City University of Hong Kong
Course Syllabus

offered by Department of Systems Engineering
with effect from Semester A 2024 / 25

Part I Course Overview

Course Title:	Quantitative Methods for Systems Engineering and Engineering Management
Course Code:	SYE8105
Course Duration:	One semester
Credit Units:	3
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	SEEM8105 Quantitative Methods for Systems Engineering and Engineering Management (offered until 2021/22) /ADSE8105 Quantitative Methods for Systems Engineering and Engineering Management (offered until 2023/24)
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course has two parts. The first part provides students with a solid foundation of statistical concepts, theory, and methods including probability theory, statistical estimation and inference methods, and multivariate statistics and linear models. Emphasis will be placed on intuitive and rigorous understanding of the fundamentals of statistics but implementation of the statistical methods via computer programming in R or Matlab will be an important part of the course as well. The second part teaches students to simulate real-world systems and analyse the simulation model. In particular, this part will cover some basic introduction of simulation and some statistical aspects of simulation such as input analysis, random variate generation, output analysis, and variance reduction techniques.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes		
			A1	*A2*	*A3*
1.	**Define** the various fundamental concepts and principles in statistics.	30%	✓	✓	
2.	**Derive** statistical inference formulas and procedures from given assumptions.	20%	✓	✓	
3.	**Establish** simulation models for real-world problem	20%		✓	✓
4.	**Perform** statistical analysis for the simulation inputs and outputs.	30%	✓		✓
		100%			

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. Learning and Teaching Activities (LTAs)

LTA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Large Class Activities	Learning through teaching is primarily based on lectures. Mini-lectures and tutorials will be used to facilitate understanding and applications of various concepts and methods.	✓	✓	✓	✓	✓	26 hrs/ semester
Tutorial Exercises	The homework exercises provide students with the opportunities to familiarize themselves with the methods learnt during the lectures.	✓	✓	✓	✓	✓	21 hrs/ semester

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: _75___%							
Midterm exam	✓	✓	✓	✓	✓	25%	
Assignments	✓	✓	✓	✓	✓	50%	
Examination: __25__% (duration: , if applicable)							
						100%	

5. Assessment Rubrics

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignments	Students' ability to apply relevant statistical procedures, draw informed conclusions in data analysis, construct simulation models and perform statistical analysis.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Midterm exam	Midterm exam focuses on the part of statistics. It assesses students' understanding of the concepts, theory, and methods of statistical inference.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Final exam	Final exam focuses on the part of simulation. It assesses students' ability to analyze simulation models.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignments	Students' ability to apply relevant statistical procedures, draw informed conclusions in data analysis, construct simulation models and perform statistical analysis.	Excellent	Good	Marginal	Failure
2. Midterm exam	Midterm exam focuses on the part of statistics. It assesses students' understanding of the concepts, theory, and methods of statistical inference.	Excellent	Good	Marginal	Failure
3. Final exam	Final exam focuses on the part of simulation. It assesses students' ability to analyze simulation models.	Excellent	Good	Marginal	Failure

Part III Other Information

1. Keyword Syllabus

- Probability theory and distributions (probability space, random variables, expectation and convergence of random variables)
- Statistical inference concepts (maximum likelihood, statistical decision theory, Bayesian inference, bootstrap)
- Multivariate statistics and linear model theory
- Construction of simulation models
- Input analysis, random variate generation
- Output analysis, and variance reduction techniques

2. Reading List

2.1 Compulsory Readings

1.	Wasserman, L. (2013). *All of statistics: a concise course in statistical inference*. Springer Science & Business Media.

2.2 Additional Readings

1.	Khuri, A. I. (2003). Advanced calculus with applications in statistics (Vol. 486). John Wiley & Sons.
2.	Rosenthal, J. S. (2006). A first look at rigorous probability theory. World Scientific Publishing Co Inc.
3.	Blitzstein, J. K., & Hwang, J. (2014). Introduction to probability. CRC Press.
4.	Martinez, W. L., & Martinez, A. R. (2007). Computational statistics handbook with MATLAB (Vol. 22). CRC press.
5.	Manuel D. Rossetti. (2015). Simulation Modeling and Arena, 2nd Edition. Wiley.