SYLLABUS FOR THE DEGREE OF BACHELOR OF ENGINEERING IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE [BEng(AI&DataSc)]

The syllabus applies to students admitted in the academic year 2025-26 and thereafter under the four-year curriculum.

Definition and Terminology

1. Each course offered shall be classified as either an introductory level course or an advanced level course.

2. "Disciplinary Core" course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

3. "Disciplinary Elective" course refers to any course offered in the professional core which can be taken by candidates to fulfil the curriculum requirements as specified in the syllabuses of the degree curriculum.

4. "Capstone Experience" course is an integral part of the degree programme which focuses on the integration and application of knowledge and skills gained in the early years of study. It is normally taken in the senior years (year 3 or 4) of study and students must complete this for the fulfilment of the graduation requirements.

5. "Elective" course means any course offered within the same or another curriculum, other than compulsory courses in the candidate's degree curriculum, that can be taken by the candidate in order to complete the credit requirements of the degree curriculum.

Curriculum

The curriculum comprises 240 credits of courses as follows:

Professional Core:

Foundation Courses
Students are required to complete at least 36 credits of Foundation Courses.

Disciplinary Core Courses
Students are required to complete all disciplinary core courses (54 credits), comprising 24 credits of introductory core courses and 30 credits of advanced core courses.

Disciplinary Elective Courses
Students are required to complete at least 42 credits of disciplinary elective courses offered for the curriculum.

Capstone Experience
Students are required to complete the 6-credit "COMP3522 Real-life AI and data science", the 6-credit "COMP4501 AI and data science in discipline project" or "COMP4502 Final year project", and the non-credit bearing "COMP3510 Internship" to fulfil the capstone experience requirement for the degree of BEng in Artificial Intelligence and Data Science.

Elective:
Students are required to complete 42 credits of elective course(s) offered by any department, except Common Core Courses.

University Requirements:
Students are required to complete 54 credits courses and non-credit bearing courses as required by the University.

The details of the distribution of the above course categories are as follows:

The curriculum of BEng(AI&DataSc) comprises 240 credits of courses with the following structure:

UG 5 Requirements (54 credits)

Course code	Course	No. of credits
CAES1001	Academic Communication in English[1]	0
CAES9542	Technical English for Computer Science	6
	Chinese language enhancement course specified for the degree curriculum[2]	6
	Common Core[3]	36
	Digital Literacy courses	6
	Non-credit bearing course in national education and national security education, and any other non-credit bearing courses as may be required from time to time	0
	Total	**54**

[1]Unless otherwise exempted through having achieved Level 5 or above in English Language in the Hong Kong Diploma of Secondary Education Examination, or equivalent.

[2]Candidates should check with the School of Computing and Data Science for the course code and course title of the Chinese language enhancement course to satisfy the programme and graduation requirements. For those who did not study Chinese language during their secondary education and have not reached the required proficiency level for the Chinese language enhancement course specified for the degree curriculum, they are required to take a course in either Chinese language or Chinese culture offered by the Chinese Language Centre of the School of Chinese in lieu.

[3]Candidates have to complete 36 credits in the Common Core Curriculum, comprising at least 6 credits and not more than 12 credits from each Area of Inquiry with not more than 24 credits being selected within one academic year except where candidates are required to make up for failed credits.

Foundation Courses (36 credits)

Course Code	Course	No. of credits
COMP1110	Computing and data science in everyday life	6
COMP1117	Computer programming	6
COMP2113	Programming technologies	6
MATH1013	University mathematics II	6
MATH2012	Fundamental concepts of mathematics*	6
MATH2014	Multivariable calculus and linear algebra*	6

*Students who are passionate and would like to explore more about mathematics can opt for MATH2101 Linear algebra I and MATH2211 Multivariable calculus in replacement of MATH2012 and MATH2014. Students are advised to check the course details of these MATH courses and consult the academic advisors of the Department of Mathematics in advance.

Disciplinary Core Courses (54 credits)

Introductory Courses (24 credits)

Course Code	Course	No. of credits
COMP2119	Introduction to data structures and algorithms	6
COMP2501	Introduction to data science	6
SDST2601	Probability and statistics I	6
SDST2602	Probability and statistics II	6

Advanced Courses (30 credits)

Course Code	Course	No. of credits
COMP3270	Introduction to artificial intelligence	6
COMP3278	Introduction to database management systems	6
COMP3312	Law and ethics in data science	6
COMP3314	Introduction to machine learning	6
COMP3340	Introduction to deep learning	6

Capstone Experience (12 credits)

Course Code	Course	No. of credits
COMP3510	Internship*	0
COMP3522	Real-life AI and data science	6
COMP4501 or COMP4502	AI and data science in discipline project or Final year project	6

*Students who are selected to participate in the Undergraduate Research Fellowship Programme are required to complete COMP3413 Research internship and are not required to complete COMP3510 Internship.

Disciplinary Elective Courses (42 credits, to be chosen from the following list)

Course Code	Course	No. of credits
COMP3317	Introduction to computer vision	6
COMP3323 / FITE3010	Advanced database systems / Big data and data mining	6
COMP3353	Bioinformatics	6
COMP3355	Cyber security	6
COMP3361	Natural language processing	6
COMP3362	Hands-on AI: experimentation and applications	6
COMP3407	Scientific computing	6
COMP3413	Research internship	6
COMP3513	Big data systems	6
COMP3516	Data analytics for IoT	6
COMP3520	Special topics in data science	6
COMP3521	Visualization for data analytics	6
COMP3523	Security and privacy in artificial intelligence	6
COMP3524	Web intelligence	6
COMP4510	Principles of machine learning	6
COMP4511	Principles of deep learning	6
COMP4512	Advanced computer vision	6

FITE2010	Distributed ledger and blockchain	6
SDST3600	Linear statistical analysis	6
SDST3612	Statistical machine learning	6
SDST3621	Statistical data analysis	6
SDST4601	Time-series analysis	6
SDST4602	Multivariate data analysis	6

Elective Courses (42 credits)

At least 42 credits of courses offered by any department, except Common Core Courses.

Students are encouraged to pursue minor programme(s) related to the application of data science. Recommended minor programmes: Finance, Economics, Marketing, Politics and Public Administration, Journalism and Media Studies, Social Data Science, Neuroscience, General Linguistics, Genetics and Genomics, Urban Studies, Urban Infrastructure Informatics, Industrial Engineering and Logistics Management, Earth Sciences, Environmental Science, Molecular Biology and Biotechnology.

Impermissible Combinations:
Major in Computer Science
Minor in Computer Science
Minor in Artificial Intelligence and Data Science
Major in Decision Analytics

Elective Postgraduate Courses

Students may take up to three 6-credit postgraduate courses as elective courses, subject to the approval of the Programme Director of BEng(AI&DataSc).

Summary of curriculum structure of BEng in Artificial Intelligence and Data Science

Course Category	No. of credits
UG 5 Requirements	54
Foundation Courses	36
Disciplinary Core Courses (Introductory)	24
Disciplinary Core Courses (Advanced)	30
Capstone Experience and Internship	12
Disciplinary Elective Courses	42
Elective Courses	42
Total	**240**

MINOR IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

The syllabus applies to students admitted in the academic year 2025-26 and thereafter under the four-year curriculum.

This minor option is open to students of Bachelor of Engineering (BEng) programmes: BEng in Biomedical Engineering, BEng in Civil Engineering, BEng in Electrical Engineering, BEng in Electronic Engineering, BEng in Data and Systems Engineering, BEng in Mechanical Engineering. Eligible students are not permitted to pursue second major in Computer Science, Minor in Computer Science and Minor in Artificial Intelligence and Data Science at the same time.

The curriculum comprises 36 credits of courses with the following structure, in which students are required to complete 18 credits of Core Courses and 18 credits of Elective Courses.

Prerequisite: completion of Year 1 study of BEng/BEng in Biomedical Engineering, inclusive of ENGG1330 Computer programming I and ENGG1340 Computer programming II.

Core Courses (18 credits)

Course Code	Course	No. of credits
COMP2118	Data structures and algorithms essentials	6
COMP2501	Introduction to data science	6
COMP3270	Introduction to artificial intelligence	6
Total for Core Courses		18

Elective Courses (18 credits to be chosen from the following list, including at least 6 and at most 12 credits of COMP/ FITE courses)

Course Code	Course	No. of credits
COMP3278	Introduction to database management systems	6
COMP3314	Introduction to machine learning	6
COMP3323 / FITE3010	Advanced database systems / Big data and data mining	6
COMP3340	Introduction to deep learning	6
COMP3353	Bioinformatics	6
COMP3361	Natural language processing	6
COMP3362	Hands-on AI: experimentation and applications	6
COMP3516	Data analytics for IoT	6
COMP3521	Visualization for data analytics	6
COMP3522	Real-life AI and data science	6
MATH3901	Operations research I	6
SDST2601	Probability and statistics I	6
SDST2604	Introduction to R/Python programming and elementary data analysis	6
SDST3600	Linear statistical analysis	6
SDST3612	Statistical machine learning	6
Total for Elective Courses		18

Notes:

1. In principle, double counting is not permissible. BEng students who have completed a core course to satisfy another programme requirement are required to complete one more elective as replacement.

2. Course enrollment in elective courses is subject to the approval of the School of Computing and Data Science, in consideration of class quota and other academic issues.

3. Students should ensure that the required prerequisite and co-requisite of MATH/SDST courses are fulfilled before enrolling in the MATH/SDST electives.

DESCRIPTION FOR UNDERGRADUATE COURSES OFFERED BY THE SCHOOL OF COMPUTING AND DATA SCIENCE

The courses listed below may not be offered every year. The content and assessment of individual

courses may be subject to adjustment upon review each academic year. Students should refer to the most up-to-date course outlines as distributed by individual course coordinators.

For the description of courses offered outside the School of Computing and Data Science, please refer to the syllabuses of the respective programmes in the corresponding teaching departments.

COMP1110. Computing and data science in everyday life (6 credits)

In this course, students will dive into the dynamic world of computing and data science, focusing on real-world problem-solving skills. The course will explore the latest advancements and innovations in computing, big data analytics and artificial intelligence technologies, and examine how they shape our daily lives. Students will also recognize the challenges and opportunities faced by computing and data science professionals. Through hands-on projects and teamwork, students will gain firsthand experience in creating data-driven solutions to solve practical challenges in computing and data science.

Assessment: 100% continuous assessment

COMP1117. Computer programming (6 credits)

This is an introductory course in computer programming. Students will acquire basic Python programming skills, including syntax, identifiers, control statements, functions, recursions, strings, lists, dictionaries, tuples and files. Searching and sorting algorithms, such as sequential search, binary search, bubble sort, insertion sort and selection sort, will also be covered.

Mutually exclusive with: ENGG1111 or ENGG1330 or IIMT2602
Assessment: 50% continuous assessment, 50% examination

COMP2113. Programming technologies (6 credits)

This course covers intermediate to advanced computer programming topics on various technologies and tools that are useful for software development. Topics include Linux shell commands, shell scripts, C/C++ programming, and separate compilation techniques and version control. This is a self-learning course; there will be no lecture and students will be provided with self-study materials. Students are required to complete milestone-based self-assessment tasks during the course. This course is designed for students who are interested in Computer Science / Computer Engineering.

Prerequisite: COMP1117 or ENGG1330
Mutually exclusive with: ENGG1340 or COMP2123
Assessment: 70% continuous assessment, 30% examination

COMP2118. Data structures and algorithms essentials (6 credits)

This course covers essential concepts in data structures and algorithms including arrays, linked lists, trees and graphs, stacks and queues, priority queues, balanced trees, sorting algorithms and basic complexity analysis. This course is designed for students interested in pursuing a minor in Computer Science or those from different disciplines seeking prerequisite knowledge for other CS courses. (Note: This course is not for students majoring in Computer Science/Artificial Intelligence and Data Science/Applied AI.)

Prerequisite: COMP2113 or COMP2123 or ENGG1340
Mutually exclusive with: COMP2119
Assessment: 40% continuous assessment, 60% examination

COMP2119. Introduction to data structures and algorithms (6 credits)

Arrays, linked lists, trees and graphs; stacks and queues; symbol tables; priority queues, balanced trees; sorting algorithms; complexity analysis.

Prerequisite: COMP2113 or COMP2123 or ENGG1340
Mutually exclusive with: COMP2118
Assessment: 40% continuous assessment, 60% examination

COMP2501. Introduction to data science (6 credits)

The course introduces basic concepts and methodology of data science. The goal of this course is to provide students with an overview and practical experience of the entire data analysis process. Topics include: data source and data acquisition, data preparation and manipulation, exploratory data analysis, statistical and predictive analysis, data visualization and communication.

Prerequisite: COMP1117 or ENGG1330
Mutually exclusive with: SDST1005 or SDST1015 or SDST1018
Assessment: 50% continuous assessment, 50% examination

COMP3270. Introduction to artificial intelligence (6 credits)

This course provides an introduction to the fundamental concepts and techniques of artificial intelligence (AI). Students will learn about intelligent agents, problem solving, uncertain knowledge, and logical agents. The course combines theoretical foundations with practical applications to equip students with the tools needed to understand and develop intelligent systems.

Prerequisite: COMP2119 or COMP2118 or FITE2000 or COMP2502
Mutually exclusive with: ELEC4544 or IIMT3688
Assessment: 50% continuous assessment, 50% examination

COMP3278. Introduction to database management systems (6 credits)

This course studies the principles, design, administration, and implementation of database management systems. Topics include: entity-relationship model, relational model, relational algebra, database design and normalization, database query languages, indexing schemes, integrity and concurrency control.

Prerequisite: COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Mutually exclusive with: IIMT3601
Assessment: 50% continuous assessment, 50% examination

COMP3312. Law and ethics in data science (6 credits)

The primary objective of this course is to explore the legal and ethical challenges and ramifications in the

modern practice of data science. Using a case-based approach, students will analyse contemporary controversies from a techno-legal and ethical perspectives. The focuses are data privacy and the regulation of using data in specific areas of law. Topics include basic privacy protection techniques, such as encryption and data anonymization data privacy laws, open data policy, data protection process and technology, issues in the usage of sensitive personal data and public data.

Assessment: 100% continuous assessment

COMP3314. Introduction to machine learning (6 credits)

This course introduces basic concepts, algorithms, practices, tools, and applications of machine learning. Topics include classical methods in supervised learning (classification and regression), such as perceptrons, linear regression, decision trees, logistic regression, support vector machines, and KNN; classical methods in unsupervised learning, such as K-means clustering and principal component analysis; common practices in data pre-processing, feature selection, hyper-parameter tuning, and model evaluation; tools/libraries/APIs such as scikit-learn and multi/many-core CPU/GPU programming; applications such as flower species prediction, tumor cell classification, and handwritten digit recognition.

Prerequisites: MATH1853 or MATH2014 or MATH1013; and COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Assessment: 50% continuous assessment, 50% examination

COMP3317. Introduction to computer vision (6 credits)

This course introduces the basic concepts, mathematical models, and methods of computer vision. In the first half of this course, we will focus on 2D computer vision tasks and cover topics in image formation and representation, digital image processing, feature extraction, and image recognition. In the second half of this course, we will look into 3D computer vision tasks and cover topics in camera models, camera calibration, stereo vision, and motion analysis.

Prerequisites: COMP2119 or COMP2118; and MATH1853 or MATH2014 or MATH2101 or MATH1013
Assessment: 50% continuous assessment, 50% examination

COMP3323. Advanced database systems (6 credits)

The course will study some advanced topics and techniques in database systems, with a focus on the system and algorithmic aspects. It will also survey the recent development and progress in selected areas. Topics include: query optimization, spatial-spatiotemporal data management, multimedia and time-series data management, information retrieval and XML, data mining.

Prerequisite: COMP3278
Mutually exclusive with: FITE3010
Assessment: 40% continuous assessment, 60% examination

COMP3340. Introduction to deep learning (6 credits)

This course provides practical skills and foundational knowledge in deep learning, emphasizing hands-on experience and computational principles. Students will explore key models, including

Convolutional Neural Networks (CNNs), Transformer Networks, Generative Adversarial Networks (GANs), and Diffusion Models. They will apply these models to real-world challenges like object detection, language tasks, and reinforcement learning. The course also covers cutting-edge applications, such as autonomous driving and AI in scientific research. By working directly with source code, students will understand model implementation and optimization deeply. The course culminates in a project where students apply their skills to a practical problem, showcasing their ability to utilize deep learning technologies.

Prerequisites: COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000; and MATH1853 or MATH2014 or MATH1013
Mutually exclusive with: ELEC4544
Assessment: 50% continuous assessment, 50% examination

COMP3353. Bioinformatics (6 credits)

The goal of the course is for students to be grounded in basic bioinformatics concepts, algorithms, tools, and databases. Students will be leaving the course with hands-on bioinformatics analysis experience and empowered to conduct independent bioinformatics analyses. We will study: 1) algorithms, especially those for sequence alignment and assembly, which comprise the foundation of the rapid development of bioinformatics and DNA sequencing; 2) the leading bioinformatics tools for comparing and analyzing genomes starting from raw sequencing data; 3) the functions and organization of a few essential bioinformatics databases and learn how they support various types of bioinformatics analysis.

Prerequisite: COMP1117 or ENGG1330
Assessment: 70% continuous assessment, 30% examination

COMP3355. Cyber security (6 credits)

This course introduces the principles, mechanisms and implementation of cyber security and data protection. Knowledge about the attack and defense are included. Topics include notion and terms of cyber security; network and Internet security, introduction to encryption: classic and modern encryption technologies; authentication methods; access control methods; cyber attacks and defenses (e.g. malware, DDoS).

Prerequisite: COMP2119 or COMP2118 or ELEC2543 or FITE2000
Mutually exclusive with: ELEC4641
Assessment: 50% continuous assessment, 50% examination

COMP3361. Natural language processing (6 credits)

Natural language processing (NLP) is the study of human language from a computational perspective. The course will be focusing on machine learning and corpus-based methods and algorithms. We will cover syntactic, semantic and discourse processing models. We will describe the use of these methods and models in applications including syntactic parsing, information extraction, statistical machine translation, dialogue systems, and summarization. This course starts with language models (LMs), which are both front and center in natural language processing (NLP), and then introduces key machine learning (ML) ideas that students should grasp (e.g. feature-based models, log-linear models and then the neural models). We will land on modern generic meaning representation methods (e.g. BERT/GPT-3) and the idea of pretraining / finetuning.

Prerequisites: COMP3314 or COMP3340; and MATH1853 or MATH1013
Assessment: 50% continuous assessment, 50% examination

COMP3362. Hands-on AI: experimentation and applications (6 credits)

This course comprises two main components: students first acquire the basic know-how of the state-of-the-art AI technologies, platforms and tools (e.g., TensorFlow, PyTorch, scikit-learn) via example-based modules in a self-paced learning mode. Students will then identify a creative or practical data-driven application and implement an AI-powered solution for the application as the course project. Students will be able to experience a complete AI experimentation and evaluation cycle throughout the project.

Prerequisite: COMP3314
Mutually exclusive with: COMP3359
Assessment: 100% continuous assessment

COMP3407. Scientific computing (6 credits)

This course provides an overview and covers the fundamentals of scientific and numerical computing. It focuses topics in numerical analysis and computation, with discussions on applications of scientific computing.

Prerequisites: COMP1117 or ENGG1330; and COMP2121
Assessment: 50% continuous assessment, 50% examination

COMP3510. Internship (0 credit)

The course consists of two components: internship and professionalism. Internship requires students to spend a minimum of four weeks employed, full-time, as IT interns or trainees. During this period, they are engaged in work of direct relevance to their programme of study. The Internship provides students with practical, real-world experience and represents a valuable complement to their academic training. Professionalism exposes students to social and professional issues in computing. Students need to understand their professional roles when working as data science professionals as well as the responsibility that they will bear. They also need to develop the ability to ask serious questions about the social impact of data science and engineering and to evaluate proposed answers to those questions. Topics include: intellectual property, privacy, social context of computing, risks, safety and security concerns for data science professionals, professional and ethical responsibilities, and continuing professional development.

Assessment: 100% continuous assessment

COMP3513. Big data systems (6 credits)

The objective of this course is to study the design and implementation of Big Data systems. Topics include: data analytics pipelines, data processing framework, distributed and parallel data systems, network attached storage, data storage virtualization, query language support, data center architecture, fault tolerance, and recovery.

Prerequisites: COMP2501; and COMP3278
Assessment: 50% continuous assessment, 50% examination

COMP3516. Data analytics for IoT (6 credits)

This course introduces basic concepts, technologies, and applications of the Internet of Things (IoT). The course covers a range of enabling techniques in sensing, computing, communication, and learning for IoT and connects them to exciting applications in smart homes, healthcare, security, etc. The course will center around intelligent perception via innovative sensing technologies, with various topics from the fundamentals (e.g., signal processing, statistical analysis, machine learning) to real-world systems. Billions of things are connected today, and this course helps students understand how IoT will evolve into AIoT (Artificial Intelligence of Things) with sensing and data intelligence.

Prerequisite: MATH1853 or MATH2014 or MATH1013; and COMP2119 or COMP2118 or COMP2502
Assessment: 60% continuous assessment, 40% examination

COMP3520. Special topics in data science (6 credits)

Computing and data science are rapidly evolving fields. Selected topics in computing and data science that are of current interest will be covered. Topics may vary from year to year. Specific titles and course descriptions are available on the school website.

Prerequisites: MATH1013; and COMP1117; and COMP2113
Assessment: 60% continuous assessment, 40% examination

COMP3521. Visualization for data analytics (6 credits)

This course aims to give an overview of the basic principles and techniques for visualization and visual analytics. In particular, topics including human visual perception, color and visualization techniques for various data kinds (e.g., spatial, geospatial and multivariate data, graphs and networks, text and document) will be covered. The use of interactive visual interface to facilitate analytical reasoning will also be discussed. Students will use practical tools and apply visualization principles and techniques to perform visual data analysis on large datasets.

Prerequisite: COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Assessment: 50% continuous assessment, 50% examination

COMP3522. Real-life AI and data science (6 credits)

In this course, students will learn data science step by step through real analytics example: data mining, modelling, tableau visualization and more. Unlike many classes where everything works just the way it should and the training is smooth sailing, this course will give students a data science odyssey through experiencing the pains a data scientist goes through on a daily basis. Corrupt data, anomalies, irregularities, etc. Upon completing this course, the students will enhance their data wrangling skills and learn how to 1) model their data, 2) curve-fit their data, and 3) how to communicate their findings. The students will develop a good understanding of Tableau, SQL, SSIS, and Gretl that give them a safe ride in data lakes. With no final exam, the students will be given practical exercises that prepare them to be at the helm for real-world challenges.

Prerequisite: ENGG1330 or COMP1117
Assessment: 100% continuous assessment

COMP3523. Security and Privacy in Artificial Intelligence (6 credits)

This course will equip students with the knowledge and hands-on experience to develop secure, privacy-preserving AI systems. As AI becomes increasingly integrated into our everyday lives, students will explore how seemingly powerful AI systems can be compromised through various attacks that manipulate decision-making processes and steal private information. Students will also learn about cutting-edge defenses designed to protect these systems. By the end of the course, students will be able to assess security and privacy risks when designing AI-driven solutions and implement effective countermeasures.

Prerequisite: COMP3314
Assessment: 50% continuous assessment, 50% examination

COMP3524. Web Intelligence (6 credits)

Web Intelligence is an exciting and rapidly evolving field that explores the intersection of web technologies, data science, and artificial intelligence. In this course, students will dive into the core principles and applications of web intelligence, including web data management, web crawling and extraction, information retrieval, web mining, web analytics, and the integration of large language models and other AI-powered techniques. We will examine the unique characteristics and challenges of web data, and how emerging technologies can be leveraged to extract valuable insights and enable personalized web experiences.

Prerequisite: COMP3270
Assessment: 60% continuous assessment, 40% examination

COMP4501. AI and data science in discipline project (6 credits)

Students will work on a capstone project which is on data science in association with a domain focus. Students are required to identify a data-intensive problem in a specific application domain, and to implement a data-driven solution for the problem. Students will undergo a complete data science project life cycle, from problem understanding, data collection, data exploration to data modelling, analysis and interpretation, and finally deliver a data science solution.

Mutually exclusive with: COMP4502
Assessment: 100% continuous assessment

COMP4502. Final year project (6 credits)

In this final year capstone project, students are required to initiate project ideas, develop feasible and effective solutions, and produce a comprehensive final deliverable. Project topics may cover diverse areas, including applied software development, practical and innovative solutions to everyday challenges, and basic research. The deliverables must demonstrate a thorough integration of the students' computing expertise and skills. Each project team member must make significant contributions, and individual assessments will be conducted for all students.

Mutually exclusive with: COMP4501
Assessment: 100% continuous assessment

COMP4510. Principles of machine learning (6 credits)

This course is for students who are familiar with machine learning methods and would like to dive deep into the mathematical foundations of machine learning. This course aims to provide students with the mathematical foundations of machine learning and prepare them for more advanced study and research in machine learning and AI. The course focuses on the design principles of machine learning methods (where they come from) and the analysis principles (how they end up). Topics include statistical machine learning framework, Bayes' rule, MLE/MAP, generative and discriminative learning, regularization, generalization, kernel methods, clustering and mixture models, factor analysis and representation learning, reinforcement learning, and applications.

Prerequisite: COMP3314 or SDST3612
Assessment: 50% continuous assessment, 50% examination

COMP4511. Principles of deep learning (6 credits)

This course aims to provide a rigorous and systematic introduction to the mathematical and computational principles of deep learning. We focus on a common fundamental problem behind almost all modern practices of artificial intelligence: how to effectively and efficiently learn a low-dimensional distribution of data in a high-dimensional space and then transform the distribution to a compact and structured representation. To this end, we will show how to derive all popular neural network architectures from the first principle of data compression. This course aims to truly bridge the theory to practice for the students by providing both written and programming exercises and hands-on projects aiming at applying the learned methods to real-world problems and tasks such as classification, completion, segmentation, generation for both image and text data.

Prerequisite: COMP3340
Assessment: 100% continuous assessment

COMP4512. Advanced computer vision (6 credits)

This course is an advanced course in computer vision, and it covers three fundamental tasks that modern computer vision strives to achieve: image understanding, image generation, and 3D reconstruction. Hence, it consists of three parts and each part consists of a coherent set of topics and methods. For image understanding, we will cover image classification, image segmentation and object detection. For image generation, we cover the typical image generation methods, including Variational Auto-Encoder, Generative Adversarial Networks, Diffusion Models, as well as their typical applications. For 3D reconstruction and generation part, we may cover multiple-view geometry that enables reconstructing 3D geometry from feature points, lines, and planes, as well as from regular textural patterns. We will also introduce how to represent a 3D scene, both implicit and explicit representations. Other than introducing basic theory and methods, this course emphasizes hands-on implementation and problem-solving skills of the students. The target students are year 4 undergraduate students or year 1 graduate students.

Prerequisite: COMP3340, COMP3317
Assessment: 50% continuous assessment, 50% examination

FITE2010. Distributed ledger and blockchain (6 credits)

This course introduces basic theories of blockchain and distributed ledger, which includes basic cryptography, public key cryptosystem, distributed computing and consensus protocols. Financial applications of blockchain and distributed ledger will be discussed.

Prerequisites: FITE1010 or MATH1853 or MATH2101 or MATH1013; and COMP2119 or COMP2118 or ELEC2543 or FITE2000
Assessment: 40% continuous assessment, 60% examination

FITE3010. Big data and data mining (6 credits)

The course will study some advanced topics and techniques in big data, with a focus on the algorithmic and system aspects. It will provide students with both theoretical and hands-on experience in big data and data mining. Topics include MapReduce, textual data management, graph data management, uncertain data management, association rule mining, and state-of-the-art data mining techniques.

Prerequisites: FITE1010 or MATH1853 or MATH2101 or MATH1013; and COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Mutually exclusive with: COMP3323
Assessment: 50% continuous assessment, 50% examination

SDST2601. Probability and statistics I (6 credits)

The discipline of statistics is concerned with situations in which uncertainty and variability play an essential role and forms an important descriptive and analytical tool in many practical problems. Against a background of motivating problems this course develops relevant probability models for the description of such uncertainty and variability.

Prerequisite/Co-requisite: MATH2014, or (MATH2101 and MATH2211)
Mutually exclusive with: ELEC2844 or MATH3603 or SDST1603 or SDST2901
Assessment: 40% continuous assessment, 60% examination

SDST2602. Probability and statistics II (6 credits)

This course builds on SDST2601, introducing further the concepts and methods of statistics. Emphasis is on the two major areas of statistical analysis: estimation and hypothesis testing. Through the disciplines of statistical modelling, inference and decision making, students will be equipped with both quantitative skills and qualitative perceptions essential for making rigorous statistical analysis of real-life data.

Prerequisite: SDST2601
Mutually exclusive with: SDST3902
Assessment: 40% continuous assessment, 60% examination

SDST2604 Introduction to R/Python Programming and Elementary Data Analysis (6 credits)

This course is designed to provide a first-level introduction to Python programming for statistics. This course focuses on learning the basic programming skills in Python with examples and applications in elementary statistical analysis. The programming skills involved can be applied to input and output of

data sets, work with different data types, manipulation and transformation of data, random sampling, descriptive data analysis, and production of professional summary reports with high-quality graphs.

Prerequisite: SDST1600 or MATH1821 or (MATH1851 and MATH1853)
Assessment: 100% continuous assessment

SDST3600. Linear statistical analysis (6 credits)

The analysis of variability is mainly concerned with locating the sources of the variability. Many statistical techniques investigate these sources through the use of 'linear' models. This course presents the theory and practice of these models.

Prerequisite: SDST2602
Mutually exclusive with: SDST3907
Assessment: 40% continuous assessment, 60% examination

SDST3612. Statistical machine learning (6 credits)

Machine learning is the study of computer algorithms that build models of observed data in order to make predictions or decisions. Statistical machine learning emphasizes the importance of statistical methodology in the algorithmic development. This course provides a comprehensive and practical coverage of essential machine learning concepts and a variety of learning algorithms under supervised and unsupervised settings.

Prerequisites: SDST3600 or SDST3907; and COMP1117 or ENGG1330 or SDST2604
Mutually exclusive with: SDST4904
Recommended: proficiency in Python, programming assignments will require use of Python
Assessment: 100% continuous assessment

SDST3621. Statistical data analysis (6 credits)

Building on prior coursework in statistical methods and modeling, students will gain a deeper understanding of the entire process of data analysis, using both frequentist and Bayesian tools. The course aims to develop skills of model selection and hypotheses formulation so that questions of interest can be properly formulated and answered. An important element deals with model review and improvement, when one's first attempt does not adequately fit the data. Students will learn how to explore the data, build reliable models, and communicate the results of data analysis to a variety of audiences.

Prerequisite: SDST3600 or SDST3907
Assessment: 50% continuous assessment, 50% examination

SDST4601. Time-series analysis (6 credits)

A time series consists of a set of observations on a random variable taken over time. Time series arise naturally in climatology, economics, environment studies, finance and many other disciplines. The observations in a time series are usually correlated; the course establishes a framework to discuss this. This course distinguishes different type of time series, investigates various representations for the processes and studies the relative merits of different forecasting procedures. Students will analyse real time-series data on the computer.

Prerequisite: SDST3600
Mutually exclusive with: SDST3614, SDST3907
Assessment: 40% continuous assessment, 60% examination

SDST4602. Multivariate data analysis (6 credits)

In many designed experiments or observational studies, the researchers are dealing with multivariate data, where each observation is a set of measurements taken on the same individual. These measurements are often correlated. The correlation prevents the use of univariate statistics to draw inferences. This course develops the statistical methods for analysing multivariate data through examples in various fields of application and hands-on experience with the statistical software SAS.

Prerequisite: SDST3600 or SDST3907
Assessment: 50% continuous assessment, 50% examination
