

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

Approval of Undergraduate Course

Section 1: Academic Administration ⁽¹⁾

1.1 Catalog

- a) Course to be effective from: Academic Year 2021-22 Term Fall
- b) Department Code⁽³⁾: CSE Subject Area⁽³⁾: COMP Course Number ⁽⁴⁾: 2211
 Previous Course Code⁽⁵⁾: _____
- c) Full Title⁽⁶⁾ (max. 100 characters): Exploring Artificial Intelligence
- d) Abbreviated Title⁽⁷⁾ (max. 30 characters): Exploring AI
- e) Course Credits⁽⁸⁾: Fixed: 3 Range: From _____ To _____

f) Catalog Description⁽⁹⁾ (word limit = 150):

This course aims to give a gentle introduction to the basic elements of artificial intelligence (AI) through understanding examples from various applications and hands-on experimentation using AI software tools. In addition to covering the technical aspect of AI through such topics as search and problem solving, knowledge representation, probabilistic reasoning, machine learning, computer vision and image processing, speech and language processing, and robotics, this course will also study the historical perspective, social and ethical implications, as well as potential and limitations of AI.

- g) Grading Type⁽¹⁰⁾: Letter Grades Distinction/Credit/Pass/Fail Pass/ Fail
 Distinction/Pass/Fail Others (please specify): _____

h) Prerequisites⁽¹¹⁾:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
COMP 1021 OR	Introduction to Computer Science
COMP 1029P	Python Programming Bridging Course

i) Corequisites⁽¹²⁾:

Course Code	Course Title

j) Exclusions⁽¹³⁾:

Course Code / Public Exam	Course Title / Exam Subject and Level / Grade attained
COMP 3211	Fundamentals of Artificial Intelligence
COMP 4211	Machine Learning
COMP 4221	Introduction to Natural Language Processing
COMP 4331	Data Mining
COMP 4332	Big Data Mining and Management
COMP 4421	Image Processing
COMP 4471	Deep Learning in Computer Vision
COMP 4901K	Machine Learning for Natural Language Processing
COMP 4901L	Foundations of Computer Vision
ELEC 4130	Digital Image Processing
ELEC 4230	Deep Learning for Natural Language Processing
IDPO 4110	Practical Machine Learning

ISOM 3360	Data Mining for Business Analytics
MATH 4336	Introduction to Mathematics of Image Processing
MATH 4432	Statistical Machine Learning
RMBI 4310	Advanced Data Mining for Risk Management and Business
COMP 5211	Advanced Artificial Intelligence
COMP 5331	Knowledge Discovery in Databases
COMP 5212	Machine Learning
COMP 5213	Introduction to Bayesian Networks
COMP 5221	Natural Language Processing
COMP 5222	Statistical Learning Models for Text and Graph Data
COMP 5223	Perception and Information Processing for Robotics
COMP 5421	Computer Vision

- k) Co-listing⁽¹⁴⁾: Multi-coding⁽¹⁴⁾:

Course Code	Course Title

- l) Other Enrollment Restrictions⁽¹⁵⁾ No Yes

Instructor's approval required

Restricted to specified student group(s)

(please specify, e.g. year and program of study): _____

Others (please specify): _____

- m) Medium of Instruction/Materials⁽¹⁶⁾: English Others, (PIs specify and provide a justification in Section 1.3): _____

- n) Allow course repetition for credit⁽¹⁷⁾: No Yes

1.2 Contribution of course to Programs of Study [Check all appropriate boxes below]

Major

Program of Study	As		
COMP, COSC, COGBM, CPEG, CPGBM	<input type="checkbox"/> Required Course	<input checked="" type="checkbox"/> Elective	<input type="checkbox"/> Prerequisite

Minor

Program of Study	As		
	<input type="checkbox"/> Required Course	<input type="checkbox"/> Elective	<input type="checkbox"/> Prerequisite

Common Core

Others (pls specify):

Program of Study	As		
Extended Major in AI (Major + AI)	<input type="checkbox"/> Required Course	<input checked="" type="checkbox"/> Elective	<input type="checkbox"/> Prerequisite

1.3 Rationale for Introducing this course and other relevant information ⁽¹⁸⁾

Although there is plenty of hype from mass media about artificial intelligence (AI), the unprecedented successes of AI in a number of real-world applications are undeniable. This 2000-level course serves to give a gentle introduction to both the technical and non-technical aspects of AI suitable for most if not all students at HKUST. No prerequisites will be required for students to understand the conceptual aspects of the course. However, prior experience in basic Python programming gained from an introductory course such as COMP 1021 (Introduction to Computer Science) or COMP 1029P (Python Programming Bridging Course) will allow students to make use of AI software tools to build interesting applications. Incorporating this practical facet as an integral part of the course will help students get more excited about the subject and practise AI thinking through realistic

examples. With this course serving to give a quick overview of some basic elements of AI, we hope to inspire and encourage students to learn more later by taking more specialized, advanced AI courses.

The reason of including the list of advanced courses as **one-way exclusion** is to prevent students who have taken advanced AI courses to take COMP2211 for easy credits, and we will not change exclusions of these advanced AI courses, so students who have taken COMP2211 can still go on to take these advanced courses. In addition, we intend to include COMP2211 as alternative required course in the curriculum of Major+AI after launching it at least once.

Section 2A: Learning Outcomes and Alignment (for courses not proposed to be Common Core Courses)

2.1 Key Course Intended Learning Outcomes (Should not normally exceed six or eight outcomes)

Upon completion of this course, students are expected to be able to do the following:

	Course ILOs	Nature of the learning outcomes (A - Knowledge/Content Related; B - Academic Skills/Competencies; C - Others)
1	Demonstrate general understanding of the historical perspective and development of artificial intelligence (AI)	A
2	Demonstrate fundamental understanding of the basic elements of AI thinking	B
3	Demonstrate proficiency in applying basic principles and techniques of AI and using AI software tools to solve problems in a range of applications	B
4	Demonstrate awareness of the social and ethical implications as well as potential and limitations of AI	A
5		
6		
7		
8		

2.2 Contribution of Learning Outcomes to Programs of Study identified in Section 1.2

(Please also complete Section 4.1)

	Program of study 1: <u>COMP/COSC</u>	To be achieved through these course ILOs (Write CILO-1, CILO-2, etc.)
	Program ILOs	
1	#1 An ability to apply knowledge of computing and mathematics appropriate to the discipline	CILO-3
2	#2 An ability to apply knowledge of a computing specialization, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models	CILO-2, CILO-3
3	#3 An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution	CILO-2, CILO-3
4	#4 An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs	CILO-2, CILO-3
5	#6 An understanding of professional, ethical, legal, security and social issues and responsibilities	CILO-4
6	#7 An ability to communicate effectively with a range of audiences	CILO-3
7	#8 An ability to analyze the local and global impact of computing on individuals, organizations, and society	CILO-4
8	#10 An ability to use current techniques, skills, and tools necessary for computing practices	CILO-2, CILO-3

	Program of study 2: <u>CPEG</u>	To be achieved through these course ILOs (Write CILO-1, CILO-2, etc.)
	Program ILOs	
1	#1 An ability to apply knowledge of mathematics, science, and computer engineering	CILO-3
2	#2 An ability to analyze an engineering problem and identify the hardware and/or software requirements appropriate to its solution	CILO-2, CILO-3
3	#3 An ability to design and implement a computer-based system including embedded systems encompassing hardware and/or software to meet desired needs	CILO-2, CILO-3
4	#5 An ability to identify, formulate and solve computer engineering problems subject	CILO-2, CILO-3

	to practical constraints	
5	#6 An ability to understand professional and ethical responsibility	CILO-4
6	#7 An ability to communicate effectively with a range of audience	CILO-3
7	#8 An ability to understand the local and global impact of computer engineering solutions on individuals, organizations, and society	CILO-4
8	#9 An ability to understand contemporary global, economic, environmental, and societal issues, and their potential connection with computer engineering	CILO-4
9	#11 An ability to use the techniques, skills, and modern engineering tools necessary for solving computer engineering problems	CILO-2, CILO-3
10	#12 An ability to use hardware and/or software tools to effectively solve engineering problems with an understanding of their processes and limitations	CILO-2, CILO-3

Program of study 3: <u>Major + AI</u>		To be achieved through these course ILOs <i>(Write CILO-1, CILO-2, etc.)</i>
Program ILOs		
1	Identify emerging technology and innovations that will create opportunities and values for people, business and society	CILO-1, CILO-2, CILO-4
2	Integrate knowledge and mindset drawn from different disciplines	CILO-2, CILO-3
3	Apply innovative knowledge and practical problem-solving skills to tackle real business, scientific or socio-economic problems relevant to their Major areas	CILO-3
4		
5		
6		
7		
8		

Section 2B: Additional Information⁽²⁾ (for courses not proposed to be Common Core Courses)

2.3 Planned Teaching & Learning Arrangement

Teaching & Learning Arrangement		Weekly Scheduled Hours/ Estimated Weekly Learning Hours	Indicate which course ILOs this activity serves to achieve <i>(Write CILO-1, CILO-2, etc.)</i>	Additional Information <i>(optional)</i>
Face-to face activities	<input checked="" type="checkbox"/> Lecture*	3	CILO-1, CILO-2, CILO-3, CILO-4	
	<input type="checkbox"/> Tutorial*			
	<input type="checkbox"/> Seminar/Small-class*			
	<input checked="" type="checkbox"/> Laboratory*	1	CILO-3	
	*Does the above scheduled component(s) involve structured active learning activities? ⁽¹⁹⁾ <input checked="" type="radio"/> No <input type="radio"/> Yes <i>If yes, please specify for each scheduled component, the percentage and the type of active learning involved in the "Additional Information" column.</i>			
<input type="checkbox"/> Others (e.g. fieldtrip, visit, etc.), pls specify: _____				
Online activities	<input type="checkbox"/> Online lecture videos			
	<input type="checkbox"/> Other online learning tasks, pls specify: _____			
The total learning hours of the course[#] is equivalent to <u>120</u> hours⁽⁸⁾ <i># including both scheduled instructional hours and hours for self-study activities & assessment</i>				

• For course adopting a pedagogic approach other than lecture, tutorial and laboratory, please indicate the pedagogy used:

- Blended learning⁽²⁰⁾
 Pure online delivery⁽²¹⁾
 Experiential learning⁽²²⁾
 Others, pls specify: _____

2.4 Planned Assessment Weightings

Assessment Task	Proportion of Final Grade (%)	Indicate which course ILOs this task is to assess <i>(Write CILO-1, CILO-2, etc.)</i>	Additional Information <i>(optional)</i>
<input type="checkbox"/> In-class test			
<input checked="" type="checkbox"/> Mid-term test	15%	CILO-1, CILO-2, CILO-3, CILO-4	
<input checked="" type="checkbox"/> Final exam	40%	CILO-1, CILO-2, CILO-3, CILO-4	
<input type="checkbox"/> Written assignment			
<input checked="" type="checkbox"/> Project report	30%	CILO-2, CILO-3	2-3 programming projects
<input checked="" type="checkbox"/> Presentation	5%	CILO-2, CILO-3	
<input type="checkbox"/> Learning portfolio			
<input checked="" type="checkbox"/> Course participation	5%	CILO-1, CILO-2, CILO-3, CILO-4	
<input checked="" type="checkbox"/> Peer evaluation	5%	CILO-2, CILO-3	
<input type="checkbox"/> Others (e.g. proctored online exam, etc.), pls specify: _____			

COMP 2211: Exploring Artificial Intelligence

Catalog Description

This course aims to give a gentle introduction to the basic elements of artificial intelligence (AI) through understanding examples from various applications and hands-on experimentation using AI software tools. In addition to covering the technical aspect of AI through such topics as search and problem solving, knowledge representation, probabilistic reasoning, machine learning, computer vision and image processing, speech and language processing, and robotics, this course will also study the historical perspective, social and ethical implications, as well as potential and limitations of AI.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Demonstrate general understanding of the historical perspective and development of artificial intelligence (AI).
- Demonstrate fundamental understanding of the basic elements of AI thinking.
- Demonstrate proficiency in applying basic principles and techniques of AI and using AI software tools to solve problems in a range of applications.
- Demonstrate awareness of the social and ethical implications as well as potential and limitations of AI.

Major Topics

Brief history
Search and problem solving
Knowledge representation
Probabilistic reasoning
Machine learning
Computer vision and image processing
Speech and language processing
Robotics
Social and ethical implications
Potential and limitations

An innovative approach will be adopted to cover some basic elements of the technical topics through interesting examples. Specifically, the topics will not be covered one-by-one separately. Instead, real-world examples that require integrative use of multiple topics will be chosen for illustration. For example, AI for games will be used to illustrate search and problem solving, knowledge representation, and machine learning; AI for autonomous vehicles to illustrate computer vision, machine learning, and robotics; AI for conversational agents (or chatbots) to illustrate speech/language processing and machine learning; AI for healthcare to illustrate image processing and machine learning; etc.

Reference Books

Hadelin de Ponteves. *AI Crash Course: A fun and hands-on introduction to machine learning, reinforcement learning, deep learning, and artificial intelligence with Python*. Packt Publishing, 2019.

Denis Rothman, Matthew Lamons, Rahul Kumar, Abhishek Nagaraja, Amir Ziai, and Ankit Dixit. *Python: Beginner's Guide to Artificial Intelligence: Build applications to intelligently interact with the world around you using Python*. Packt Publishing, 2018.

Online courses:

- AI for Everyone (<https://www.coursera.org/learn/ai-for-everyone>)
- AI Foundations for Everyone Specialization (<https://www.coursera.org/specializations/ai-foundations-for-everyone>)
- Machine Learning for All (<https://www.coursera.org/learn/uol-machine-learning-for-all>)
- Artificial Intelligence A-Z: Learn How to Build an AI (<https://www.udemy.com/course/artificial-intelligence-az/>)

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes



(To be completed by EACH of the program(s) of study noted under Section 1.2)

<input checked="" type="checkbox"/> The course contributes to this Major/ Minor * Program:	COMP/COSC _____ (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____ please refer to the below signature		

<input checked="" type="checkbox"/> The course contributes to this Major/ Minor * Program:	CPEG _____ (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____ please refer to the signature in page 16		

<input checked="" type="checkbox"/> The course contributes to this Major/ Minor * Program:	Extended Major in AI (Major + AI) _____ (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____ please refer to the signature in page 11		

4.2 Approvals

Department/Program unit level Recommendation			
	<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
<input checked="" type="checkbox"/> Offering Department/Program Unit: (Please specify unit): <u>CSE</u>	UG coordinator/ Dr. Qiong Luo		12-Nov-2020
<input checked="" type="checkbox"/> Recommending School/IPO: (Please specify): <u>SENG</u>	Prof. Philip K. T. MOK Assoc. Dean of Engineering		14 Dec 2020
School-level Concurrence			
<u>Name of School/Unit</u>	<u>Position / Name</u>	<u>Signature</u>	<u>Date</u>
<input type="checkbox"/> IPO	_____	_____	_____
<input type="checkbox"/> DDP	_____	_____	_____
<input type="checkbox"/> ECE	_____	_____	_____
<input type="checkbox"/> ISOM	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____

Section 4: Development, Concurrence and Approval

4.1 Contribution to the Program Learning Outcomes

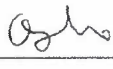
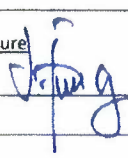
(To be completed by EACH of the program(s) of study noted under Section 1.2)


<input checked="" type="checkbox"/> The course contributes to this Major/ Minor * Program:	COMP/COSC (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____		

<input checked="" type="checkbox"/> The course contributes to this Major/ Minor * Program:	CPEG (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____		

<input checked="" type="checkbox"/> The course contributes to this Major/ Minor * Program:	Extended Major in AI (Major + AI) (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____		

4.2 Approvals

Department/Program unit level Recommendation			
	<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
<input checked="" type="checkbox"/> Offering Department/Program Unit: (Please specify unit): <u>CSE</u>	UG coordinator/ Dr. Qiong Luo		12-Nov-2020
<input type="checkbox"/> Recommending School/IPO: (Please specify):	_____	_____	_____
School-level Concurrence			
<u>Name of School/Unit</u>	<u>Position / Name</u>	<u>Signature</u>	<u>Date</u>
<input checked="" type="checkbox"/> IPO	Prof. Jimmy Fung Chair of IUSC		11-11-2020
<input type="checkbox"/> DDP	_____	_____	_____
<input type="checkbox"/> ECE	_____	_____	_____
<input type="checkbox"/> ISOM	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____

CPEG			
RMBI			
MATH			
ISOM - IS	Deputy Head / Hui Kai Lung		Nov 20, 2020

Section 4: Development, Concurrence and Approval

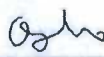

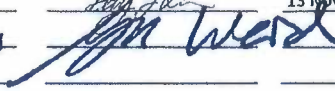
4.1 Contribution to the Program Learning Outcomes
(To be completed by EACH of the program(s) of study noted under Section 1.2)


<input checked="" type="checkbox"/> The course contributes to this Major/Minor* Program:	COMP/COSC (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____		

<input checked="" type="checkbox"/> The course contributes to this Major/Minor* Program:	CPEG (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____		

<input checked="" type="checkbox"/> The course contributes to this Major/Minor* Program:	Extended Major In AI (Major + AI) (* Delete as appropriate)	
<input type="checkbox"/> The relevant program learning outcomes are attached.		
<input type="checkbox"/> On behalf of this program of study, I confirm that the course will contribute appropriately to overall program learning outcomes.		
<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
Program Director / Head of Department: _____		

4.2 Approvals

Department/Program unit level Recommendation			
<input checked="" type="checkbox"/> Offering Department/Program Unit: (Please specify unit): <u>CSE</u>	<u>Position / Name:</u>	<u>Signature</u>	<u>Date</u>
	UG coordinator/ Dr. Qiong Luo		12-Nov-2020
<input type="checkbox"/> Recommending School/IPO: (Please specify): _____			
School-level Concurrence			
<u>Name of School/Unit</u>	<u>Position / Name</u>	<u>Signature</u>	<u>Date</u>
<input type="checkbox"/> IPO			
<input type="checkbox"/> DDP	UGC/Betty Lin		13 Nov 2020
<input type="checkbox"/> ECE	Professor Weichuan YU		16 NOV 2020
<input type="checkbox"/> ISOM (IS)			

	Position/name	Signature	Date
CPEG			
RMBI	UG Coordinator/Dr. Jiyang Wang		Nov 17, 2020
MATH			
XSONX			

UPECK			
RMBI			
MATH	UGC / Tsz-Kin Lam	<i>Tsz Kin Lam</i>	16 Nov 2020
ISOM / OXX			
CPEG			

IOPOK			
RMBI			
MATH			
ISOMAXX			
CPEG	Director/Prof. Wilfred Ng <i>Wilfred Ng</i> 17 NOV 2020		