City University of Hong Kong
Course Syllabus

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

Part I Course Overview

Course Title:	Data Analysis and Artificial Intelligence for Systems Engineering
Course Code:	SYE6110
Course Duration:	One Semester
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	SYE4003 Artificial Intelligence and Advanced Technology in Manufacturing and Operations or SYE6106 Intelligent Manufacturing for Engineering Managers
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	ADSE6110 Data Analysis and Artificial Intelligence for Systems Engineering (offered until 2023/24)
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

As one of the most popular disciplines in recent years, data-driven Artificial Intelligence (AI), particularly machine learning-based approaches, is gradually transforming nearly all industries, such as domain of the engineering management Advances in artificial intelligence, such as deep learning methods, are widely employed in many engineering industries for data analysis and research. Therefore, for those who wish to join the waves of AI, this course covers fundamental but comprehensive concepts and experiments of data analysis and machine learning, including but not limited to topics such as classification and regression, unsupervised clustering, machine learning, and an introduction to deep learning. This course provides hands-on opportunities to develop fundamental statistical, data-analysis, and AI models using the popular Python tools for smart manufacturing cases. This course will construct a solid foundation for more advanced courses in engineering, marketing, finance, economics, and more advanced data science, deep learning, and AI.

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.	Identify the state-of-the-art key issues of a data analysis problem engineering management or manufacturing; and formulate these issues into machine learning or AI models for further analysis.	30%	✓	✓	✓
2.	Apply the data analysis, machine learning knowledge acquired through the course to select the most appropriate technique for a given problem.	25%		✓	✓
3.	Analyze relevant data effectively using appropriate data analysis/machine learning techniques to solve the problems and evaluate the results in the context of the problems.	25%		✓	✓
4.	Develop the ability to use python module to conduct data analysis for manufacturing related problems.	20%		✓	✓
		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 real-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)

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

LTA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	Concepts and specific subject knowledge are explained	✓	✓	✓		13 hours/sem
In-class exercise	With the teacher acting as a facilitator, students work together on assigned engineering problem sets to consolidate their understanding of the concepts and methods. They are required to formulate the problem into a data driven model (define the machine learning inputs and targets) and proceed to solve the problem (the method). These exercises are based on data from real-life applications.	✓	✓	✓	✓	26 hours/sem

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: __50__%						
Assignment or midterm	✓	✓	✓	✓	50%	
Examination: _50__% (duration: 2 hrs , if applicable)						
Examination	✓	✓	✓	✓	50%	
					100%	

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following 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. Assignment	Core concepts, ideas and coding of data driven software	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Examination	Core concepts and ideas; use of appropriate data-driven, machine learning, or AI methods	High	Significant	Moderate	Basic	Not even reaching marginal levels

Applicable to students admitted in 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. Assignment	Core concepts, ideas and coding of data driven software	Excellent	Good	Marginal	Failure
2. Examination	Core concepts and ideas; use of appropriate data-driven, machine learning or AI methods	Excellent	Good	Marginal	Failure

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.)

- Introduction to AI, machine learning, deep learning, and their applications in engineering and engineering management
- Python programming
- Linear regression with multiple approaches
- Bayes' Theorem
- Unsupervised learning and kmeans
- Logistic regression
- Decision tree
- Support vector machine
- Deep learning and neural networks
- Case studies for engineering and manufacturing applications

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.)

Nil

2.2 Additional Readings

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

1.	Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming 2nd Edition
2.	Statistics for Business: Decision Making and Analysis, by Robert Stine and Dean Foster
3.	Deep Learning with Python
4.	Machine Learning, Andrew Ng, coursera.org