Subject to approval

REGULATIONS FOR THE DEGREE OF
MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE
[MSc(AI)]
For students admitted in 2025-2026 and thereafter

(See also General Regulations and Regulations for Taught Postgraduate Curricula)

Any publication based on work approved for a higher degree should contain a reference to the effect that the work was submitted to the University of Hong Kong for the award of the degree.

Admission requirements

MAI1 To be eligible for admission to the courses leading to the degree of Master of Science in Artificial Intelligence, a candidate

(a) shall comply with the General Regulations and the Regulations for Taught Postgraduate Curricula;

(b) shall hold
   (i) a Bachelor's degree of this University, or
   (ii) another qualification of equivalent standard from this University or another University or comparable institution acceptable for this purpose; and

(c) shall pass a qualifying examination if so required; and

(d) shall possess knowledge of linear algebra, calculus, probability theory, introductory statistics, and computer programming.

Qualifying examination

MAI2 (a) A qualifying examination may be set to test the candidate's formal academic ability or his/her ability to follow the courses of study prescribed. It shall consist of one or more written papers or their equivalent and may include a project report.

(b) A candidate who is required to satisfy the examiners in a qualifying examination shall not be permitted to register until he/she has satisfied the examiners in the examination.

Period of study

MAI3 The curriculum shall normally extend over one and a half academic years of full-time study or two and a half academic years of part-time study. Candidates shall not be permitted to extend their studies beyond the maximum period of registration of three academic years of full-time study or four academic years of part-time study, unless otherwise permitted or required by the Board of the Faculty.

Course Exemption and advanced standing

MAI4 (a) In recognition of studies completed successfully before admission to the curriculum, advanced standing of up to 12 credits may be granted to a candidate with appropriate qualification and professional experiences, on production of appropriate certification, subject to the approval of the Board of the Faculty. The candidate should write formally to apply for advanced standing via the Department within two weeks after admission to the curriculum.

(b) For cases of having satisfactorily completed more than 12 credits of another course or courses equivalent in content to any of the compulsory courses as specified in the syllabuses, candidates may, on production of appropriate certification, be exempted from the compulsory course(s), subject to approval of the Board of the Faculty.

Candidates so exempted must replace the number of exempted credits with electives course(s) in the curriculum of the same credit value.

Award of degree

MAI5 To be eligible for the award of the degree of Master of Science in Artificial Intelligence, a candidate shall

(a) comply with the General Regulations and the Regulations for Taught Postgraduate Curricula;
(b) successfully complete the curriculum in accordance with the regulations set out below; and
(c) have achieved a cumulative grade point average of at least 2.0.

A candidate who fails to fulfill the requirements within the maximum (i) three academic years for full-time mode of study or (ii) four academic years for part-time mode of study shall be recommended for discontinuation under the provisions of General Regulation G12, except that a candidate is granted permission to extend period of study by the Board of the Faculty in accordance with Regulation MAI3.

Completion of curriculum

MAI6 To successfully complete the curriculum, a candidate shall satisfy the requirements prescribed in TPG 6 of the Regulations for Taught Postgraduate Curricula; follow courses of instruction; and satisfy the examiners in the prescribed courses and in any prescribed form of examination in accordance with the regulations set out below.

Assessments

MAI7 (a) In any course where so prescribed in the syllabus, coursework or a project report may constitute part or whole of the examination for the course.
(b) The written examination for each module shall be held after the completion of the prescribed course of study for that module, and not later than January, May or August immediately following the completion of the course of study for that module.
(c) There shall be no appeal against the results of examinations and all other forms of assessment.

MAI8 If during any academic year a candidate has failed at his/her first attempt in a course or courses, but is not required to discontinue his/her studies by Regulation MAI10, the candidate may be permitted to make up for the failed courses in the following manner:

(a) undergoing re-assessment/re-examination in the failed course or courses to be held before the next academic year; or
(b) repeating the course or courses and satisfying the assessment requirements in the next academic year; or
(c) for elective courses, taking another course in lieu and satisfying the assessment requirements.

MAI9 Failure to undertake the examination of a course as scheduled shall normally result in automatic failure in that course. A candidate who, because of illness, is unable to be present at the written examination of any course may apply for permission to present himself/herself at a supplementary examination of the same course to be held before the beginning of the following academic year. Any such application shall be made on the form prescribed within seven calendar days of the examination concerned.

MAI10 A candidate may be required to discontinue his/her studies if he/she

(a) during any academic year has failed in half or more than half the number of credits of all the courses to be examined in that academic year; or
(b) has failed at a repeated attempt in any course; or
(c) has exceeded the maximum period of registration.

Grading

MAI11 Individual courses shall be graded according the letter grading system as determined by the Board of Examiners. The standards and the grade points for assessment are as follows:

Grade	Standard	Grade Point
A+	**Excellent**	4.3
A		4.0
A-		3.7
B+	**Good**	3.3
B		3.0
B-		2.7
C+	**Satisfactory**	2.3
C		2.0
C-		1.7
D+	**Pass**	1.3
D		1.0
F	**Fail**	0

MAI12 On successful completion of the curriculum, candidates who have shown exceptional merit at the whole examination may be awarded a mark of distinction, and this mark shall be recorded in the candidates' degree diploma.

SYLLABUSES FOR THE DEGREE OF MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE

The Department of Mathematics and the School of Computing and Data Science jointly offer a postgraduate curriculum leading to the degree of Master of Science in Artificial Intelligence, with two study modes: the one and a half academic years' full-time mode and the two and a half academic years' part-time mode. The curriculum is designed to provide graduates with training in the principles and practice of artificial intelligence. Candidates should possess knowledge of linear algebra, calculus, probability theory, introductory statistics and computer programming.

STRUCTURE AND EVALUATION

Each student must complete at least 72 credits of courses, split into 42 credits of core courses, 18 credits of disciplinary electives, and 12 credits of a capstone project. If a student selects a course whose contents are similar to a course (or courses) which he/she has taken in his/her previous study, the Department may not approve the selection in question.

CURRICULUM
(applicable for both full-time and part-time modes)

Compulsory Courses (42 credits)	
ARIN7001	Foundations of artificial intelligence
ARIN7011	Optimization in artificial intelligence
ARIN7013	Numerical methods in artificial intelligence
ARIN7101	Statistics in artificial intelligence
ARIN7102	Applied data mining and text analytics
COMP7404	Computational intelligence and machine learning
DASC7606	Deep learning
Disciplinary Electives (18 credits)*	
with at least 6 credits from each of the following lists	
List A:	
ARIN7014	Topics in advanced numerical analysis
ARIN7015	Topics in artificial intelligence and machine learning
MATH7224	Topics in advanced probability theory
MATH7502	Topics in applied discrete mathematics
MATH7503	Topics in advanced optimization
List B:	
STAT6011	Computational statistics and Bayesian learning
STAT7008	Programming for data science
STAT8020	Quantitative strategies and algorithmic trading
STAT8307	Natural language processing and text analytics
List C:	
COMP7308	Introduction to unmanned systems
COMP7309	Quantum computing and artificial intelligence
COMP7409	Machine learning in trading and finance
COMP7502	Image processing and computer vision
ARIN7017	Legal issues in artificial intelligence and data science
* Students who have completed the same or similar courses in their previous studies may, on production of relevant transcripts, be permitted to select up to 18 credits of disciplinary electives from the other two lists if they are not able to find any untaken options from any one of the lists of disciplinary electives.	
Capstone Project (12 credits)	
ARIN7600	Artificial intelligence project (12 credits)

All courses should be 6-credit bearing unless otherwise stated.

COURSE DESCRIPTION

Compulsory Courses

ARIN7001 Foundations of artificial intelligence (6 credits)

This course introduces foundational knowledge, methods and tools in mathematics, statistics and computer science for the purpose of studying and applying artificial intelligence.

Prerequisites: Nil

Assessment: coursework (50%) and examination (50%)

ARIN7011 Optimization in artificial intelligence (6 credits)

This course introduces students to the topics in theory and algorithms of optimization that play important roles in artificial intelligence and machine learning. Topics include: 1) Fundamental optimization models in AI (linear programming models, integer programming models, kernel learning and deep learning models, etc.); 2) Optimization theory in AI (optimality conditions, constraint qualification, landscape analysis of neural networks, duality, complexity analysis, etc.), 3) Optimization algorithms in AI: (a) Classic algorithms (simplex method, interior point method, cutting plane method, gradient type methods, projection methods, Lagrange methods, Newton type methods, Nesterov acceleration), (b) Stochastic algorithms (stochastic gradient descent (SGD), stochastic coordinate descent methods, stochastic variance reduced gradient, adaptive gradient methods, adaptive moment estimation (ADAM), etc.), (c) Algorithms for large-scale optimization problems (Operator splitting algorithms (BCD type algorithms, ADMM, primal-dual type algorithms, etc.), centralized/decentralized algorithms, etc.). (d) Algorithms for nonconvex optimization and training deep neural networks.

Prerequisites: Prior/basic knowledge in calculus and linear algebra

Assessment: coursework (50%) and examination (50%)

ARIN7013 Numerical methods in artificial intelligence (6 credits)

This course introduces students to the numerical methods that are instrumental in artificial intelligence and machine learning. Topics include: 1) Supervised learning (CNN in classification, kernel methods in supervised learning, and Kernel Ridge Regression). 2) Numerical methods for solving linear systems (Gaussian elimination methods, LU factorization, Jacobi Method, Gauss-Seidel method, singular value decomposition (SVD), low-rank approximation, with applications in artificial intelligence and machine learning). 3) Principal component analysis, kernel PCA and their applications to computer vision, image processing and artificial intelligence and machine learning in general. 4) Compute eigenvalues and eigenvectors (Power/inverse/Rayleigh quotient methods, with applications in artificial intelligence and machine learning). 5) Numerical methods for ordinary differential equations and related neural network architectures (stability, convergence analysis, and neural network architectures related to ODEs, such as ResNets and Neural ODE).

Prerequisites: Nil

Assessment: coursework (50%) and examination (50%)

ARIN7101 Statistics in artificial intelligence (6 credits)

The development of artificial intelligence has revolutionized the theory and practice of statistical learning, while novel statistical learning approaches are becoming an integral part of artificial intelligence. By focusing on the interplay between statistical learning and artificial intelligence, this course reviews the main concepts underpinning classical statistical learning, studies computer-intensive methods for conducting statistical learning, and examines important issues concerning statistical learning drawn upon modern artificial intelligence technologies. Contents include classical frequentist and Bayesian inferences, variational inference, latent variable model, regularization, introduction on Markov chain and Markov decision process and fundamental reinforcement learning.

Prerequisites: Nil

Assessment: coursework (50%) and examination (50%)

ARIN7102 Applied data mining and text analytics (6 credits)

With the rapid developments in computer and data storage technologies, the fundamental paradigms of classical data analysis are mature for change. Data mining aims at automated discovery of underlying structure and patterns in large amounts of data, especially text data. This course takes a practical approach to acquaint students with the new generation of data mining tools and techniques, and show how to use them to make informed decisions. Topics include data preparation, feature selection, association rules, decision trees, bagging, random forests and gradient boosting, cluster analysis, neural networks, introduction to text mining.

Prerequisites: Nil

Assessment: coursework (100%)

COMP7404 Computational intelligence and machine learning (6 credits)

This course will teach a broad set of principles and tools that will provide the mathematical, algorithmic and philosophical framework for tackling problems using Artificial Intelligence (AI) and Machine Learning (ML). AI and ML are highly interdisciplinary fields with impact in different applications, such as, biology, robotics, language, economics, and computer science. AI is the science and engineering of making intelligent machines, especially intelligent computer programs, while ML refers to the changes in systems that perform tasks associated with AI. Ethical issues in advanced AI and how to prevent learning algorithms from acquiring morally undesirable biases will be covered.

Topics may include a subset of the following: problem solving by search, heuristic (informed) search, constraint satisfaction, games, knowledge-based agents, supervised learning (e.g., regression and support vector machine), unsupervised learning (e.g., clustering), dimension reduction learning theory, reinforcement learning, transfer learning and adaptive control and ethical challenges of AI and ML.

Pre-requisites: Nil, but knowledge of data structures and algorithms, probability, linear algebra, and programming would be an advantage.

Assessment: coursework (50%) and examination (50%)

DASC7606 Deep learning (6 credits)

Machine learning is a fast-growing field in computer science and deep learning is the cutting edge technology that enables machines to learn from large-scale and complex datasets. Ethical implications of deep learning and its applications will be covered and the course will focus on how deep neural networks are applied to solve a wide range of problems in areas such as natural language processing, and image processing. Other applications such as financial predictions, game playing and robotics may also be covered. Topics covered include linear and logistic regression, artificial neural networks and how to train them, recurrent neural networks, convolutional neural networks, generative models, deep reinforcement learning, and unsupervised feature learning.

Prerequisites: Basic programming skills, e.g., Python is required.

Assessment: coursework (50%) and examination (50%)

Disciplinary Electives

ARIN7014 Topics in advanced numerical analysis (6 credits)

This course delves into advanced topics in numerical analysis, providing students with a comprehensive understanding of key concepts and methods. The course covers a diverse range of topics that include: 1) Numerical methods for linear algebra, such as QR method, Krylov subspace methods, generalized minimal residual method (GMRES), robust PCA, and dimensional reduction methods; 2) Numerical methods for partial differential equations, including both traditional numerical methods and deep-learning methods; 3) Stochastic computational methods, such as the Monte Carlo method and its variants, and their applications in artificial intelligence and machine learning; 4) Fourier analysis, approximation theory, and high-dimensional approximation in the field of deep learning. The specific topics covered in the course may be subject to change on an annual basis, ensuring that students receive the most up-to-date and relevant education.

Prerequisites: Students should have basic knowledge in numerical analysis and scientific computing; and pass in ARIN7013 Numerical methods in artificial intelligence or equivalent.

Assessment: coursework (50%) and examination (50%)

ARIN7015 Topics in artificial intelligence and machine learning (6 credits)

The course introduces selected topics in the theory and algorithms that are fundamental in artificial intelligence and machine learning. Topics include statistical learning theory (generalization gap, risk decomposition, concentration inequalities, model complexities and Vapnik–Chervonenkis theory), algorithmic stability (basic convex analysis, stochastic gradient methods, regularization schemes, convergence analysis and stability analysis of stochastic optimization algorithms), Min-Max optimization (gradient descent ascent, convergence and generalization), early stopping, implicit bias of stochastic optimization algorithms and online learning.

Prerequisites: Prior/basic knowledge in calculus and linear algebra

Assessment: coursework (50%) and examination (50%)

MATH7224 Topics in advanced probability theory (6 credits)

Selected topics in probability theory will be discussed in this course.

Assessment: coursework (100%)

MATH7502 Topics in applied discrete mathematics (6 credits)

This course aims to provide students with the opportunity to study some further topics in applied discrete mathematics. A selection of topics in discrete mathematics applied in combinatorics and optimization (such as algebraic coding theory, cryptography, discrete optimization, etc.) The selected topics may vary from year to year.

Pre-requisites: Knowledge in introductory discrete mathematics. Students may be asked to present appropriate evidence of having met the pre-requisites for enrolling in this course.

Assessment: coursework (50%) and examination (50%)

MATH7503 Topics in advanced optimization (6 credits)

A study in greater depth of some special topics in mathematical programming or optimization. It is mainly intended for students in Operations Research or related subject areas. This course covers a selection of topics which may include convex programming, nonconvex programming, saddle point problems, variational inequalities, optimization theory and algorithms suitable for applications in various areas such as machine learning, artificial intelligence, imaging and computer vision. The selected topics may vary from year to year.

Pre-requisites: Knowledge in introductory mathematical programming and optimization. Students may be asked to present appropriate evidence of having met the pre-requisites for enrolling in this course.

Assessment: coursework (100%)

STAT6011 Computational statistics and Bayesian learning (6 credits)

This course aims to give students an introduction on modern computationally intensive methods in statistics, with a strong focus on Bayesian methods. The role of computation as a fundamental tool in data analysis and statistical inference will be emphasized. The course will introduce topics including the generation of random variables, optimization techniques, and numerical integration using quadrature and Monte Carlo methods. This course will then cover the fundamental Bayesian framework, including prior elicitation, posterior inference and model selection. For posterior computation, Monte Carlo methods such as importance sampling and Markov chain Monte Carlo will be introduced. Methods for approximate inference such as variational Bayes will also be covered. Advanced Bayesian modeling with nonparametric Bayes will then be explored, with applications in machine learning. This course is particularly suitable for students who intend to pursue further studies or a career in research.

Pre-requisites: Nil

Assessment: coursework (50%) and examination (50%)

STAT7008 Programming for data science (6 credits)

Capturing and utilising essential information from big datasets poses both statistical and programming challenges. This course is designed to equip students with the fundamental computing skills required to use Python for addressing these challenges. The course will cover a range of topics, including programming syntax, files IO, object-oriented programming, scientific data processing and analysis, data visualization, data mining and web scraping, programming techniques for machine learning, deep learning, computer vision, and natural language processing, etc.

Assessment: coursework (100%)

STAT8020 Quantitative strategies and algorithmic trading (6 credits)

Quantitative trading is a systematic investment approach that consists of identification of trading opportunities via statistical data analysis and implementation via computer algorithms. This course introduces various methodologies that are commonly employed in quantitative trading.

The first half of the course focuses at strategies and methodologies derived from the data snapshotted at daily or minute frequency. Some specific topics are: (1) techniques for trading trending and mean-reverting instruments, (2) statistical arbitrage and pairs trading, (3) detection of "time-series" mean reversion or stationarity, (4) cross-sectional momentum and contrarian strategies, (5) back-testing methodologies and corresponding performance measures, and (6) Kelly formula, money and risk management. The second half of the course discusses statistical models of high frequency data and related trading strategies. Topics that planned to be covered are: (7) introduction of market microstructure, (8) stylized features and models of high frequency transaction prices, (9) limit order book models, (10) optimal execution and smart order routing algorithms, and (11) regulation and compliance issues in algorithmic trading.

Pre-requisites: Students should have basic knowledge and experience in financial data analysis.

Assessment: coursework (50%) and examination (50%)

STAT8307 Natural language processing and text analytics (6 credits)

Natural Language Processing (NLP) is a core area of artificial intelligence and data science that focuses on enabling machines to understand, process, and generate human language. This course introduces fundamental NLP techniques and text analytics methods, covering topics such as information retrieval, text classification, word embeddings, neural networks, sequence models, encoder-decoder architectures, transformers, contextualized word representations, and modern language models. The course emphasizes practical applications and hands-on experience in analyzing textual data.

Pre-requisites: Pass in ARIN7102 Applied data mining and text analytics or equivalent; and proficiency in Python programming

Assessment: coursework (100%)

COMP7308 Introduction to unmanned systems (6 credits)

To study the theory and algorithms in unmanned systems. Topics include vehicle modelling, vehicle control, state estimation, perception and mapping, motion planning, and deep learning related techniques.

Assessment: coursework (50%) and examination (50%)

COMP7309 Quantum computing and artificial intelligence (6 credits)

This course offers a theoretical overview of selected topics from the interdisciplinary fields of quantum computation and quantum AI. The scope of the lectures encompasses an accessible introduction to the fundamental concepts of quantum computation. Importantly, the introduction does not require preliminary knowledge of quantum theory. Detailed comparisons of computational principles and related phenomena in the classical and quantum domain outline the potential and challenges of quantum theory for fundamentally novel algorithms with enhanced processing power. The theoretical capability of quantum computers is illustrated by analyzing a selection of milestone algorithms of quantum computation, and their potential applications to artificial intelligence and optimization.

Assessment: coursework (50%) and examination (50%)

COMP7409 Machine learning in trading and finance (6 credits)

The course introduces our students to the field of Machine Learning, and help them develop skills of applying Machine Learning, or more precisely, applying supervised learning, unsupervised learning and reinforcement learning to solve problems in Trading and Finance.

This course will cover the following topics. (1) Overview of Machine Learning and Artificial Intelligence, (2) Supervised Learning, Unsupervised Learning and Reinforcement Learning, (3) Major algorithms for Supervised Learning and Unsupervised Learning with applications to Trading and Finance, (4) Basic algorithms for Reinforcement Learning with applications to optimal trading, asset management, and portfolio optimization, (5) Advanced methods of Reinforcement Learning with applications to high-frequency trading, cryptocurrency trading and peer-to-peer lending.

Assessment: coursework (65%) and examination (35%)

COMP7502 Image processing and computer vision (6 credits)

To study the theory and algorithms in image processing and computer vision. Topics include image representation; image enhancement; image restoration; mathematical morphology; image compression; scene understanding and motion analysis.

Assessment: coursework (50%) and examination (50%)

ARIN7017 Legal issues in artificial intelligence and data science (6 credits)

This course introduces students to the growing legal, ethical and policy issues associated with artificial intelligence, data science and the related issues security and assurance. In particular, the relationship of AI and data science to personal autonomy, information assurance and privacy are analyzed and legislative responses studied. Class participation, research, writing, and oral/electronic presentations are integral components of the course.

The course contributes to the following goals: written communication and life-long learning. It includes coverage of the following goals: problem analysis, problem solving and teamwork.

Assessment: coursework (100%)

Capstone Project

ARIN7600 Artificial intelligence project (12 credits)

The students will be expected to carry out independent work on a research project under the supervision of staff members. A written report as well as an oral presentation on the research work are required.

Assessment: written report (75%) and oral presentation (25%)