

City University of Hong Kong
Course Syllabus

offered by School of Energy and Environment
with effect from Semester A 2021/22

Part I Course Overview

Course Title: Introduction to Energy and Environmental Data Analysis

Course Code: SEE2003

Course Duration: 1 semester

Credit Units: 3 credits

Level: B2

Arts and Humanities

Proposed Area:
(for GE courses only)

Study of Societies, Social and Business Organisations

Science and Technology

Medium of Instruction: English

Medium of Assessment: English

Prerequisites:
(Course Code and Title)

MA1200 Calculus and Basic Linear Algebra I or
MA1300 Enhanced Calculus and Linear Algebra I; AND
MA1201 Calculus and Basic Linear Algebra II or
MA1301 Enhanced Calculus and Linear Algebra II

Precursors:
(Course Code and Title)

Nil

Equivalent Courses:
(Course Code and Title)

Nil

Exclusive Courses:
(Course Code and Title)

Nil

Part II Course Details

1. Abstract

(A 150-word description about the course)

The course will provide students with the knowledge of using statistical methods in energy and environmental science. Analysis methods, such as probability, random variable (discrete & continuous), parameter estimation, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test, are very helpful for students to understand the physical processes occurring in the environment, and to work on climate prediction. Students are required to use the knowledge learnt from this course to analyse the data with computational tools, such as Python. Overall, students would gain the understanding of statistical methods in energy and environmental science and they would be capable to analyse the data using statistical methods.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs [#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Describe the concepts of basic statistical methods	20%	✓		✓
2.	Use probability, random variable (discrete & continuous), parameter estimation, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test to describe energy and environmental datasets and solve energy and environmental problems creatively	30%		✓	✓
3.	Use correlation method to analyse energy and environmental datasets and discover the linkage between the data results and with energy and environmental problems	35%		✓	✓
4.	Apply the statistical methods creatively to explain the problems in energy and environmental science	15%	✓	✓	✓
		100%			

* If weighting is assigned to CILOs, they should add up to 100%.

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.				Total Hours
		1	2	3	4	
Lecture	Deliver basic knowledge of statistical methods and explain numerical method of describing energy and environmental data	7	7	6	2	22
Tutorials	Apply theories and concepts on practical examples	1	3	3	1	8
Project	Require students to study a real energy and environmental problem by means of analysing data using statistics method (i.e. Python programming)		2	2	5	9
Total		8	12	11	8	39

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: 65%						
Assignments There will be several assignments throughout the semester. Students will complete the assignments to demonstrate their ability to apply their knowledge in statistics/probability to solve energy and environmental related problems.	✓	✓	✓	✓	15%	
Mid-term	✓	✓	✓	✓	25%	
Project Students are required to pick up one energy or environmental related problem to analyse the data by statistical method and computational tool (i.e. Python programming). They need to write a program and submit a report to present their findings, outcomes and conclusion. Their personal recommendation to address the problem is also needed.		✓	✓	✓	25%	
Examination: 35% (duration: 2 hours) Final exam will test students' ability to apply their knowledge learned throughout the course in energy and environmental problems.						
					100%	

* The weightings should add up to 100%.

Examination duration: 2 hrs

Percentage of coursework, examination, etc.: 65% by coursework; 35% by exam

To pass a course, a student must do ALL of the following:

- 1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
- 2) obtain at least 30% of the total marks allocated towards final examination (if applicable);
and
- 3) meet the criteria listed in the section on Assessment Rubrics.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	Ability to use the statistical concepts and knowledge to analyse and solve the energy and environmental related application problems	Excellent analysis and problem-solving skills to demonstrate in-depth understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Good analysis and problem-solving skills to demonstrate good understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Acceptable analysis and problem-solving skills to demonstrate adequate understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Marginally acceptable analysis and problem-solving skills to demonstrate some understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Poor analysis and problem-solving skills and are barely able to demonstrate an understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.
2. Mid-term	Ability to use the statistical concepts and knowledge to analyse and solve the energy and environmental related application problems	Excellent analysis and problem-solving skills to demonstrate in-depth understanding of probability, population, distributions random variable (discrete & continuous).	Good analysis and problem-solving skills to demonstrate good understanding of probability, population, distributions random variable (discrete & continuous).	Acceptable analysis and problem-solving skills to demonstrate adequate understanding of probability, population, distributions random variable (discrete & continuous).	Marginally acceptable analysis and problem-solving skills to demonstrate some understanding of probability, population, distributions random variable (discrete & continuous).	Poor analysis and problem-solving skills and are barely able to demonstrate an understanding of probability, population, distributions random variable (discrete & continuous).
3. Project	Capacity for self-directed learning in exploring the	Excellent report writing and no difficulties in identifying syntax	Good report writing and minor problems with syntax. Programs are	Acceptable report writing and moderate problems with syntax. Programs are structured	Marginally acceptable report writing and numerous problems	Poor report writing and little understanding of Python syntax.

	energy and environmental problems, and to analyse the data using Python	errors. Programs conform to standard Python style and give the correct output. The energy and/or environmental problems can be solved creatively and innovatively by providing a very comprehensive recommendation.	structured correctly but some of the output are incorrect. The energy and/or environmental problems can be solved basically, and some recommendations are provided and discussed.	incorrectly and the output are largely incorrect. The energy and/or environmental problems can be solved fairly, but the recommendations are missing.	with syntax. Programs are somewhat relevant but cannot solve the problem. Findings and recommendations are all missing.	Programs are unrelated to the problem.
4. Examination	Ability to use the statistical concepts and knowledge to analyse and solve the energy and environmental related application problems	Excellent analysis and problem-solving skills to demonstrate in-depth understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Good analysis and problem-solving skills to demonstrate good understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Acceptable analysis and problem-solving skills to demonstrate adequate understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Marginally acceptable analysis and problem-solving skills to demonstrate some understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.	Poor analysis and problem-solving skills and are barely able to demonstrate an understanding of probability, parameter estimation, random variable, confidence interval and hypothesis testing, inferences involving one and two populations, simple linear regression, analysis of variance and goodness-of-fit test.

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- The role of statistics and the data analysis process
- Numerical method of describing data
- Probability
- Population distributions
- Random variable (discrete & continuous)
- Hypothesis testing and confidence interval
- Inferences involving one population (e.g. t-distribution, chi-square distribution, etc.)
- Inferences involving two populations (e.g. comparison of two populations, f-distribution)
- Simple linear regression
- Analysis of variance
- Goodness-of-fit test

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Statistics: The exploration and analysis of data, 7 th Edition, 2012. Roxy Peck Jay L DeVore. ISBN-10:0840058012.
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2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Statistics for Environmental Engineers, 2nd Edition, 2002. Linfield C. Brown, Paul Mac Berthouex, ISBN: 1566705924
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