Academic Year	2018/2019 **Semester** 2
Course Coordinator	Dr Kyle Bradley
Course Code	ES0001
Course Title	Physical Environments of Singapore
Pre-requisites	Nil
No of AUs	3
Contact Hours	26 hours lecture, 39 hours lab and field excursion
Proposal Date	10.01.19

Course Aims

This is an introductory course designed to provide you with a broad understanding of the physical environments in Singapore. You will learn about how Earth Systems have affected the physical environment of Singapore over time. The emphasis will be on the natural physical processes by which these environments form, evolve and interact dynamically in the Earth Systems as part of the lithosphere, hydrosphere, atmosphere, biosphere and anthrosphere. Since Earth Systems Science is interdisciplinary by nature, we will use multi-scientific disciplines, especially geology, chemistry, physics, biology and mathematics. Emphasis will be placed on examining the various environments in the field and through exploratory laboratory exercises. The material covered in this course will provide a strong basis for understanding and evaluating potential changes to Singapore's environment in the future.

Intended Learning Outcomes (ILO)
By the end of this course, you (as a student) would be able to:

1. Identify and describe the key physical environments of Singapore.
2. Critically evaluate the effects of human interventions into Singapore's marine, coastal and terrestrial environments.
3. Apply scientific methods of investigation of the environments of Singapore.
4. Speculate in an informed manner on the future of the physical environments of Singapore.

Course Content

See schedule below

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/ Individual	Assessment Rubrics
1. Continuous Assessment I – Homework (Appendix I)	1,2,3,4	Knowledge; Intellectual flexibility and critical thinking; Passion and communication; Formulating questions;	30%	Individual	Appendix I

		Research; Problem solving; Interdisciplinary; Lifelong learning; Values; Collaboration and leadership			
2. Continuous Assessment II – Lab and Field reports	1,2,3,4	Knowledge; Intellectual flexibility and critical thinking; Passion and communication; Formulating questions; Research; Problem solving; Interdisciplinary; Lifelong learning; Values; Collaboration and leadership	30%	Individual	Appendix II
3. Continuous Assessment II – In-class quizzes	1,2,3,4	Knowledge; Intellectual flexibility and critical thinking; Passion and communication; Formulating questions; Research; Problem solving; Interdisciplinary; Lifelong learning; Values; Collaboration and leadership	10%	Individual	Appendix III
4. Final Project	1,2,3,4	Knowledge; Intellectual flexibility and critical thinking; Passion and communication; Problem solving; Interdisciplinary	30%	Team/Individual	Appendix IV
Total			100%		

Formative feedback

You will receive informal feedback continuously throughout the course where appropriate, including in the field, and formal feedback following every assignment. In addition, I will be available to answer questions regarding your assignments and labs/excursions throughout this course.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Active learning	You will engage in active learning techniques periodically throughout lectures, and during lab sessions and field excursions.
Independent learning	You are required to show self motivation and initiative in your learning process, such as completion of homework and preparation for tutorials and excursions.

Recommended reading

Dynamic Environments of Singapore, Daniel A. Friess and Grahame J. H. Oliver, 2015, McGraw-Hill Education (Asia) ISBN 978-981-4575-70-6

Course Policies and Student Responsibilities

(1) General

Students are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and hand in all scheduled assignments and labs/field activities by scheduled due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements for lectures or lab sessions they have missed. Students are expected to participate in all activities.

(2) Absenteeism

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Dr. Kyle Bradley	N2-01C-75	+65 9855 2732	kbradley@ntu.edu.sg

Planned Weekly Schedule

Week	Date	Intended LOs	Lecture/Activity	Topic
1.1	17.01.18	1,2,4	Lecture	**Introduction to the course and assignments** - Course structure, teaching style, learning outcomes, - Details on assignments and deadlines
		3	*Tutorial*	***Mapping Singapore's environments*** - *Hand draw a map of Singapore* - *Use external sources to locate current areas with different physical environments.*
1.2	18.01.19	1,2,3,4	Lab	**Discovering Singapore's geology** - Discovering the geological units of Singapore by description of hand samples - Initial thoughts about paleoenvironment and geological history
2.1	24.01.19	1,2,4	Lecture	**The Bedrock Geology of Singapore** - The deep subsurface environment - Geological inference - Geological units and facies - Paleoenvironments of formation
		3	*Tutorial*	*Group discussion of paleoenvironments*
2.2	25.01.19	1,2,3,4	Excursion	***Little Guilin Quarry*** - Field observations and cross-cutting relationships
3.1	31.01.19	1,2,4	Lecture	**Singapore's Global Geological Context** - Global tectonics and Earth history - Pangea - Collision with Asia - Sunda
		2,5	*Tutorial*	*Group exercise - Locating Singapore on*

				paleogeographic reconstructions and comparison with geological units
3.2	01.02.19	1,2,3,4	Excursion	***Bukit Batok West*** - Observations of the Jurong Formation and depositional environments
4.1	07.02.19	1,2,4	Lecture	**Topography, Soils, and Slopes** - The shallow subsurface environment - Erosion, landsliding, and geomorphology - Types and distribution of soils
		3	*Tutorial*	*Evaluation of slope stability in a theoretical excavation*
4.2	08.02.19	1,2,3,4	Lab	**Singapore's Changing Landscape** - Evaluation of topographic changes from excavation, quarrying, and land reclamation - Internal vs external fill material
5.1	14.02.19	1,2,4	Lecture	**Singapore's Climate and Weather** - Singapore's atmospheric environment - Weather and climate in Southeast Asia - Climate change
		3	*Tutorial*	*Group analysis of weather data from Singapore*
5.2	15.02.19	1,2,3,4	*Excursion*	***East Coast Park***
6.1	21.02.19	1,2,4	Lecture	**Singapore's Forest Environments** - Primary and secondary forests - Native and non-native species - Forest management
		3	*Tutorial*	*Group identification of typical Singapore forest plants*
6.2	22.02.19	1,2,3,4	Excursion	***Dairy Farm and Wallace Center*** - Mapping tree types - Interpretation of forest history
7.1	28.02.19	1,2,4	Lecture	**Agricultural heritage of Singapore** - Crops in Southeast Asia - Deforestation and economy - Estates and modern Singapore
		3	*Tutorial*	**Singapore's principal crops**
7.2	02.03.19	1,2,3,4	Lab	**Historical maps and land use** - Tracking the development of

				Singapore's forest, agricultural, and urban landscape over time using historical maps.
RW			**RECESS WEEK**	
8.1	14.03.19	1,2,4	Lecture	**Singapore's Coastal Environments** - Coral reefs - Mangrove swamps - Modified coastlines
		3	*Tutorial*	*Group examination of Singapore's coast using Google Earth*
8.2	15.03.18	1,2,3,4	Excursion	**Sungei Buloh** - Mapping mangroves - Primary or modified coastal environment?
9.1	21.03.18	1,2,4	Lecture	**Urban Environments of Singapore** - Infrastructural development - Drainage and flooding - Environmental impacts
		3	*Tutorial*	*Group investigation of recent development in Bukit Batok West, Tengah, and Jurong West*
9.2	22.03.18	1,2,3,4	Excursion	**Marina Barrage** - Urban hydrology and flooding
10.1	28.03.18	1,2,4	Lecture	**Fauna of Singapore** - Ancient fauna - Modern fauna - Environmental change and challenges
	29.03.19	1,2,3,4	*Lab*	*Final project introduction: Bats at NTU*
11.1	04.04.19	2,3,4	Lecture	**No lecture – final project work – office hours**
11.2	05.04.18	2,3,4	Lab	**Final project lab time**
12.1	11.04.18	2,3,4	Lecture	**No lecture – final project work – office hours**
12.2	12.04.18	2,3,4	Lab	**Final project lab time**
13.1	18.04.18	2,3,4	**Final project presentations**	
13.2	19.04.18		**VESAK DAY – NO CLASS**	

Appendix I. Assessment Criteria for Homework

Grade / Numerical Score	Criteria
A+ (Exceptional) A (Excellent)	- Takes an original approach to the question. - Very well structured and focused, and does not deviate from the given question. - Evidence of excellent ability to apply knowledge taught in the course while thinking outside the box - Evidence of deep understanding and not just memorization of key concepts taught in the course.
A- (Very good)	- Takes a conventional approach to the question. - Has evidence of structure and focus, and is mostly on-topic. - Evidence of some ability to apply knowledge taught in the course. - Some evidence of understanding and not just memorization of key concepts taught in the course.
B+ (Good) B (Average)	- Takes a conventional (though somewhat unoriginal) approach to the question. - Has some evidence of structure and focus, and does not deviate substantially from the topic. - Evidence of some (but not significant) ability to apply knowledge taught in the course. - Some familiarization of key concepts taught in the course but evidence of deep understanding is limited.
B- (Satisfactory) C+ (Marginally satisfactory) C (Bordering unsatisfactory)	- Does a poor to middling job of addressing the question. - Has limited structure and focus, and frequently strays off topic. - Limited evidence of ability to apply knowledge taught in the course. - Limited familiarization of key concepts taught in the course.
C- (Unsatisfactory) D (Deeply unsatisfactory)	- Inadequate in addressing the question. - Lacks structure and focus and is mostly or wholly off topic. - Inadequate capacity to apply knowledge taught in the course. - Poor familiarization of key concepts taught in the course.
F (0-44)	- Failure to complete homework

Appendix II. Assessment Criteria for Field and Lab Reports

Grade / Numerical Score	Criteria
A+ (Exceptional) A (Excellent)	- Exceptional quality of field or lab observations. - Well-organized responses with carefully drafted figures and neat handwriting. - Clear evidence for independent thought about course subjects - Addresses the questions at hand clearly and systematically.
A- (Very good)	- Exceptional quality of field or lab observations. - Well-organized responses with carefully drafted figures and neat handwriting. - Abundant evidence for independent thought about course subjects - Addresses the questions at hand clearly and systematically.
B+ (Good) B (Average)	- Good quality of field or lab observations. - Organized responses with well drafted figures and neat handwriting. - Clear evidence for independent thought about course subjects - Mostly addresses the questions at hand clearly and systematically.
B- (Satisfactory) C+ (Marginally satisfactory) C (Bordering unsatisfactory)	- Poor quality of field or lab observations. - Disorganized responses with poorly drafted figures and messy handwriting. - Little evidence for independent thought about course subjects - Tangentially addresses the questions at hand.
C- (Unsatisfactory) D (Deeply unsatisfactory)	- Exceptionally poor quality of field or lab observations. - Disorganized responses with very carelessly drafted figures and illegible handwriting. - No evidence for independent thought about course subjects - Does not address the questions at hand.
F (0-44)	- Failure to submit field or lab report.

Appendix III. Assessment Criteria for In-Class Quizzes

In-class quizzes are summative assessments that measure student retention of basic factual information presented in class. Grades are directly derived from the number of questions correctly or incorrectly answered. The lowest two quiz grades are dropped from the final score to account for the possibility of missed lectures.

Appendix IV. Assessment Criteria for Final Project

Standards	Criteria
A+ (Exceptional) A (Excellent)	- Clear description, interpretation and explanation of research process and findings - Clarity and distinct originality of thought, with clear link to major topics from research materials, as well as important linked topics. - Correct use of referencing throughout. - Use of stylish scientific language, with no grammatical or spelling errors. - Shows clear understanding of key concepts and theories, and interpretation of wider context issues. - Formatted in the correct scientific specification.
A- (Very good) B+ (Good)	- Clear description and explanation of research process and findings - Clarity of thought, with clear link to major topics from research materials - Correct use of referencing throughout. - Use of scientific language, with few grammatical and no spelling errors. - Shows an understanding of secondary readings/research - Shows an understanding of the key concepts and theories. - Formatted to the correct scientific specification.
B (Average) B- (Satisfactory) C+ (Marginally satisfactory)	- Some description and explanation of research process and findings. - Some discernable links to the major topics from research materials. - Correct use of referencing throughout most of the paper. - Fair use of scientific language, with some grammatical and spelling errors. - Shows a fair understanding of secondary readings/research - Shows some understanding of the key concepts and theories. - Formatted to the correct scientific specification.
C (Bordering unsatisfactory) C- (Unsatisfactory)	- Some description of research process and findings. - Limited link to major topics from research materials. - Correct use of referencing throughout some of the paper. - Some use of scientific language, with grammatical and spelling errors. - Identifies secondary readings/research - Identities key concepts and theories. - Some attempt to format to the correct scientific specification.
D (Deeply unsatisfactory) F (0-44)	- Unclear or no description of research process and findings - Failure to link to major topics from research materials - Incorrect use of referencing throughout most of the paper. - No scientific language, with grammatical and spelling errors. - No secondary readings/research referenced. - No identification or misinterpretation of key concepts and theories. - Incorrect formatting. - Failure to submit project report or presentation