-an introduction to the principles*. Elsevier.

Learning outcomes

At the end of this course the students will be able to:

a. Understand the fundamental design processes in civil and mining engineering and the realm of rock engineering.
b. Conduct rock mass and discontinuity surveys; use stereographic projection methods to present discontinuity data; carry out kinematic analysis to identify potential structural failure modes in surface and underground excavations.
c. Describe and use empirical discontinuity shear strength, and intact rock and rock mass failure criteria.
d. Classify rock masses and use the associated rock quality values for preliminary assessment of rock mass properties and support requirements.
e. Know reliability and back analysis concepts in rock engineering.

Pre-requisites

Course GEOS7015 Rock Mechanics

LNYW 12 Dec 2023

THE UNIVERSITY OF HONG KONG

MASTER OF SCIENCE IN APPLIED GEOSCIENCES

GEOS8104 Natural hillside landslide and hazard studies (3 credits)

COURSE OUTLINE

Course venue and time
JL314A, 3/F, James Lee Science Building 7:00-9:45pm
JL105, 1/F, James Lee Science Building 7:00-9:45pm (Nov 19 & 26)

Course objective
To provide the working engineering geologist with an appreciation of the concepts and a basic grasp of the models and skills employed in studies of natural terrain landslides, and to provide an introduction to natural terrain landslide hazard assessments in Hong Kong.

Learning outcomes

1. The student will be able to identify, describe and classify natural terrain landslides, and will have an appreciation of the processes, mechanisms and causes of rainfall-induced landslides on Hong Kong's natural terrain.
2. The student will gain an understanding of landscape evolution in Hong Kong and be able to explain and critically assess landform models of Hong Kong.
3. The student will have a basic grasp of the engineering geological and geomorphological mapping principles, tools and techniques for landslide investigation and landslide hazard assessment, and be able to apply this knowledge (including items 1 and 2) practically, including when performing Aerial Photographic Interpretation.
4. The student will be able to describe the main approaches to the assessment and mitigation of natural terrain hazards, and explain the strategies to deal with the risk from natural terrain landslides.

Schedule of classes (6 in total)

1. **Introduction to Landslides**
   1.1 Classification and description of landslides. International terminology for landslide types and processes, with particular reference to Cruden & Varnes (1996).
   1.2 Landslide terminology and examples from Hong Kong. Reference to Appendix B in GEO Report 138 (2nd Edition) (Ho & Roberts, 2016), plus notable natural terrain landslides in Hong Kong.

2. **Rainfall-induced landslides**
   Processes, mechanisms and causes of rainfall induced landslides in Hong Kong. Hillslope hydrology including modes of runoff, infiltration, groundwater flow and piping. Hydrological and morphological conditions for: (i) initiation of shallow landslides in regolith; and, (ii) debris mobility following initiation. Correlation between rainfall and landsliding (e.g. Corominas, 2000). Examples of rainfall-induced landslides on natural terrain in Hong Kong will be illustrated and discussed.

3. **Hillslope evolution**
   Quaternary geology of Hong Kong and geomorphological principles (including evolutionary landform models of, for example, Dalrymple, Hansen, Baynes (North Lantau).With particular emphasis on landforms and superficial geology associated with landslide processes, debris fans etc.

4. **Engineering geological / geomorphological mapping (Part 1)**
   4.1 Introduction to mapping for hazard assessments, GEO Report 138, and the 2nd homework assignment (which requires students to read some Sections of GEO Report 138).
   4.2 Mapping techniques for landslide investigations and hazard assessments. Introduction to the techniques, tools, products and uses. Morphological mapping; landforms; geomorphological processes; regolith mapping. Reference to Savigear, 1968.
   4.3 Introduction to terrain mapping, land-systems, concepts of terrain units and their use as predictive models for landslides (Cooke & Doornkamp models, Fookes et al models).
   4.4 Towards the end of the session there will be a discussion on the use of advanced mapping tools and technology to assist the engineering geologist /geomorphologist.

5. **Engineering geological / geomorphological mapping (Part 2)**
   JL105
   Practical session using stereoscopes for API to carry out engineering geological and geomorphological mapping for natural terrain hazard assessments.
   5.1 The first part of the practical will be used to carry out morphological and geological (regolith) mapping.
   5.2 The second part of the practical will be used to identify and map geomorphological units based on the morphological boundaries and regolith units identified in part 1 of the practical. Geomorphological units form the basis for a landscape model, which will be discussed.

6. **Introduction to natural terrain hazard assessments** ***JL105***
   6.1 Introduction to concepts of ‘hazard’ and ‘risk’. Introduction to approaches, international and in Hong Kong (GEO Report 138). Landslide susceptibility

assessment (including discussion on landslide susceptibility and landslide magnitude frequency relationships) for hazard assessment purposes.

6.2 Introduction to landslide hazard mitigation and risk reduction. Concepts of risk reduction through (i) avoidance, (ii) protection, (iii) prevention.

Teaching and learning methods

The course is mainly taught by class lectures. Learning is monitored by short Q-A sessions and two home assignments.

Teaching materials

Students can download the teaching materials from HKU GEOS8104 Moodle or will be sent to the students by email after each lecture.

Assessment methods

One 2-hr written examination (70%) and coursework (30%) consisting of two home assignments.

Exam

Answer 3 questions. Each question contains short questions.
Question 1: Covers classes 1 & 3
Question 2 & 3: Cover classes 2, 4, 5 & 6

Coursework

Home Assignment no. 1 (10%) Issue date: 22 October; deadline: 5 November 2020
Home Assignment no. 2 (20%) Issue date: 12 November; deadline: 26 November 2020

Grade Descriptors

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.

JH/RPM 26.08.2020

THE UNIVERSITY OF HONG KONG
Master of Science in Applied Geosciences

Course GEOS8204 Basic Structural Mechanics and Behaviour (3 credits)

Objective

To introduce engineering geologists to the concepts and vocabulary of structural mechanics and behaviour as applied in civil engineering design.

Course Schedule

(1)	Behaviour of structural members Statically determinate structures – pin-jointed frames	3 hours
(2)	Statically determinate structures – beams Stresses and deflection	3 hours
(3)	Design of steel members	3 hours
	Chinse New Year – No class	
(4)	Design of reinforced concrete members	3 hours
(5)	Foundations and retaining walls I	3 hours
(6)	Foundations and retaining walls II Revisions and tutorial	3 hours

Teaching and learning methods

The course is mainly taught by class lectures and a tutorial session. Learning is monitored by short Q-A sessions and home assignments.

Assessment methods

Achievement will be assessed by coursework (30%) and a 2-hour written examination (70%).

The course work assignment consists of 9 exercises, which will be distributed to the students during the lectures.

Please scan your answers into a computer file, and submit the soft copy to Erica at the email address erica25@hku.hk. The assignment will not be returned to you, and it is desirable for you to keep a copy.

Grade Descriptors

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.

Learning Outcomes

LO1 has a basic understanding of the general behaviour of structural systems especially in respect of foundation and shoring designs.
LO2 can determine forces in pin-jointed axial force frames and the shearing forces, bending moments and support reactions in simply supported beams.
LO3 can determine the deflections of simply supported beams.
LO4 can calculate the factor of safety against overturning and sliding of a gravity retaining wall and the associated ground bearing pressures.
LO5 can calculate the ultimate compression load capacity of steel sections.
LO6 can decide suitable main reinforcement for concrete slabs, by the method given in the Hong Kong Code of Practice for Structural Use of Concrete .
LO7 can determine the suitable size of and design the steel reinforcement for a reinforced concrete pad footing for a column by the method given in the Hong Kong Code of Practice for Structural Use of Concrete and check the adequacy of the pad foundation in shear.

PK/AWM/el 28.1.2019

THE UNIVERSITY OF HONG KONG

MASTER OF SCIENCE IN APPLIED GEOSCIENCES

GEOS8205 Mathematics I

Course objective

To provide earth sciences graduates with instruction in mathematics to meet the academic requirements of the Hong Kong Institution of Engineers for membership in the Geotechnical Discipline.

Course Contents (provisional)

1. Calculus

a) Functions

b) Differential calculus

- i. Limit of a function / continuous functions
- ii. First derivative of a function / rules of differentiation
- iii. Higher-order derivatives / Taylor's theorem
- iv. Applications: Approximations / finding maxima & minima/ l'Hopital's Rule

c) Integral calculus

- i. Indefinite integral / anti-derivatives
- ii. Definite integral / area
- iii. Fundamental theorem of calculus
- iv. Integration techniques: change of variables / integration by parts / substitution
- v. Applications: Finding arc-lengths, areas, volumes, moments & centre of mass

d) Infinite sequences and series

- i. Convergence tests
- ii. Power & Taylor series
- iii. Applications: Newton's method / improper integrals / numerical integration

2. Multivariable Calculus

a) Vectors and spatial geometry

- i. Rectangular, polar, cylindrical & spherical coordinate systems
- ii. Dot & cross product
- iii. Lines, planes & surfaces
- iv. Vector-valued functions

b) Differentiation

- i. Partial derivatives & chain rule
- ii. Directional derivatives & gradient vectors

iii. Tangent planes & differentials

iv. Applications: maxima, minima, saddle points, approximation, Taylor's theorem

c) Integrations

i. Double, triple & iterated integrals

ii. Change-of-variables in polar, cylindrical & spherical coordinates

iii. Line & surface integrals

iv. Green's, Stokes' & divergence theorems

v. Applications: work, conservative fields & potential functions

3. Basic Linear Algebra

a) Systems of linear equations

b) Row operations & Gaussian elimination

c) Matrices, matrix operations & determinants

d) Inverses of matrices

e) Eigenvalues & eigenvectors / diagonalization

f) Linear independence, bases & dimension

Teaching and learning methods

The course is mainly taught by class lectures. Learning is monitored by short Q-A sessions and home assignments.

Assessment Methods

Achievement will be assessed by examination (70%) and coursework (30%). A 3-hour written examination will be held at the end of the semester in December 2019. During the course there will be several homework assignments.

Grade Descriptors

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.

Course Textbook

E. Kreyszig, *Advanced Engineering Mathematics*, latest edition, Wiley

Learning outcomes

By the end of this course, students will be able to:

LO1 Describe and explain mathematical results using set notations and operations;

LO2 Evaluate solution(s) to systems of linear equations using elementary row operations;

LO3 Evaluate matrix determinants, inverses, eigenvalues / eigenvectors;

LO4 Describe the process of diagonalization of symmetric matrices;

LO5 Interpret positive / negative / in- definiteness of a matrix;

(*For 1-variable Calculus*)

LO6 Describe functions and their inverses; compose functions using different operations; interpret periodic, odd, and even functions;

LO7 Explain the intuitive meaning of limit, continuity, and differentiability of a function;

LO8 Evaluate limits using Limit Laws, techniques in factorization and rationalization, sandwich theorem;

LO9 Evaluate derivatives using definition and rules of differentiation;

LO10 Determine derivatives of composited functions using Chain Rule;

LO11 Describe the behaviour (e.g., increasing or decreasing properties, extreme points) of a function using derivative tests and limits;

LO12 Conclude (if exist) the absolute Max/Min points of a function;

LO13 Determine polynomial approximations to functions using Taylor's theorem;

LO14 Interpret Exp and log functions (e.g., differentiation and integration) and relate the two functions on the same x-y plane;

LO15 Relate indefinite integration as anti-derivatives, and definite integration as area of graph of a function;

LO16 Evaluate areas / anti-derivatives using standard integration techniques (e.g., method of substitutions, integration by parts, sinusoidal formulas);

LO17 Determine arc-length of a function, and volume of revolution;

(*For Multivariate Calculus*)

LO18 Evaluate partial derivatives for f(x,y) in the x- and y- directions, and then generalize these concepts to functions of n variables;

LO19 Explain the intuitive meaning of partial derivatives;

LO20 Evaluate the gradient and Hessian of f(x,y) at a point (a,b), then determine the Taylor's approximation of f(x,y) using Second order Taylor Polynomial;

LO21 Determine critical points of a function f(x,y), then using the Hessian to identify local extremum / saddle points;

LO22 Relate Cartesian system, Polar coordinate system, and Spherical coordinate system;
LO23 Evaluate partial derivatives using the chain rule for functions of several variables;
LO24 Evaluate double / triple integrals using Fubini's theorem or using different (Polar, Spherical) coordinate systems;
LO25 Evaluate the area / volume of two / three dimensional objects.

FLT 30.8.19

THE UNIVERSITY OF HONG KONG

MASTER OF SCIENCE IN APPLIED GEOSCIENCES

GEOS8206 Mathematics II

Course objective

To provide earth sciences graduates with instruction in mathematics to meet the academic requirements of the Hong Kong Institution of Engineers for membership in the Geotechnical Discipline.

Course Contents (provisional)

1. Ordinary Differential Equations

a) Separable & exact equations / integrating factor

b) First- & second order linear equations

c) Characteristic equations & Wronskian

d) Method of undetermined coefficients / variation of parameters

e) Laplace transform & numerical methods

2. Partial Differential Equations

a) Separation of variables / Fourier series

b) Laplace: heat & wave equations

3. Probability and Statistics

a) Random variables & probability distribution

b) Sampling, estimation & hypothesis testing

c) Regression analysis

Teaching and learning methods

The course is mainly taught by class lectures. Learning is monitored by short Q-A sessions and home assignments.

Assessment Methods

Achievement will be assessed by examination (70%) and coursework (30%). A 3-hour written examination will be held at the end of the semester in Dec 2020. During the course there will be several homework assignments.

Grade Descriptors

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.

Course Textbooks

William E. Boyce, Richard C. DiPrima. *Elementary differential equations and boundary value problems*, 8th ed. Hoboken: Wiley, 2005.

J. Crawshaw, J. Chambers. *A concise course in advanced level statistics : with worked examples*. Cheltenham: Nelson Thornes, 2001.

Robert V. Hogg, Joseph W. McKean, Allen T. Craig. *Introduction to mathematical statistics*, 6th ed.. Upper Saddle River, N.J.: Pearson Education, 2005.

Gregory Baker. *Differential Equations as Models in Science and Engineering.* Singapore: World Scientific, 2016.

Learning outcomes

By the end of this course, students will be able to:
LO1. Identify ordinary differential equations (ODEs) and their orders.
LO2. Verify whether a given function is a solution to a given ODE.
LO3. Classify ODEs into linear and nonlinear types.
LO4. Solve first order linear differential equations using integrating factor method.
LO5. Analyze and solve first order nonlinear ODEs using exact equation.
LO6. Solve second or higher order homogeneous ODEs with constant coefficients using characteristic equations.
LO7. Solve second order nonhomogeneous ODEs using the method of undetermined coefficients and the method of variation of parameters.
LO8. Compute the Laplace transform of a function.
LO9. Compute the solution of second order ODEs with constant coefficients using Laplace transform.
LO10. Use the method of separation of variables to reduce some partial differential equations to ODEs.

LO11. Calculate the Fourier series of periodic functions.
LO12. Find the Fourier sine and cosine series for functions defined on an interval.
LO13. Solve heat equation, wave equation, and the Laplace equation, subject to certain boundary conditions using Fourier series.
LO14. Explain the concepts of sample space, probability (density) function, and random variable.
LO15. Identify different types of distributions, e.g., Binomial, Poisson, Normal.
LO16. Apply Central Limit Theorem to obtain the confident interval for population mean from collected sample data.

FL 1.9.2020