Part I   Course Overview

Course Title:	Machine Learning for Business
Course Code:	IS4861
Course Duration:	One Semester
Credit Units:	3
Level:	B4
Proposed Area: *(for GE courses only)*	☐Arts and Humanities ☐Study of Societies, Social and Business Organisations ☐Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	(CB2200 Business Statistics or MA2506 Probability and Statistics) and one programming course (either IS3230 Java Programming for Business or IS2240 Python Programming for Business)
Precursors: *(Course Code and Title)*	IS4834 Business Intelligence and Analytics
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)

   Machine learning plays a central role in the emergence of technology trends such as big data, artificial intelligence, and FinTech.   This course introduces students to the real world challenges of implementing machine learning based business solutions.   The main topics covered in this course include advanced machine learning techniques (clustering, classification, and regression), Ensemble Method, Neural Network, Deep Learning, sequence models, and so on.

   This course is an introduction to advanced machine learning and algorithms relevant for business students. Through this course, students will develop a basic understanding of the concepts in machine learning and apply these knowledge to derive business solutions in a wide range of domains.   Students will get hands-on experience with machine learning and artificial intelligence from a series of business case studies.

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 main concepts in machine learning such as classification, clustering, ensemble method, and deep learning.	20%	✓		
2.	Apply the concepts and techniques of machine learning in a wide range of business applications.	30%		✓	✓
3.	Develop solutions based on machine learning algorithms using Python programming language.	30%		✓	✓
4.	Identify appropriate tools and techniques in machine learning to create innovative business solutions.	20%	✓	✓	
		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.				Hours/week
		1	**2**	**3**	**4**	**(if applicable)**
TLA1: Lecture	Explain the fundamental and emerging supervised and unsupervised machine learning techniques that are applied in contemporary business applications.	✓	✓			Seminar: 3 Hours/Week
TLA2: Laboratory	Demonstrations by instructor and hands-on exercises by students to reinforce various machine learning techniques learnt in lectures.		✓	✓	✓	
TLA3: Group Project	Students will have to complete a group project requiring them to adopt machine learning to solve a specific business problem.		✓	✓	✓	

4. Assessment Tasks/Activities (ATs)
(ATs are designed to assess how well the students achieve the CILOs.)

Indicative of likely activities and tasks students will undertake to learn in this course.   Final details will be provided to students in their first week of attendance in this course.

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks[#]
	1	2	3	4		
Continuous Assessment: <u>60%</u>						
AT1: Continuous Assessment Students are expected to participate in laboratory exercises using Python programming languages. Students are expected to discuss and reflect on the materials covered in the lecture. The specific assessments include: - in-class and take-home laboratory assignments on using machine learning packages in Python - class presentation and discussion on machine learning topics	✓	✓	✓	✓	40%	
AT2: Group Project A group project, which includes a written report and oral presentation, will be assigned to students to apply the concepts and techniques of machine learning to solve business problems.		✓	✓	✓	20%	
Examination: <u>40%</u> (duration: one 2-hour exam)						
AT3: Final Examination Students will be assessed via the examination on their understanding of concepts learned in class and reading materials, and their ability to apply subject-related knowledge.	✓	✓	✓	✓	40%	
* The weightings should add up to 100%.					100%	

[#] Remark: Students must pass BOTH coursework and examination in order to get an overall pass in this course.

5.   Assessment Rubrics

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

Assessment Task (AT)	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
AT1: Continuous Assessment	Ability to accurately describe the key concepts of machine learning and deep understanding of their importance to business.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Ability to evaluate accurately the requirements of various machine learning algorithms in order to solve different business problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Capability to compare and evaluate accurately the advantages and disadvantages of different machine learning techniques for the same purpose.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Capability to innovatively analyze and apply machine learning techniques to solve business problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
AT2: Group Project	Ability to evaluate accurately the requirements of various machine learning algorithms in order to solve different business problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Capability to compare and evaluate accurately the advantages and disadvantages of different machine learning techniques for the same purpose.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Capability to innovatively analyze and apply machine learning techniques to solve business problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
AT3: Final Examination	Ability to accurately describe the key concepts of machine learning and deep understanding of their importance to business.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Ability to evaluate accurately the requirements of various machine learning algorithms in order to solve different business problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Capability to compare and evaluate accurately the advantages and disadvantages of different machine learning techniques for the same purpose.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	Capability to innovatively analyze and apply machine learning techniques to solve business problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels

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.)

     Unsupervised learning; Supervised learning; Sampling; Ensemble Methods; Feed Forward Neural Network; Recurrent Neural Networks; Deep Learning; Sequence models; Tensorflow; Machine learning applications in Sentiment Analysis; Machine learning applications in tick-level stock trading, and so on.

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.	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Media, 2017.
2.	Pang-Ning Tan; Michael Steinbach; Anuj Karpatne; Vipin Kumar, Introduction to Data Mining, Pearson, 2019.
3.	John D. Kelleher, Brian Mac Namee and Aoife D'Arcy, Fundamentals of Machine Learning for Predictive Data Analytics Algorithms, Worked Examples, and Case Studies, The MIT Press, 2015.

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

1.	Max Tegmark, Life 3.0: Being Human in the Age of Artificial Intelligence, Penguin random House, 2017.
2.	Brett Lantz, Machine Learning with R – Second Edition, Packt Publishing, 2015.
3.	Bing Liu, Sentiment Analysis: Mining Opinions, Sentiments, and Emotions, Cambridge University Press, 2015.

2.3   **Online Resources**

     Readings will be augmented by pertinent journal/newspaper/magazine articles.