

THE UNIVERSITY OF HONG KONG
MASTER OF SCIENCE IN APPLIED GEOSCIENCES
GEOS7010 Geology: Principles and Practice

Objective

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.

Class schedule (3-hour tutorial)

Matter and Minerals	
Igneous Rocks	SN
Weathering and Soils	
Sedimentary Rocks	
Metamorphic Rocks	SN
Earth Resources	
Origin and Evolution of the Ocean Floor	SN
Earth's Structure and Plate Tectonics	
Crustal Deformation and Mountain Building	SN
Geological Hazards: Earthquakes and Volcanoes	
Geologic Time	SN
Earth's Evolution	

Teaching and Learning Methods

The course is taught through online learning and tutorials. Students study the learning material before class using an eLearning platform (Pearson "Essentials of Geology"). The platform provides a textbook with videos, quizzes and written assignments. The instructor specifies a programme for learning and for submission of assignments. Classroom time is devoted to presentations by students, discussion guided by the instructor and problem-solving activities.

Assessment Methods

Achievement will be assessed by assignments (20%), tutorial participation and performance (20%), and a three-hour examination (60%).

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

Essentials of Geology by Lutgens and Tarbuck, Published by Pearson Education, Inc., 12th edition, 2015.

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 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 tsunami).
6. Demonstrate an understanding of early Earth and supercontinents in the Earth's history.

Course Coordinator: Dr. Samuel Wai-Pan NG (waipanng@hku.hk)

SN/AM 11.10.19

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

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.

Teachers: GEO; Dr Jason R. Ali, DES, HKU,

Dr Rod J Sewell, Geological Survey of HK,

Coordinator: Dr Jason R. Ali

JRA/AWM 28.11.14

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

DRAFT

Course on Site Investigation & Engineering Geological Techniques GEOS7012 2019-20

Dick Martin, <i>GeoconsultHK</i>	1. Site Investigation (SI) for Civil Engineering Projects assignment #1	3 hours
	2. Formulating SI Questions, SI Stages, Desk Study	3 hours
	3. Walkover Survey, Field Mapping, Planning the GI, Ground Models assignment #2	3 hours
	+ half day field class on engineering geological plans	3 hours
Kevin Styles, <i>Fugro</i> JL105	4. Air Photo Interpretation	3 hours
Dick Martin	5. Ground Investigation: Drilling, Probing, Pitting, Sampling assignment #3	3 hours
	6. Ground Investigation: Field Testing, Supervision, Reporting + half-day field class at GI works site or contractor's depot	3 hours
		3 hours
Philip Chung, <i>GEO</i>	7. Laboratory Testing	3 hours
	8. Laboratory Testing + half-day laboratory practical	3 hours
	assignment #4	
Dick Martin	9. Description and Classification of Soil and Rock for Engineering Purposes. JL104, JL106	3 hours
	10. Case Studies and Other Topics: Geotechnical Uncertainty, SI Ethics and Quality Issues, Work of the Engineering Geologist	

Teaching Assistant: Mobile: Office Tel:

Classes

Classes will be held in three-hour sessions on Thursday evenings in JL314A but in JL105 on 20 Feb. Classes will start at 7.00pm and end at 9.45pm, with a 10-minute break. Field classes will be held at times and locations shown.

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. These will be set on or about 23 Jan, 13 Feb, 27 Feb and 19 March.

Course Books

The course textbook is: 'Site Investigation', Clayton, Matthews & Simons, published by Blackwell, 1995. All students should have a copy of this book: 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

Course Learning Outcomes

1. Know how civil engineering projects are accomplished, and how civil engineering design is carried out. **Classes 1 and 2**
2. Understand when and how geological knowledge is best applied in civil engineering projects in the interests of safety, economy and the environment. **All classes**
3. Demonstrate the ability to formulate appropriate questions for geotechnical site investigation. **Classes 2 and 3**
4. Can create simple engineering geological models; can carry out basic soil and rock description and characterisation, and simple air photo interpretation tasks. **Classes 3 and 4, 9**
5. Can critically evaluate the quality of ground investigation operations and the reliability of the associated data. **Classes 6 to 9. Classes 7 and 8** also contribute to the ability to use soil mechanics in geotechnical design.
6. Demonstrate an understanding of the significance of uncertainty in geotechnical prediction and for site investigation. **Class 10**

Course Lecturers

Dick Martin, <i>GeoconsultHK</i>	t 2905 8800	dickmartin1@hotmail.com
Kevin Styles, <i>Fugro</i>	t 2894 5738	k.styles@fugro.com
Philip Chung, <i>GEO</i>	t 2760 5712 f 2762 2389	philipchung@cedd.gov.hk

Co-ordinator: Dick Martin t 2905 8800 dickmartin1@hotmail.com

RPM 21.11.19

Master of Science in the field of Applied Geosciences

Faculty of Science, Department of Earth Sciences, University of Hong Kong

Provisional Timetable for the course GEOS7015 Rock Mechanics 2019-20 First Year - First Semester

Objective:

To introduce the basic concepts of rock mechanics as used in geotechnical practice.

Course Outline:

1. Stress and strain, trigonometry
2. Transformation of stress and strain
3. Mohr's stress circle
4. Stereographical projection, kinematic analysis of rock slope stability
5. Index properties, strength and deformability of intact rock
6. Strength and deformation characteristics of rock masses

Teaching:

- Six 3-hr classes over 6 weeks.
- Classes 1 to 3 will be taught by Ir Ivan Ho. Each class will comprise a lecture followed by a problem solving tutorial. Students will need to bring their scientific calculators to class.
- Classes 4 to 6 will be taught by Dr Louis Wong.
- Students who are unfamiliar with Stereographic Projection methods are advised to prepare for class 4 by studying Appendix B in the recommended textbook.

Assessment:

One 2-hour unseen written examination (70%) and coursework (30%). The coursework includes multiple take-home assignments and a quiz.

Textbook:

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

Learning objectives

1. To be able to perform calculations on stress and strain as used in rock mechanics.
2. To develop an understanding of intact rock strength and deformability and the use of index tests for engineering classification. To be able to analyse laboratory test results and derive intact rock deformability and strength parameters.
3. To know the methods to characterize the key geomechanical properties of joints.
4. To be able to carry out kinematic analysis of rock slope stability (wedge, block, topple) using joint orientation data plotted on stereonet.
5. To know the methods used to characterize and model the strength and deformability of rock masses, including the Hoek-Brown approach and Geological Strength Index (GSI).
6. To be prepared for course GEOS 8102 Rock Engineering and Geomaterials.

Teachers:

Dr Louis Wong (course coordinator) Tel: 2241 5970, Email: LNYWONG@hku.hk

Ir Ivan Ho (external teacher) Tel: 2760 5712, Email: mlho@cedd.gov.hk

LW 11.6.19

THE UNIVERSITY OF HONG KONG

MASTER OF SCIENCE IN APPLIED GEOSCIENCES

GEOS7016 Soil Mechanics

Course objective

To give engineering geologists with no prior learning in Soil Mechanics an understanding of the basic theories and how they are used in geotechnical engineering.

Schedule of classes

Phase relationships, Analysis of plane stress (and strain), Elasticity and Plasticity in geomechanics, Mohr's circles	3 hrs
Principle of effective stresses, compaction	3 hrs
Darcy's law, seepage analysis and flow nets	3 hrs
Consolidation	3 hrs
Lateral earth pressure	3 hrs
Shear strength	3 hrs

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

One 2-hr written examination (70%) and coursework (30%) consisting of 3 home 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.

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.

Lecturer: Ir Prof Philip Chung

Ir Florence Ko

Coordinator: Ir Prof Philip Chung

PC 8.10.2019

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

This course is the first phase of a self-directed study of a problem in applied geosciences. The study includes literature review, data acquisition and data analysis, for the student to enhance understanding of scientific principles and investigation techniques relevant to the problem, and develop insights into it. The first phase focuses on reviewing literature on scientific principles relevant and background to the study, defining precisely the knowledge to be developed, and planning actions to develop the knowledge within the timeframe of the MSc programme.

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 first two semesters. Work is to continue into the summer break after the second semester

Topic

The topic 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 own observations, or provided by the adviser, or acquired from publications, or retrieved from an archive, or obtained by numerical modelling.

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; max 40 words, each sentence ending in a question mark
- (ii) the data needed and how it will be acquired
- (iii) what will be done with the data including the scientific principles and/or skills needed
- (iv) possible roadblocks
- (v) strategy for effective use of limited time for a part-time student

The 500-word written version of the Project Plan should contain the same topics, in addition to a section each on literature review and resources needed, with as appendices a list of key publications reviewed or to be reviewed and a bar chart programme. 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 with not more than 60 words using a font not less than 20-pt, with illustrations on at least five of them.

A Q & A session follows each presentation. The student is to invite a class-mate to record the questions and answers. The student is responsible for the accuracy of the record but may expand on the answers. The Q & A record must be sent to the adviser and Course Coordinator within 7 days of the presentation.

At the end of the semester, 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%.

Grade Descriptors

See the templates attached.

Key Dates

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

6 September: students to submit to the Course Coordinator the project subject to work on.

6 September: briefing to students on the objectives and requirements of the dissertation project and success factors.

13 September: briefing to students on projects and project planning

20 September: briefing to students on reading and writing skills

Between Late October and Early January: student to present on a day agreed with the adviser either a project plan or a submission as directed by the adviser

11 January 2020: students to submit the latest Project Plan or the updated submission to the Adviser with a copy to the Course Coordinator

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

17 January: advisers report the 6-credit grade for course GEOS7020 to Course Coordinator

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

6 September: briefing to students on the objectives and requirements of the dissertation project and success factors.

13 September: briefing to students on projects and project planning

15 September: instruction to students on choosing an adviser and a project topic.

20 September: briefing to students on reading and writing skills

31 October: students to submit to the Course Coordinator a 50-word project statement setting down the project title and broad objective agreed by the adviser named

15 January 2020: briefing to students on project documentation and revision of good practises of self-directed study projects

9 and 10 March: student to present orally the project plan to an invited audience and submit a written version

12 June: students to submit the updated Project Plan

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

Learning Outcomes

LO1 can review literature 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

Course Coordinator

YC Chan Tel: 97845761; email: ycycchan@hku.hk

YCC/190609

(i) Approach and involvement with adviser

Percentage marks and letter grades		Grade Descriptors
MSc Grade	Percentage marks	
A+	90	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	80	
A-	70	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 the student being a bit detached from the advisor
B+	67.5	
B	62.5	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
B-	60	
C+	57.5	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.
C	52.5	
C-		
D	50	D: Marginal pass
F		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

Master of Science in Applied Geosciences
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, \geq half of the slides with illustration Facilitate understanding of points			/10
			/10
2. Delivery Speaks slowly and clearly, facing the audience Follows a clear and logical structure Makes good use of slides Makes good use of time			/10
			/10
			/10
			/10
3. Content – Audience gain clear understanding of questions to be answered data needed and sources planned action on the data potential roadblocks Strategies for effective use of limited time			/6
			/6
			/6
			/6
			/6
4. Questions Response promptly by answering questions or appreciating implications			/10
Total score			/100

Marker's Name: _____

Marks: /100

Date of Marking: _____

YCC/AWM 14.06.18

(iii) Quality of Documentation of Project Plan

Percentage marks and letter grades		Grade Descriptors
MSc Grade	Percentage marks	
A+		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
	90	
A		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
	80	
A-		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
	70	
B+		C- to C+: a collection of points that describes the knowledge to be developed and an action plan that appears to be workable
	67.5	
B		D: Marginal pass
	62.5	
B-		F: an incoherent collection of points that cast doubts on the student's understanding of the knowledge to be developed and ability to deliver.
	60	
C+		
	57.5	
C		
	52.5	
C-		
D	50	
F		

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

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: Sedimentary rocks and structures	7 hrs
Day trip: Igneous rocks	8 hrs
Day trip: Geological history and surficial deposits	7 hrs

Reading material

Hong Kong Geological Survey memoirs 'The Quaternary Geology of Hong Kong' and 'The Pre-Quaternary Geology of Hong Kong', published by Geotechnical Engineering Office, Civil Engineering & Development Department.

Basic geological mapping (5th Ed.) by Richard J. Lisle, Peter Brabham and John W. Barnes. Wiley-Blackwell, Chichester, 2011. (**HKUL** Call no. 550.223 L771 b31)

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.

HC 19.9.19

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

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.

Course coordinator: Prof AW Malone awmalone@hku.hk

AWM 23.5.19

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 Management
GEOS7024 2019-20

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, Butterworth-Heinemann (2003)

Civil Engineering Procedure, Institution of Civil Engineers 6th edition (2009)

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.

Course coordinator

Chan Yun-cheung

Tel 97845761 Fax 25408177 ycyccchan@hku.hk

Teacher

Ng Pui-lam

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YCC 15.5.19

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

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

Teacher and Coordinator: Dr. Haz MC Cheung (hmcc@hku.hk)

MCC 18.12.2019

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

Lecturer: Prof JJ Jiao

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 2019-20

Y C Chan	Analysing the Kwun Lung Lau disaster. Risk management - introduction Assignment no. 1	3 hrs
Barry Hoy Robertson	Sources of law in Hong Kong Law of Tort: negligence	3 hrs 3 hrs
Y C Chan	The risk management process and examples of its use Assignment No 2 Regulation of professional practice: role of trade associations, learned societies, professional qualifying bodies, professional licensing systems, and non-government organisations	3 hrs 3 hrs
Barry Hoy Robertson	Introduction to contracts Assignment No 3	3 hrs

Venue and time: JL104 Thursdays 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. 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

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

**Course outline GEOS8003
Seminars on unforeseen ground conditions, geotechnical and environmental failures**

Objective:

To be able to analyse failures/accidents and draw lessons relating to technical, human and organisational factors.

Course schedule:

Andrew Malone, HKU	The Abbeystead tunnel explosion UK on 23 May 1984
YC Chan HKU	The Space Shuttle Challenger disaster 28 January 1986
Andrew Malone	Settlement due to tunnelling at Tseung Kwan O 1999
Ken Ho, GEO	The Ching Cheung Road landslide of 3 August 1997
Matthew Lam, Clyde & Co	The Lamma Ferry disaster on 1 October 2012

This is a course of five student-led seminars - read the following instructions very carefully.

Start by reading the course Learning Outcomes; you will be assessed for the Grade on how well you have achieved these outcomes. The student team for each seminar is given above and the required reading material is listed below. Having studied this material, each student will prepare a PowerPoint presentation, present for 10 minutes or less and answer questions from the class. Presenters will each use no more than 15 PowerPoint slides, at least half of which must have illustrations. Each presenter must appoint a team-mate to record the Q&A for their presentation.

In presentation 1, student 1 will state briefly the salient **facts** relating to the failure/accident.

In presentation 2, student 2 will analyse the case using the James Reason model to examine the factors which contributed to the cause of the failure. Identify a) the initiating event, b) the barriers which might have prevented the failure/accident and c) the defects in each barrier which allowed the failure/accident to occur.

In presentation 3, student 3 will give analysis and opinions on whether the failure/accident was reasonably foreseeable by the parties whose act(s) and/or omission(s) contributed to the cause of the failure/accident.

Presenters must collaborate with teammates in preparing their presentations. PowerPoint files must be exchanged between students **7 days before the seminar**. Students 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. Group 1 will formulate and present the defence case for one of the parties involved in the failure/accident. Group 2 will provide constructive criticism of the presentations. 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

1. Academic achievement will be assessed against the Learning Outcomes stated below. Oral presentation (50%, using the Oral Presentation scorecard); first assignment paper (20%); second assignment paper (30%).
2. First assignment paper: presenters will each prepare an essay of 800 or more words about their case describing *the factors which contributed to the cause of the failure/accident*. The assignment submission must be emailed to the class, the instructor and erica25@hku.hk within 7 days after the presentation. Bullet points or tables if used must contribute less than 30% of the words.
3. The second assignment requires each student to generalise the findings of the five cases and write individually a newspaper article of 800 or more words on the topic: *Common causative factors in five failures*. To be submitted to erica25@hku.hk before 5 May.
4. Attendance at all seminars is compulsory and examination attendance rules will apply to absentees. Latecomers 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 engineering failures using the James Reason model to examine the multiple factors, both technical and non-technical, 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.

Seminar Instructors

Andrew Malone, HKU DES t2559 2555 f2517 6912 awmalone@hku.hk course coordinator
 Matthew Lam, partner Clyde & Co. t2878 8600 f 2522 5907 matthew.lam@clydeco.com
 Ken Ho, deputy head GEO t2762 5158 kenho@cedd.gov.hk
 YC Chan, HKU DES t2857 8247 f2517 6912 ycycchan@hku.hk

Reading Material*Abbeystead*

Eckersley v Binnie 1988 *18 Construction Law Reports 1*.

Health & Safety Executive 1985. *The Abbeystead explosion*. London: HMSO.

Orr, W.E. et al 1991. The Abbeystead outfall works: background to repairs and modifications and the lessons learned. *J Inst Water Environmental Management*, v5, 7-20.

The Space Shuttle Challenger disaster

Presidential Commission on the Space Shuttle Challenger Accident (1986). *Report of the Presidential Commission on the Space Shuttle Challenger Accident*. <http://history.nasa.gov/rogersrep/genindex.htm>

Feynman, R. (1988). *What Do You Care What Other People Think? – Further adventures of a curious character*. Harper Collins, 255p

Tseung Kwan O settlement

Maunsell Consultants Asia Ltd 2000. *Unusual settlement in Tseung Kwan O Town Centre*, Final Report to Territory Development Department, Hong Kong Government.

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.

Benton I, 2015. A comparative engineering study of HATS stage 1 tunnels C and F. MSc (Applied Geosciences) Dissertation HKU.

Hencher SR 2012 *Practical engineering geology*. Spon Press CRC Press.

Ching Cheung Road landslide

Halcrow Asia Partnership Ltd, 1998. *Report on the Ching Cheung Road landslide of 3 August 1997*.

Geotechnical Engineering Office.

Halcrow Asia Partnership Ltd, 1999. *Addendum report on the Geology and Hydrogeology of Slope No. 11NW-A/C55, Ching Cheung Road*. Landslide Study Report 12/99 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 (unpublished).

Maunsell Consultants Asia 1973. *Report on landslides on Ching Cheung Road*. Report to Public Works Department, Hong Kong Government (unpublished).

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

AWM 15.1.20

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

The second phase of a self-directed study of a problem in applied geosciences for the student to enhance understanding of scientific principles and investigation techniques relevant to the problem, and develop insights into it. It continues with literature review, data acquisition and data analysis and culminates in the production of a dissertation documenting the work carried out by the student and the knowledge developed. 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 own 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 in the first week of June, with a 500-word handout, to an invited audience. The 10-minute oral presentation should cover the following.

1. Objective: what the student set out to achieve: Slide no.1
2. Methodology: what the student did and the outcomes: Slide nos.2-5
3. Results: what the student achieved with respect to the objective: Slide no.6

All slides should contain illustrations, each have less than 60 words using a font not less than 20-pt, and with a plain background.

A Q & A session follows each presentation. The student is to invite a class-mate to assist in recording the questions and answers. The student is responsible for the accuracy of the record but may expand

on the answers. The Q & A record must be sent to the adviser and Course Coordinator within 7 days of the presentation.

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 should be consulted for guidance on the standards required. Ms Erica Lee (erica25@hku.hk) holds a list of examples of dissertations of a high standard.

The binding specification is that applying to HKU higher degrees and may be viewed at Graduate School website.

Assessment

Students will be assessed in four 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 first draft of the dissertation, and
- (iv) Quality of the dissertation as submitted

The four parts carry the relative weight of 20%, 20%, 30% and 30%.

Grade Descriptors

See the templates attached

Key Dates

For students enrolled to finish the Programme within one year

Around 2 and 3 July: students to make an oral presentation of preliminary results to an invited audience, with a 500-word handout

25 July: students to submit draft dissertations in standard format to advisers, with a copy of the Q&A record from the preliminary results presentation; copy both to the Course Coordinator

15 August: students to submit final dissertations to advisers

20 August: advisers report Grade for GEOS8020 to Course Coordinator

31 August: students to submit to DES Office two bound volumes, CD and HKU Library consent form.

For students enrolled to finish the Programme within two years

Around 2 and 3 June: students to make an oral presentation of preliminary results to an invited audience, with a 500-word handout

30 June: students to submit draft dissertations in standard format to advisers, with a copy of the Q&A record from the preliminary results presentation; copy both to the Course Coordinator

31 July: students to submit final dissertations to advisers

20 August: advisers report Grade for GEOS8020 to Course Coordinator

31 August: students to submit to DES Office two bound volumes, CD and HKU Library consent form.

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

Course Coordinator

Y C Chan Tel: 97845761; email: ycycchan@hku.hk

YCC/190609

(i) Approach and involvement with adviser

Percentage marks and letter grades		Grade Descriptors
MSc Grade	Percentage marks	
A+		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
	90	
A		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 the student being a bit detached from the advisor
	80	
A-		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.
	70	
B+		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.
	67.5	
B		D: marginal pass
	62.5	
B-		F: the student has no meaningful contact with the adviser and problems surface too late to be solved
	60	
C+		
	57.5	
C		
	52.5	
C-		
D	50	
F		

(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 Facilitate understanding of points			/10
			/10
2. Delivery Speaks slowly and clearly, facing the audience Follows a clear and logical structure Makes good use of slides Makes good use of time			/10
			/10
			/10
			/10
3. Content – Helps audience gain clear understanding of Objectives Methodology Results			/5
			/20
			/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: _____

YCC/AWM 20.1.16

Marks:	/100
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(iii) Quality of the Dissertation (for both draft and final versions)

Percentage marks and letter grades		Grade Descriptors
MSc Grade	Percentage marks	
A+		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.
	90	
A		B- to B+: Is generally competent in using the basic principles and the essential skills in practice
	80	
A-		C- to C+: Is able to state most of the basic principles but makes limited use of them and the essential skills in practice
	70	
B+		D: marginal pass
	67.5	
B		F: Does not know most of the basic principles and has not mastered the essential skills used in practice
	62.5	
B-		
	60	
C+		
	57.5	
C		
	52.5	
C-		
D	50	
F		

**Master of Science in the field of Applied Geosciences
Faculty of Science Department of Earth Sciences 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

The instructor-led fieldtrips will take place in Southern Lamma Island, with mapping and synthesis projects based in adjacent areas.

Field trip 1 MoTatWan - Tung O

Field trip 2 Tung O – Sham Wan

Field trip 3 LoSoShing coastline south (Introduction to report field areas)

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

Notebook

Synthesis report

(Marked on pass/fail basis.)

Learning Outcomes

1. Can produce a geological map and fieldsheets of an area $\sim 2\text{km}^2$
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.

Instructor and Coordinator

Dr. Jess King

JK/AWM 13.1.15

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 2019-20

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.

Course schedule

Vickie Kong GEO	Earth Pressures and the Stability of Retaining Walls	4.5 hrs
	Bearing Capacity and the Settlement of Shallow Foundations	4.5 hrs
	Design of Piled Foundations	6 hrs
	Practice in calculating forces acting on retaining walls and the bearing capacity of foundations	3 hrs
Andrew Malone	Practice in calculating stresses in the ground	3 hrs
Philip Chung GEO	Stability of Geotechnical Structures (bound methods and limit equilibrium method)	6 hrs
	Stability of Slopes	6 hrs
Andrew Malone	Burland's Triangle; mechanics, observed behaviour geological models & empiricism in geotechnical design	3 hrs

Full-time students start the course in class 7 on 21 Oct and take classes 1-6 in the second semester weeks 3-6, 8 & 9.

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 about five 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 required 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).
- 2 Knows basic soil mechanics theory and how it is applied in geotechnical design. This includes the Principle of Effective Stress, Consolidation Theory, Mohr-Coulomb failure criterion, Bound Methods, Limit Equilibrium Method, Earth Pressure theories, Bearing Capacity theories. 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, landfills, marine reclamations and slopes.
- 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

Teachers

Andrew Malone (Coordinator)

Philip Chung

Vickie Kong

AWM 3.6.19

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

Course on Rock Engineering and Geomaterials GEOS8102 (2019-2020)

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)	Teacher
1	Stereographic projection methods & rock slope stability	Dr Louis NY Wong
2	Rock mass and discontinuity surveys (online)	
3	Discontinuity shear strength criteria (online)	
4	Intact rock/rock mass failure criteria (online)	
5	Rock mass classifications (online)	
6	Foundations and piling on/in rock (online)	
7	Reliability and back analysis in rock engineering (online)	
	University Holiday	
8	Online quiz	Dr Louis NY Wong
9	Engineering use of geomaterials (online)	Ir Roy Hung
10	Design in rock engineering (online)	Ir Patrick Chau
	Holiday	
11	TBM excavation in urban areas (online)	Ir Patrick Chau
12	Tunnels and underground excavations (online)	Ir Patrick Chau
13	Case Histories-Tunneling in rock (online)	Ir Patrick Chau

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.rocsience.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:

- Understand the fundamental design processes in civil and mining engineering and the realm of rock engineering.
- 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.
- Describe and use empirical discontinuity shear strength, and intact rock and rock mass failure criteria.
- Classify rock masses and use the associated rock quality values for preliminary assessment of rock mass properties and support requirements.
- Know reliability and back analysis concepts in rock engineering.

Pre-requisites

Course GEOS7015 Rock Mechanics

Lecturers

Dr Louis NY Wong (Coordinator)

Ir Roy Hung (External teacher)

Ir Patrick Chau (External teacher)

LNYW 06 January 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

	Approximate number of hours
(1) Behaviour of structural members	4
(2) Statically determinate and indeterminate structures	2
(3) Load transfer mechanism	2
(4) Design of reinforced concrete and steel members	4
(5) Design of foundations and retaining walls	4
(6) Tutorial	2

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 coursework will comprise a set of exercises, questions involving solutions to structural mechanics problems.

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 2013.

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 2004 and check the adequacy of the pad foundation in shear.

Course Lecturer

Prof H K Ng

Course Coordinator

Prof A W Malone

AWM/HKN 3.12.2014

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

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|---------|---|
| 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.

Coordinator & Lecturer:

Dr FL Tsang HKU Dept of Mathematics

FLT 30.8.19

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

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 May 2015. 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.

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.

Prerequisite

A pass in course GEOS8205 Mathematics I.

Lecturer: Dr FL Tsang HKU Department of Mathematics

Coordinator: Prof Andrew Malone