City University of Hong Kong
Course Syllabus

offered by Department of Computer Science
with effect from Semester B 2021/22

Part I Course Overview

Course Title:	Artificial Intelligence
Course Code:	CS4486
Course Duration:	One semester
Credit Units:	3 credits
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)*	CS2310 Computer Programming
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)

This course aims to equip students with the knowledge and skills of problem solving using artificial intelligence (AI) techniques through a demonstrable knowledge in a range problem solving methods and the associated decision making, optimization and machine learning techniques.

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.	Demonstrate knowledge of the fundamental principles of artificial intelligence.		✓		
2.	Understand the difference/hybrid of various AI techniques.		✓		
3.	Analysis of strengths/weaknesses of AI methods.		✓	✓	
4.	Comparison of various AI techniques.		✓	✓	
5.	Design and implement AI problem-solving methods.				✓
** If weighting is assigned to CILOs, they should add up to 100%.*		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.)

Teaching pattern:
Suggested lecture/tutorial/laboratory mix: 2 hrs. lecture; 1 hr. tutorial.

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	The lecture will focus on the introduction of the main concepts of AI, and their applications to real world problems.	✓	✓	✓	✓	✓	2 hrs/wk
Tutorial	Students will work on a set of problems on the principles and applications of AI, and present their solutions in the class.	✓	✓	✓	✓		1 hr/wk
Programming projects	There will be two projects. In the first project, students will implement selected AI algorithms using a high-level programming language. In the second project, students will judiciously select/combine different AI algorithms to solve a real world problem.		✓	✓	✓	✓	7 hrs/wk for 8 weeks

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	5		
Continuous Assessment: 50%							
Assignment 1 (Problem-solving questions and implementation of AI algorithms.)	✓	✓	✓		✓	10%	
Assignment 2 (Problem-solving questions and implementation of AI algorithms)	✓	✓			✓	10%	
Assignment 3 and presentation (Application of AI algorithms to different domains.)	✓		✓	✓	✓	10%	
Mid-term quiz	✓	✓	✓	✓	✓	20%	
Examination^: 50% (duration: 2 hours)							
** The weightings should add up to 100%.*						100%	

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

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 / presentation	1.1 Capability to effectively demonstrate practical and analytical skills to implement and evaluate AI techniques.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	1.2 Capacity for judiciously applying AI approaches to solve a specific real-world problem.					
2. Mid-term quiz	2.1 Capacity for understanding AI concepts and techniques in depth.	High	Siginificant	Moderate	Basic	Not even reaching marginal levels
	2.2 Capacity for formulating real-world problems as AI problems and designing AI methods to solve the problems.					
3. Examination	3.1 Capacity for understanding a range of AI concepts and techniques in depth.	High	Significant	Moderate	Basic	Not even reaching marginal levels
	3.2 Ability to analyse and evaluate a variety of AI problem solving techniques.					

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.)

Artificial intelligence, Heuristic search, Rule-based systems, Fuzzy inference, Stochastic search algorithms, Artificial neural networks, Learning Processes, Machine Learning.

Syllabus

1. Overview
   An introduction to the goals and objectives of AI as a discipline and its relationship with other disciplines. Approaches in AI.

2. Fuzzy set theory
   Binary logic, concept of fuzziness, fuzzy sets, operations on fuzzy sets, fuzzy relations, fuzzy compositions, extension principle, fuzzy numbers, arithmetic operations, approximate reasoning, fuzzy inference, linguistic model of complex systems, construction of knowledge base, fuzzy nonlinear simulations, design of fuzzy systems.

3. Search and optimization
   Heuristic search methods, A* search, hill-climbing search, simulated annealing, genetic algorithm, schemata theorem, nature-inspired algorithms, multi-objective optimization, hybrid AI techniques.

4. Artificial neural networks
   Human brain, models of a neuron, network architectures, learning processes, single layer perceptrons, multilayer perceptrons, back-propagation algorithm, approximations of function, time series, other learning networks: radial-basis function networks, deep learning models and algorithms etc.

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.	Some freely available web-based resources will be used.
2.	D. B. Fogel, D. R. Liu, J. M. Keller (2016), *Fundamentals of Computational Intelligence: Neural Networks, Fuzzy Systems, and Evolutionary Computation*, IEEE.
3.	S. Russell and P. Norvig (2009), *Artificial Intelligence: A Modern Approach.* Prentice-Hall, 3rd edition.
4.	S. Haykin (1999), *Neural Networks: A Comprehensive Foundation*, Prentice Hall, 2nd edition.
5.	D. E. Goldberg (1989), *Genetic Algorithms in Searching, Optimization and Machine Learning*, Addison-Wesley.
6.	G. J. Klir and T. A. Folger (1992), *Fuzzy Sets, Uncertainty, and Information*, Prentice-Hall.